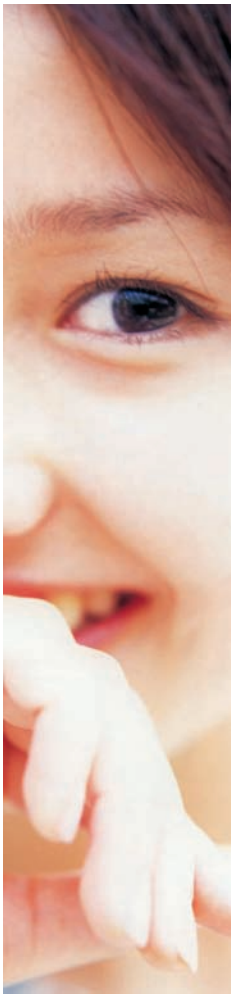
Research for

Development of an Optimal Policy Strategy for Prevention and Control of CERVICAL CANCER IN THAILAND

International Health Policy Program, Thailand *and*
Health Intervention and Technology Assessment Program
Ministry of Public Health, Thailand



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Preface

Recently, two Human Papilloma Virus (HPV) vaccines were licensed by the Food and Drug Administration, the National Drug Regulatory Authority of Thailand. In the context of availability of HPV vaccines in the Thai market, there is a strong market promotion to administer vaccines in voluntary private sector through direct to consumer advertisement and sponsoring workshops and conferences for medical professional through medical associations and Royal Colleges. In addition, there is effort to push HPV vaccines into the benefit package of the national health insurance schemes.

There is a number of international literature on the cost effectiveness of HPV vaccine and some provides mis-leading conclusion that HPV vaccination is cost-effective, assuming the cost of US$ 5 per dose which is impossible at the early launch of this monopoly vaccine. Meanwhile, there is a lack of evidence to guide vaccine adoption in developing countries such as the information on the cost-effectiveness of the vaccines and prevalence of HPV sub-types in these settings.

In the current context, there is an urgent need to revisit the current performance of the cervical cancer screening programs. Even when a vaccination initiative is launched; there is still a vital role of effective and high performance cervical cancer screening. Vaccine cannot be introduced separately from a cervical screening program.

It is opportune time to conduct this study, as we observed aggressive market promotion of HPV vaccines in Thailand and elsewhere. Some of these marketing plans provide mis-leading information, for instance that advocates vaccine for all women regardless of their age groups, that vaccine can stamp out cervical cancer, and that screening is not required once vaccinated. This study uncovers the poor performance of cervical screening and rules out the role of HPV vaccine as national program, on the ground of not cost effective and unaffordable. The study recommends to foster the screening program through sequential screening of VIA for the younger women and Pap smear for older women.

This study demonstrates that decision to adopt new vaccine into national program must be guided by country evidence, not market promotion and information from pharmaceutical industry alone. The research team declares no conflict of interest in conducting this study.

Dr. Viroj Tangcharoensathien

Director of International Health Policy Program Thailand

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Executive Summary

The authors wish to acknowledge financial support from the World Bank's Population and Reproductive Health Capacity Building Program. We would like to thank all research participants including administrators and staff of Provincial

In the context of an increased burden of morbidity and mortality associated with cervical cancer, a stagnation in the performance of cervical screening programmes, in terms of coverage of target population, and the evolution of new and expensive health technology for the prevention of cervical cancer, this World Bank funded study aims to critically assess the current performance of the cervical cancer prevention and control programmes in Thailand. A second aim, in recognition of the limitations of resources and healthcare infrastructures specific to the Thai health care system, is to conduct economic evaluation of several interventions in order to identify the most cost-effective option to reduce the burden of cervical cancer. The outcome of policy choices generated from the assessment of cervical screening programs performance and economic appraisals were fed into a policy discussion among key stakeholders in order to reach a consensus on the best possible policy option. The final aim was to propose strategies to scale up the cervical cancer prevention and control programme interventions to the national programme manager.

Both Pap smear and visual inspection with acetic acid (VIA) are proven to be effective when screening for the detection of cervical cancer. Both are covered by the Universal Health Insurance Scheme (UC) in Thailand. However, because of a lack of effective programme coordination for the two interventions, they are managed separately by two Departments of the Ministry of Public Health (MOPH). The Department of Medical Services, led by the National Cancer Institute, oversees Pap smear while the Department of Health promotes VIA. These two departments operate independently without effective inter-departmental planning or dialogues.

The recommendations jointly made by the MOPH and the National Health Security Office, the national programme manager of the UC Scheme, are: that Pap smear cover women at five-year intervals between the ages of 35 and 60 years (i.e., 35, 40, 45, 50, 55, and 60 years). The target for VIA covers women younger than 45 years old since the squamo-columnar junction (SCJ) of the cervix may not be seen completely among older age groups. For ease of administration in the provinces, many of which adopt both screening methods, the VIA target ages are set at a range between 30 and 44 years by excluding women aged 35 to 40 years from Pap smear services. These recommendations reflected that the national policies concerning the disease screening were not well harmonised, resulting in programme fragmentation and competing services delivered at the local level. This was found to be true especially when payment incentives differed between the two services. As a consequence, screening practice depends on the discretion of the province and varies across the country, with some provinces adopting VIA, while others adhere to the conventional cytological intervention of Pap smear.

Based on the performance assessment, the target population coverage of cervical cancer screenings, either by Pap smear or VIA, fell well short of the desirable target of 80% coverage. The two national representative surveys, namely the Health and Welfare Survey (2003) and the Reproductive Health Survey (2006), both conducted by the National Statistical Office, revealed that the self-reported coverage of cervical cancer screening was between 38% and 63% during 2003-2006. However, the target population coverage estimated from the reported cases screened by health care facilities against the preset target was unacceptably low; 11% for Pap smear and 19% for VIA (which is mostly confined to rural provincial areas).

The consistently below the national average figures of population coverage in the central and southern regions, and in the non-municipal areas in most regions, reflected the contextual influences on both the supply and demand sides. In the provinces that implemented both Pap smear and VIA, the good performers on VIA also had above average performance on Pap smear. Health facilities that were very proactive in VIA were also actively engaged in Pap smear implementation.

Only 0.8% of the prepared slides were rated to be of an unsatisfactory quality. The epithelial abnormality detected by Pap smear was 2% on average. In younger women initially seeking VIA though, 12% could not perform VIA, mostly because of an incomplete SCJ. The VIA-positive rate was 4% on average and most (71%) positive cases received an immediate cryotherapy on the spot. The relatively high positive rate of VIA also increases the service loads to the provincial referral hospitals for the final diagnosis.

We applied a model-based cost-utility analysis which compared the value for money of different strategies for the prevention and control of cervical cancer in Thailand; the model revealed that the current policy of providing Pap smear screening to all females aged between 35-60 years of age, every 5 years, provides a life year gain of 0.005 at a cost of PPP $-39.52 (cost saving). However, the study found that the most cost-effective option was the combination strategy of VIA and sequential Pap smear, which provides VIA, every 5 years to females aged 30 to 45 years of age, and then followed by Pap smear every 5 years to women aged 50 to 60 years of age. This strategy provides a life year gain of 0.006 at a cost of PPP $-58.90 (cost saving).

Universal HPV vaccination of females aged 15 years of age provides a life year gain of 0.031 at a cost of PPP $ 606.36 based on the cost of PPP $ 1,145.04 for a full immunization schedule and a vaccine efficacy of 78.7%. The incremental cost-effectiveness ratio, comparing HPV vaccinations of 15 year old girls with the current national policy of Pap smear for women aged between 35 and 60 years every 5 years, is approximately PPP $24,343 per life year saved. This is very high compared to Thailand's annual per capita GDP of PPP $8,138 in 2007.

The incremental cost-effectiveness ratio of HPV vaccination for females aged 15 years of age depends largely on the duration of the vaccine protection. This study took the best scenario of a life-long protection, and is significantly affected by the discount rate because the real outcome of the vaccine, in terms of cancer cases averted, is observed in the long term future (namely at middle age, after vaccination at the age of 15 years). The ICER for different discounting rates were:

- 0% discounting: PPP $-6,012 per life year saved.
- 3% discounting: PPP $24,343 per life year saved.
- 5% discounting: PPP $85,024 per life year saved.
- 10% discounting: PPP $655,499 per life year saved

In Thailand and other countries the most common discounting rate applied was 3-5%.

A one-day consultation was convened in late December 2007 with the aim of soliciting perspectives and recommendations by key stakeholders concerning an appropriate strategy to control cervical cancer in Thailand. After the researchers gave presentations on the findings of the situation analysis and economic evaluation study, the forum was opened for discussion. A consensus emerged that Pap smear and VIA were significantly more cost-effective than other interventions available in the country: HPV DNA test and HPV vaccine. Therefore, either Pap smear or VIA should be scaled-up to meet the health needs of the target population. The major programmatic difficulties and drawbacks in the screening service were identified by the participants. Apparently, HPV vaccine was not a cost effective policy choice given the current market prices of vaccines, which indicated that Thailand should not embark upon a program of this preventive intervention. In addition, policymakers and health officials expressed reservations that the innovative policy generated from economic assessment, namely delivering VIA to women 30-45 years of age, and covering those between 50 and 60 years old with Pap tests, would be difficult to implement at programmatic levels.

The major impeding factors of such an innovative policy included the inadequate number of well-trained nurses to provide VIA on a national scale, and the negative perception of physicians towards VIA and immediate cryotherapy, since the treatment was administered by paramedic personnel as an associated service of the visual inspection test. Ultimately, any improvement in the cervical cancer control programme required clear policy guidance, leadership of high-level policymakers in the Ministry of Public Health, and inter-departmental collaboration of concerned partners in the Departments of Medical Service and Health. The National Health Security Office, the service purchaser on behalf of the whole population, could have a key role in promoting cervical cancer screening by introducing appropriate financial mechanisms.

The major health facilities providing Pap smear and VIA services are health centres and district hospitals respectively. This finding is congruent with the set up of public health systems in the country, whereas district health systems are the major hub of primary care, prevention and health promotion services. In terms of human resources, providing Pap smear is not complex and is compatible with the skill-mix of health workers, whereas VIA requires a relatively high training and skill at the level of professional nurses. This is mostly confined to hospitals. Cytology laboratories needed for Pap smear interpretation and the colposcopy procedure needed for confirmed diagnoses of positive screening tests were considered as major bottlenecks in completing the Pap screening chains. However, this study found that the existing national production capacity of cytologists, cyto-technicians and colposcopists are adequate if the cervical screening programme needs to be rapidly scaled up. Private laboratories play an important role in serving the patients between screening and treatment. The main challenge is the inequitable geographic distribution of these personnel and facilities, with the northeast being the worst-off region. Assessment indicated that the existing cyto-screeners who were health workers and nurses in health centres and hospitals can accommodate the target population even though the screening coverage was set at 50% or higher. In contrast, a major limitation of scaling up VIA is caused by an inadequate capacity to increase the number of trained nurses within a limited time.

In conclusion, this study highlights difficulties and barriers of the current practice for the prevention and control of cervical cancer in Thailand and it shows that serious attention needs to be given to improve the current programme performance. The study found that the combination strategy of VIA and sequential Pap smear for screening females aged between 30 and 60 year at a 5-year period has the potential to remarkably reduce the morbidity and mortality of cervical cancer. However, for this to work it needs to overcome the limitations of inadequate numbers of well-trained nurses to deliver VIA and the political dimension associated with the acceptance of VIA services provided by nurses among, especially, the powerful medical professionals and decision makers at the national level.

List of Abbreviations

ASCUS	Atypical squamous cells of undertermined significance
CPIStm	Cervical Precancerous Information System with Thai Modification
CUPS	Contracting units for primary heath care
DHS	District health system
DMS	Department of Medical Services
DOH	Department of Health
DOPA	Department of Provincial Administration
EPI	Expanded Programme on Immunization
GNI	Gross National Income
HPV	Human papillomavirus
HSIL	High grade of squamous intraepithelial lesion
HWS	Health and Welfare Survey
ICER	Incremental cost-effectiveness ratio
JHPIEGO	Johns Hopkins Program for International Education in Gynecology and Obstetrics
LEEP	Loop electrosurgical excision procedure
LSIL	Low grade of squamous intraepithelial lesion
LY	Life Years
MD	Doctor of Medicine degree
MOPH	Ministry of Public Health
NCD	Non-Communicable Disease Department
NCI	National Cancer Institute
NHES	National Health Examination Survey
NHSO	National Health Security Office
NSO	National Statistical Office
Pap smear	Papanicolaou smear
P&P	Disease prevention and health promotion
PHO	Provincial health office
PSA	Probabilistic sensitivity analysis
QALY	Quality Adjusted Life Years
RHS	Reproductive Health Survey
RTCOG	Royal Thai College of Obstetricians and Gynaecologists
SCJ	Squamo-columnar junction
SVA	Single visit approach
UC	Universal health care coverage scheme
VAS	Visual analogue scale
VIA	Visual Inspection with Acetic acid
WP	Work package

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CHAPTER 1
Introduction

1.1 Background

Cervical cancer is a global public health problem, with approximately 500,000 new cases identified each year globally (1). The disease is the most common cancer among women in the developing world with high mortality, nearly 300,000 deaths per year, 80% of which are in resource-poor settings. In Thailand, where cervical cancer has been highly prioritised as one of the major causes of health burden in terms of disability-adjusted life years (DALYs) loss, it was ranked 13th and 15th of the overall disease burden in Thai women aged 15-59 and 60+ years respectively (2). Among all cancers in the female population, cervical cancer ranked second with over 54,000 DALYs lost in 1999 (Figure 1.1).

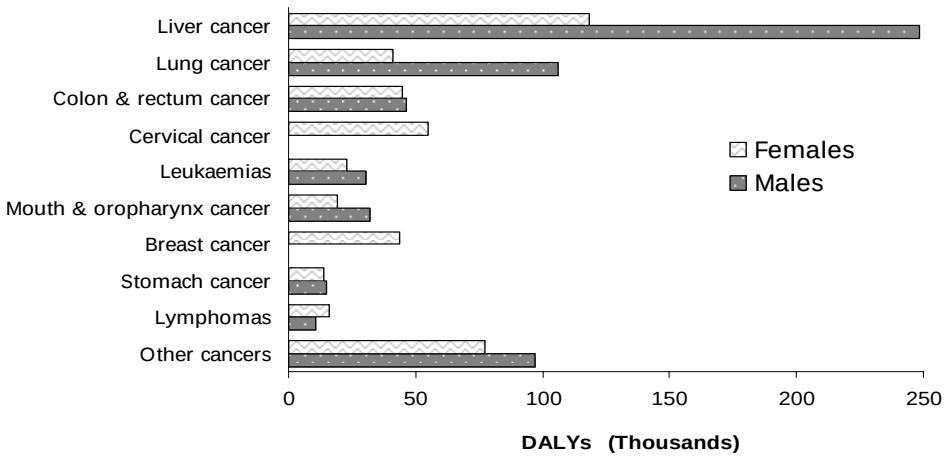

FIGURE 1.1 Burden of cervical cancer in disability-adjusted life years, 1999
Source: Thai Working Group on Burden of Disease and Injury (2002)

Incidences of cervical cancer have been relatively stable during the last two decades, with approximately 20-25 per 100,000 females populations (3). The cases detected vary widely by disease stage and across geographic regions as well as age groups. The peak

incidence was shown in women at middle-to-old age, varying from 41 to 48, 57, 65, and 68 per 100,000 women for 45-49 to 50-54, 55-59, and 60-64 years of age, respectively in 1999 (Figure 1.2).

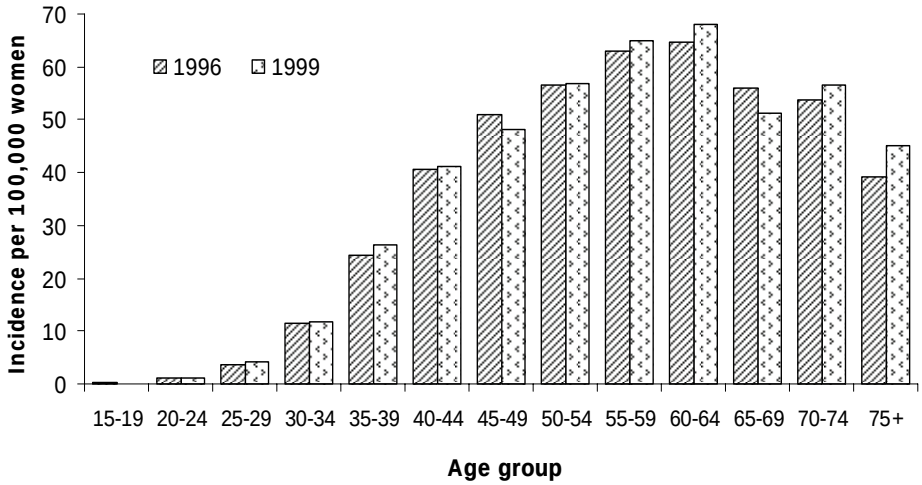

FIGURE 1.2 Age-specific incidences of cervical cancer, 1996 and 1999
Source: Cancer in Thailand (2003)

Almost half of the total cervical cancer cases in Thailand were found in Stage II, followed by Stages III, I, and IV, respectively (4). Figure 1.3 shows that the pattern varied only slightly during the years 2002-2006. It was found that women in northern Thailand are more at risk of contracting cervical cancer than those in the southern region. The incidence was relatively higher in the northern provinces (25.6 and 23.6 per 100,000 in Chiang Mai and Lampang, respectively) as compared with in the south (16.1 per 100,000 in Songkla) (5).

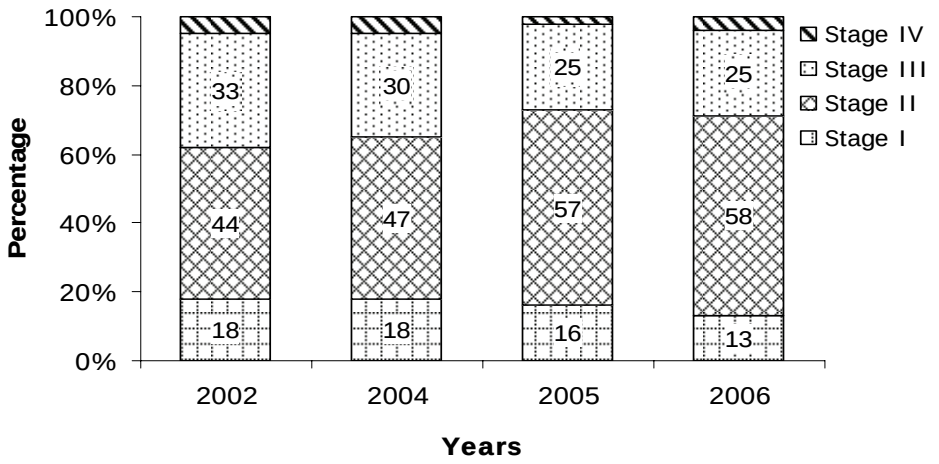

FIGURE 1.3 Cervical cancer staging in Thailand, 2002-2006

Source: Thai Gynecologic Oncology Collaborative Group and Clinical Research Collaboration Network: Development of National Research Network of Cervical Cancer in Thailand Phase I Edidemiology. 2005.

The public health service package for the control of cervical cancer includes a range of prevention, screening, treatment and palliative interventions. While there is no effective pharmacological or surgical approach to treat advanced stages of cervical carcinoma, early detection of the abnormal cell growth by performing regular cytological screenings, either Papanicolaou (Pap) smear or direct visual inspection, is recommended (6). Human papillomavirus (HPV) has also been proven as a major causative agent for the cancer (7). HPV infection generally occurs in the population aged between 16 and 20 years of age. As a result, an HPV DNA method was developed to be a specific test for the viral infection. However, these methods vary in their sensitivity, specificity and costs, as well as indications and advantages when introduced as a component of national cervical cancer control initiatives (8, 9).

Currently, both Pap smears and direct visual inspection (visual inspection with acetic acid—VIA), for women 35 years of age and over, are publicly subsidized through the Universal Health Coverage (UC) plan. In many developing countries, Thailand included, cancer prevention programmes including the provision of cervical-cancer screening services and referral of positive cases for diagnostic testing and treatment, are not well performed. It appears that the coverage of Pap smears and VIA are limited, and access to

precancerous treatment is restricted as it is available only in certain hospitals (10, 11). The recent recommendations jointly made by the MOPH and the National Health Security Office, the national programme manager of the UC, are: Pap smears should cover women at five-year intervals between the ages 35 and 60 years (i.e., 35, 40, 45, 50, 55, and 60 years); the target for VIA should cover women younger than 45 years old since the squamo-columnar junction (SCJ) of the cervix may not be seen completely among older age groups. For ease of administration in the provinces that adopt both screening methods, the VIA target ages are set at the range of between 30 and 44 years - the two years 35 and 40 being excluded as women are to undergo Pap smear services then.

Until recently, the newly developed HPV vaccines appeared to be a new hope for bringing cervical cancer under control (12). Two types of the vaccines were approved by the Thai Food and Drug Administration in 2007. Ironically, however, the launch of these HPV vaccine has generated significant policy debates, and even opposition in some cultures circles (13, 14). The high cost of the vaccine, competition from other life-saving health interventions and insufficient health system capacity are among the anticipated obstacles in implementing immunisation in resource-poor settings (15). Moreover, as HPV vaccine is indicated in adolescent and young adults, not in infants under the expanded programme for immunisation (EPI) schedule, how to efficiently deliver the vaccine to the target populations is a challenge for policy makers and programme managers. In this light, a thorough understanding of the decision making process including the perception, position and potential concerns of key stakeholders in HPV vaccine adoption and integration into the existing health delivery system will be helpful not only for the preparedness of responsible organisations, but also in providing guidance for policy movement to strengthen the national cancer control programmes as a whole.

However, to our concern it was discovered that there was no systematic assessment of the cervical cancer prevention and control programme's performance in Thailand, or of alternative interventions that can be used for substituting or complementing the cytology-based technique Pap smears in order to enhance the current performance. It is possible that the programme's performance may be significantly improved if some or all of the said newer technologies described above are introduced. It could yield substantial benefits by maximising the programme's coverage with more appropriate interventions to be delivered to different groups of the target populations. In the light that decision makers

and health care planners in Thailand are increasingly interested in working to determine an optimal policy strategy that would maximise benefits within limited resources, this is the first study to make a comprehensive analysis to assess the current performance of cervical cancer prevention and control, and to identify an optimal strategy that would be the most cost-effective in reducing the burden of cervical cancer in Thailand. Lessons learned from this study will not only contribute to the Thai health care system but also to broader international audiences in resource-poor settings where cervical cancer is still a major cause of disease burden among female populations.

1.2 Scope and objectives of this study

The prime objective of this study is to generate reliable and relevant information to guide health policy choices regarding the prevention and control of cervical cancer in Thailand and other similar settings especially in developing countries with limited financial and infrastructure resources.

Specifically, the study addresses the following research questions:

1. What is the performance of the current programmes for the prevention and control of cervical cancer in Thailand? The programme performance is to be measured by:
    a. identifying the current population coverage with respect to geographic and demographic variations and trends over time;
    b. exploring the practical variations of screening programs implemented at the local levels if any;
    c. gathering qualitative information on the both the supply and demand side barriers and constraints to scaling up cervical cancer screening programmes.
2. Given the availability of newly developed interventions for the prevention and control of cervical cancer what is the best policy strategy that is technically feasible, affordable, sustainable long-term and represents good value for money in the Thai setting?
3. How do policy makers value different programme configurations for the prospective cervical cancer control initiatives where the interventions to be included in each policy option and related programme strategy will be drawn on

the findings from economic analyses conducted in this study? This research question is posed to:

a. examine the perceptions and valuation of policy makers and other stakeholders towards particular programme characteristics, as suggested by the economic evaluation study, in terms of their effectiveness, efficiency and feasibility;
b. identify the potential advantages of and impediments to the introduction of each policy option in policy makers' and other stakeholders' perspectives;
c. solicit the opinions of policy makers and other stakeholders concerning desirable national cervical cancer control programme features. Strategies to mitigate the foreseen impediments will also be examined.

4. Given the existing human and physical resources used for the cervical cancer prevention and control program, how many additional human resources and facilities are required in both the short- and long-terms for appropriately phasing in a scaling up delivery of the new policy strategy for the prevention and control of cervical cancer?

1.3 How the report is organized

This study was divided into four work packages according to the research questions. These include:

- *Work package 1:* the determination of the performance of the current programmes for the prevention and control of cervical cancer in Thailand;
- *Work package 2:* an economic evaluation of policy strategies for the prevention and control of cervical cancer in Thailand;
- *Work package 3:* a policy analysis for the prospective cervical cancer control initiative;
- *Work package 4:* an estimation of the human resources and facilities required for the new policy strategy for the prevention and control of cervical cancer.

Each work package was designed and conducted separately but in chronological order. This report presents all findings from each work package, and was written as a stand-alone research report. Consequently, there are some repetitions to the format for each of these chapters, which contain an introduction, methods, results and discussion section.

Chapter 2 presents the current situation of the coverage of cervical cancer screening programs among Thai females. It focuses on Pap smears and VIA screening, in particular, since they have already been implemented at the national level. Information on practice variations by geographic region and trends in Pap smear and VIA coverage are also reported. At the end, this chapter presents results from an in-depth analysis from three selected provinces to understand supply and demand side barriers and constraints to scaling up cervical cancer screening programmes.

Chapter 3 addresses objective 2 by investigating the best policy strategy for the prevention and control of cervical cancer in Thailand. The chapter reports on an economic evaluation study that was conducted by researchers to explore the value for money of each health technology related to the prevention of cervical cancer and the various combinations. It is expected that the findings can be useful for guiding policy decisions concerning resource allocations for cervical cancer at both the national and sub-national levels.

Chapter 4 presents the results from a qualitative policy analysis. It explores the perceptions, attitudes and valuations of policy makers and other stakeholders towards particular programme characteristics suggested by the economic evaluation study. This chapter also illustrates the potential advantages of and impediments to the introduction of the policy option from policy makers' and other stakeholders' perspectives.

Finally, chapter 5 presents analysis results used to determine health resources and facilities required for the scaling up of the optimal strategy for the prevention and control of cervical cancer in Thailand. It focuses on the issue of health personnel in completing the screening process, from the initial service encounter (either Pap smear slide preparation or visual inspection with acetic acid) to the intermediate screening interpretation (cytology laboratory) and the confirmed diagnosis (colposcopy).

CHAPTER 2
Current Performance of the Cervical Cancer Prevention and Control Programme in Thailand

2.1 Introduction

Amidst an emergence of a promising primary prevention of cervical cancer through the use of human papillomavirus (HPV) vaccines, a secondary prevention through pre-cancer screening is deemed an indispensable component. The efficacy of the screening strategies existing in developed countries has been understood. However, knowledge regarding the performance of screening programs in developing countries has rarely been up to date.

In Thailand, the conventional cytology method, known as the Pap smear, has been available for more than 40 years. This technique is used mainly for diagnostic purposes rather than for screening the cervical cancer. The national program of Pap smear screening is planned and supervised by the Ministry of Public Health (MOPH), the Department of Medical Services (DMS). The National Cancer Institute (NCI) under the DMS is responsible for maintaining the cervical cancer, along with other cancer, registries. For monitoring and evaluation of the national implementation of cervical cancer screening, the NCI recently developed a large database of Pap smear services, called the Pap Registry.

For the secondary prevention to have a major impact on the incidence of cancer, the coverage of screening programs in the population at risk should be as large as possible. The incidence of cervical cancer is expected to be reduced by 55% if the effective screening coverage is at least 80% of the target population (16). Furthermore, those women identified as having precancerous lesions need to have the lesions treated before they progress to an invasive cancer. The screen-and-treat coverage is claimed to be more important for reducing the cervical cancer incidence than the screening frequency alone (17). In such cases, the effectiveness of a long-standing screening strategy like Pap smear, that requires a tandem of health services, has to be examined in terms of the continuum of care.

In the past, the NCI reported that in several provinces the opportunistic Pap smear covered only 5% of the female population (18). Even as recently as 2005, the MOPH Division of Reproductive Health revealed that only 37.7% of women of reproductive age (15-44 years) underwent cervical cancer screening. This indicated that the existing national screening program could not effectively control or reduce the incidence of cervical cancer.

In 2001, the Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) Corporation, in collaboration with the Royal Thai College of Obstetricians and Gynaecologists (RTCOG), introduced a direct visual inspection with acetic acid (VIA) as a cervical cancer screening alternative. The initial project was launched in four districts of Roi-Et province in the northeast, and has demonstrated that the use of VIA followed by cryotherapy (if tested positive), known as the single visit approach (SVA), was safe, acceptable and feasible (10). During the period 2002-2004, only four provinces (Roi-Et, Nong Khai, Yasothon, and Nakhon Phnom[1]) in the northeast region adopted the VIA/SVA program. In 2005, the program expanded to a further 4 provinces in the north and 2 provinces in the south. In 2006, this VIA/SVA program existed in a total of 17 out of 75 provinces, mostly at the district health system (DHS) level in rural areas (a total of 186 districts).

For the nation-wide planning and implementation of the VIA program, the Division of Reproductive Health, under the Department of Health (DOH), itself under the MOPH, has assumed the role of national manager. The JHPIEGO Corporation Cervical Cancer Prevention Group helps organize a 2-week competency-based VIA/SVA training module for registered nurses who will engage in this screen-and-treat service.

Beginning in 2005, the National Health Security Office (NHSO), as the national manager of the universal health care coverage (UC) scheme, boosted the cervical cancer screening program by establishing a service contract with the MOPH, the official body that takes care of most health facilities in the public sector, especially in the provincial areas. Based

[1] *Implemented in 2003 as a pilot in one district but later in 2006 the district quitted from the program.*

on such an agreement, the NHSO would pay an individual health care provider who performs the screening activities to women at the target ages.[2]

Under this NHSO-MOPH agreement, both Pap smear and VIA are eligible benefits. The screening frequency for each individual woman is set at a five year interval. The Pap smear target covers women at 5-year intervals between the ages of 35 and 60 years (i.e., 35, 40, 45, 50, 55, and 60 years) for each year of planning and implementation. The target for VIA includes women younger than 45 years old since the squamo-columnar junction (SCJ) of the cervix may not be seen completely in older women. For ease of administration in the provinces that adopt both screening methods, the VIA target ages are set at the range between 30 and 44 years but excluding the ages of 35 and 40 years, which are the Pap smear target ages.

This nation-wide NHSO financial incentive and the VIA/SVA program in selected provinces are the two major recent developments expected to raise the performance of the national cervical cancer prevention and control program which is the focus of work package 1 (WP1) in this study.

2.2 Objective

This work package presents the results from an analysis of the current situation of the national cervical cancer prevention and control program in Thailand by examining the program performance of Pap smear and VIA with respect to certain important characteristics.

The performance was evaluated through the program outputs in terms of the screening coverage in the female population. Test results in the screened population were determined in terms of positive rates and completeness of the tests. The qualitative method using an in-depth interview was used to explain the possible reasons behind practice variations found in the quantitative information.

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[2] In 2005, NHSO planned the target for Pap smear of 0.6 million female in all 75 provinces, whereas the planned target for VIA covered 0.1 million female in every district of 9 provinces (Roi-Et, Nong Khai, Yasothon, Amnat Charoen, Chiang Mai, Utraradit, Nan, Surat Thani, and Nakorn Srithamaraj) and one district in Phitsanulok.

2.3 Methodology

The population coverage of cervical cancer screening was estimated using two major sources of data. The first data set was obtained from nationally representative household surveys. These included a Health and Welfare Survey (HWS) and Reproductive Health Survey (RHS) conducted by the National Statistical Office (NSO) in 2003 and 2006, respectively. Both surveys used a face-to-face structured interview based on event recalls. The HWS questionnaire asked women aged at least 35 years if they had ever undergone cervical cancer screening in the past. The RHS focused on female respondents aged 35-59 years and used a similar question. However, the RHS question clearly defined the screening frequencies and periods using the 5-year timeframe.

The second type of data was electronic records of screening activities performed by health care personnel. Service encounter-level data was reported by health care facilities in two different formats. The first was for the VIA/SVA program which was initiated in 2000 by the JHPIEGO's SAFE project. This database is called the Cervical Precancerous Information System with Thai Modification (CPIStm). The second database was a Pap Registry. As mentioned previously, the Pap Registry was developed by the NCI in various versions to support the reporting and reimbursement system according to the NHSO-MOPH agreement, and has been in use since 2005.

The CPIStm database contains variables indicating the 13-digit personal identification number and age of the VIA recipient, screening date and health facility providing the service, and the screening result (positive vs. negative). In addition, the following cryotherapy and referral (if any) are recorded for the positive cases. Those who were not able to receive VIA (for example elderly patients or those with an incomplete SCJ), and underwent Pap smear instead, are recorded in the CPIStm.

The Pap Registry database covers similar information with regard to the Pap smear recipients-dates of slide fixation and slide reading, and service provider. The screening results, including (non)matching slides, quality of the slide preparation (satisfactory vs. unsatisfactory), and epithelial (ab)normality result, are recorded.

The CPIStm database covers the period from 2002 to 2006, with data being gathered until December 2006. As the Pap smear data from the Pap Registry had not been readily available until 2005, the records of Pap smear obtained from the CPIStm database were not used for further analysis. As of the fiscal year end of 2007 (September 30, 2007), the Pap Registry data for the most recent year (2006) was still incomplete. The NCI had not finished matching the health facility records (i.e., from screeners) with the laboratory records (i.e., from slide readers).

For a calculation of the population screening coverage, the denominator is generated from the total number of female population in various age categories specific to the nationally set target under the NHSO-MOPH contract. This is obtained from the official population registration system, which is maintained by the Ministry of Interior's Department of Provincial Administration (DOPA). The population coverage was determined on an annual basis. The overall coverage was stratified by years of the service encounters, women's ages, and the regional location of the health care facilities that provided the screening services. In addition, distribution of the screened women each year was analyzed according to women's ages (by number of cases) and health facility types (by number of visits).

One major point in estimating the population coverage needs to be distinguished between Pap smear and VIA due to the nature of the target population. As Pap smear focus on women aged between 35-60 years, by 5 year multiples, its target population will move to six totally new cohorts: 35, 40, 45, 50, 55, and 60 years for every rolling year. Hence, the effective coverage could be determined for each year independently based upon the new number of moving targets. In other words, the overall coverage during the period 2005-2006 can be estimated as the ratio of the sum of the screened cases divided by the sum of the total number of target women across the two years.

For VIA, the target ages cover 13 ages in three separate ranges: 30-34, 36-39, and 41-44 years. This excludes the two ages (35 and 40 years) when the women are eligible for Pap smear screening. For the next year to come, only one new cohort, women who will turn 30 years of age at their next birthday, will become the target population, whereas those who are already 44 years old will be no longer be eligible for VIA. To allow for repeated eligibility for VIA over five years in an individual woman, an annual population cannot be

added up to become the denominator for an estimation of the overall coverage over the five-year period. Indeed, only a province that has implemented the VIA program for the full 5 years (i.e., Roi-Et) can determine if the final coverage met the goal or not.[3] In other provinces with less than 5 years of VIA implementation, the cumulative screened cases divided by the average number of annual population should be perceived as the scaling up rather than the final coverage.

In-depth interviews were carried out with health care providers and health managers at both district and provincial levels in three selected study provinces; Chiang Mai, Nakhon Phnom and Roi-Et. Key informants included health workers in the sub-district health centres; registered nurses in the district hospitals; gynecologists and cytologists /cytotechnicians in the provincial hospitals; heads of district health offices; and heads and staff of the provincial health office (PHO)'s Non-Communicable Disease (NCD) Departments. The interviewing guide covers issues concerning the identification of the target population, information, education and counseling regarding cancer and prevention strategies, screening and referral procedures, and barriers to the screening program.

[3] Most provinces set the goal of VIA coverage as 80% within 5 years, whereas the goad for Pap smear is usually 50% annually. In this case, the final coverage for VIA should be estimated as the ratio between the cumulative annual cases and the 5-year average of target population.

2.4 Results

(1) Overall screening coverage

National household surveys

Coverage in 2003

Based on the household survey response to the HWS conducted in 2003, a total of approximately 4 million women, aged at least 35 years old, in Thailand have received cervical cancer screening at least once in the past (Table 2.1). This is correspondent to the overall coverage of 37.7% of the population at risk regardless of the screening period or frequency.

TABLE 2.1 Number of female population having cervical cancer screening in the past by place of living, HWS 2003

Place of living	Inside municipality		Outside municipality	
	Not screened	Screened	Not screened	Screened
Bangkok	780,907	603,911	—	—
	(56.4%)	(43.6%)		
Central	568,949	259,438	1,103,290	524,355
	(68.7%)	(31.3%)	(67.8%)	(32.2%)
North	240,103	217,908	1,016,924	695,035
	(52.4%)	(47.6%)	(59.4%)	(40.6%)
Northeast	342,179	241,816	1,932,166	1,040,228
	(58.6%)	(41.4%)	(65.0%)	(35.0%)
South	145,326	106,729	569,363	359,167
	(57.7%)	(42.3%)	(61.3%)	(38.7%)
Total	2,077,464	1,429,802	4,621,743	2,618,785
	(59.2%)	(40.8%)	(63.8%)	(36.2%)

Source: HWS 2003

When broken down by place of residence, it can be seen that women living inside a municipal area (except for the central region) have been exposed to the screening services in a greater proportion than their non-municipal counterparts. As much as 63.8% of those living outside a municipal area have never had their uterine cervix screened for cancer. This probably reflects an issue of physical inaccessibility to health care facilities. However, a relatively lower rate of screening in the central region

(31.9%) when compared with other regional locations (42.1% in the north, 39.5% in the south, and 36.0% in the northeast) signals other additional factors that can explain variations in the utilization of cervical cancer screening. Since the HWS did not specify the exact time period or frequency of the screening service each respondent received, the 37.7% coverage did not reveal the magnitude of the adherence to the cancer screening guideline and the true performance of the national cervical cancer prevention and control program.

Another national-level survey was conducted during 2003-2004. The National Health Examination Survey (NHES) of the working age (15-59 years) female population contained two questions pertaining to the cervical cancer screening experience: (1) Has the respondent ever been screened by health personnel?; and (2) How long is it since the last screening, if any? By using a cut-out point of 5 years, the screening coverage can be further broken down into two categories: prior to and within 5 years. By restricting NHES analysis to 35-59 year old women, findings from the 2003-04 NHES were compared with that from the 2003 HWS. The overall coverage of cervical cancer screening in 2003 obtained from NHES (54.5%) was much higher than that from the HWS (37.7%) (Table 2.2). Focusing on the within 5-year screening, the NHES-HES disparity is found with a greater magnitude in those women living in a rural area outside a municipality and in the central region. Information from the NHES reveals that the coverage of the recent (i.e., within 5 years) screenings in municipal areas was a little higher than in non-municipal areas in every region, except in the south.

TABLE 2.2 Number of female population having cervical cancer screening in the past 5 years by place of living, NHES 2003-04

Place of living	Inside municipality			Outside municipality		
	Never screened	Screened beyond 5 years	Screened within 5 years	Never screened	Screened beyond 5 years	Screened within 5 years
Bangkok	183,385	86,586	236,877	—	—	—
	(36.2%)	(17.1%)	(46.7%)			
Central	407,877	80,675	399,594	770,027	200,957	780,135
	(45.9%)	(9.1%)	(45.0%)	(44.0%)	(11.5%)	(44.6%)
North	191,714	34,226	231,951	747,234	80,484	840,688
	(41.9%)	(7.5%)	(50.7%)	(44.8%)	(4.8%)	(50.4%)
Northeast	230,630	66,831	271,653	1,430,590	168,349	1,267,240
	(40.5%)	(11.7%)	(47.7%)	(49.9%)	(5.9%)	(44.2%)
South	154,960	38,603	136,016	420,381	97,744	411,007
	(47.0%)	(11.7%)	(41.3%)	(45.2%)	(10.5%)	(44.2%)
Total	1,168,566	306,921	1,276,091	3,368,232	547,534	3,299,070
	(42.5%)	(11.2%)	(46.4%)	(46.7%)	(7.6%)	(45.7%)

Source: NHES 2003-04

Coverage in 2006

The RHS conducted by the NSO in 2006 provides the most recent survey-based information concerning screening coverage at the national level. Of the 11.4 million estimated women aged 35-59 years, 49.8% have been screened for cervical cancer at least once in the last 5 years, 13.5% were screened beyond the 5-year period, and 36.7% have never been exposed to the screening services (Figure 2.1).

The screening coverage at any time in the past increased to 63.3% in total (Table 2.3). Compared with the NHES 2003-04 data, the major increases are found in women living in rural areas outside a municipality, and in the north and north-eastern regions. Whether or not this is an effect of the 2005 NHSO initiative of offering financial incentives to the service providers in those particular areas is too early to conclude. Noticeably, in Bangkok, the within 5-year coverage in 2006 dropped from the 2003-04 figure by 11.4 percentage points.

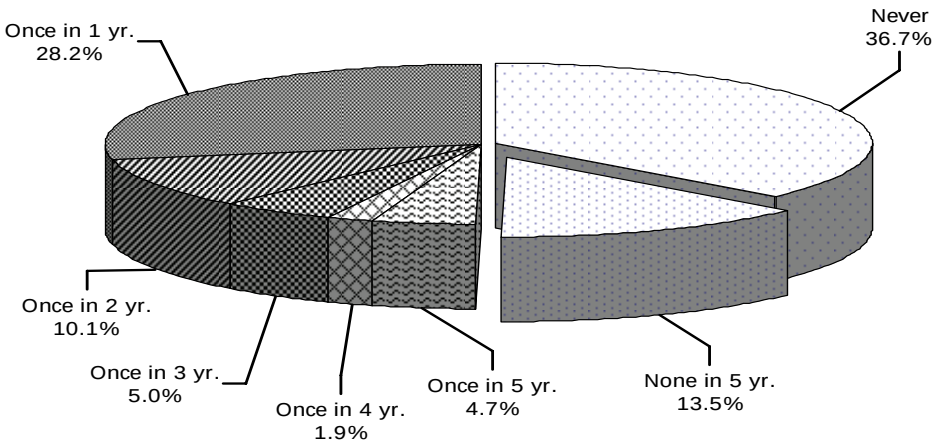


FIGURE 2.1 Percentages of women 35-59 years old having undergone cervical cancer screening at different intervals

Source: RHS 2006

TABLE 2.3 Number of female population having cervical cancer screening in the past 5 years by place of living, RHS 2006

Place of living	Inside municipality			Outside municipality		
	Never screened	Screened beyond 5 years	Screened within 5 years	Never screened	Screened beyond 5 years	Screened within 5 years
Bangkok	626,518	243,504	473,974	-	-	-
	(46.6%)	(18.1%)	(35.3%)			
Central	345,472	148,853	401,894	749,159	293,791	816,667
	(38.6%)	(16.6%)	(44.8%)	(40.3%)	(15.8%)	(43.9%)
North	128,680	44,530	276,899	541,027	146,145	1,100,318
	(28.6%)	(9.9%)	(61.5%)	(30.3%)	(8.2%)	(61.6%)
Northeast	178,184	73,360	315,017	1,041,862	382,063	1,719,959
	(31.5%)	(13.0%)	(55.6%)	(33.1%)	(12.2%)	(54.7%)
South	116,837	47,596	162,172	454,681	163,896	417,761
	(35.8%)	(14.6%)	(49.7%)	(43.9%)	(15.8%)	(40.3%)
Total	1,395,691	557,843	1,629,956	2,786,729	985,895	4,054,705
	(39.0%)	(15.6%)	(45.5%)	(35.6%)	(12.6%)	(51.8%)

Source: RHS 2006

The RHS in 2006 shows a pattern of urban-rural variation in cervical cancer screening similar to the previous two surveys, especially the NHES of 2003-04. The coverage of the

within 5-year screening is a little higher in the municipal areas in each region. The most conflicting information regarding urban-rural coverage variation across the three national surveys was found in the southern region. The HWS and RHS yielded a similar picture in the higher coverage for the municipal areas; whereas only in the NHES that the rural south coverage dominated that in the municipal area.

By regional variation, the highest coverage of the within 5-year screening in 2006 was found in the north (61.5%). This RHS finding is congruent with that from the HWS in 2003 and the NHES in 2003-04. Ironically, the lowest coverage (35.3%) was found in Bangkok, followed by the southern (42.6%) and central (44.2%) regions.

Facility-based records for the national program

Pap Registry and CPIStm reporting systems

As mentioned previously, the two major sources of cervical cancer screening data at the national level are the Pap Registry (for Pap smear) and CPIStm (for all VIA and some Pap smear). Reporting systems for Pap smear and VIA are different in several aspects. Pap Registry has a relatively short history when compared with CPIStm. The Pap Registry software was first developed in 2005 by the NCI - the national manager of the Pap smear screening program under the MOPH's DMS. The main purpose of Pap Registry development is to support the reimbursement system nation-wide under the NHSO-MOPH contract on incentive payment for the providers of Pap smear services.This includes slide fixing and reading. The Pap Registry software has been modified twice since its inception.

The CPIStm software has been developed with the purpose of supporting the monitoring and evaluation of VIA/SVA, of which the Division of Reproductive Health (belonging to the MOPH's DOH) is the national manager. The CPIStm system was initially implemented in 2000 under the JHPIEGO project in Roi-Et province. In 2006, the VIA/SVA program was expanded to 17 provinces, covering 186 districts in total (Table 2.4). The CPIStm software has been revised several times.

The Pap Registry data flow for the Pap smear reporting system can be elaborated as follows (Figure 2.2). First, the service encounter-level data, recorded by each health facility at DHS level (i.e., district hospital, sub-district health centre), is sent to the

cytology units of the provincial hospital or private laboratory offices for reading and interpretation of the fixed slides. This process can take weeks or months depending on the service workloads and laboratory availability. In each province, data from the cyto-screeners are pooled at the PHO NCD Department. The data is then forwarded to the NCI for further verification by matching the slide fixing part with the slide reading part from the laboratory units. The data is also recorded in the Pap Registry. If both parts match perfectly, the NCI-verified data will be transferred to the NHSO for further reimbursement to health care providers.

TABLE 2.4 Number of provinces and their districts adopting VIA program

Region	2002	2003	2004	2005	2006
Central	-	-	-	-	1 province[g] (11 districts)
North	-	-	-	4 provinces[d] (49 districts)	6 provinces[h] (69 districts)
Northeast	1 province[a] (20 districts)	3 provinces[b] (38 districts)	4 provinces[c] (47 districts)	5 provinces[e] (54 districts)	7 provinces[i] (56 districts)
South	-	-	-	2 provinces[f] (42 districts)	3 provinces[j] (50 districts)
Total	1 province (20 districts)	3 provinces (38 districts)	4 provinces (47 districts)	11 provinces (145 districts)	17 provinces (186 districts)

[a] *Roi-Et*
[b] *Roi-Et, Nong Khai, and Nakhon Phnom (one district)*
[c] *Roi-Et, Nong Khai, Nakhon Phnom (one district), and Yasothon*
[d] *Chiang Mai, Utraradit, Nan, and Phitsanulok (one district)*
[e] *Roi-Et, Nong Khai, Nakhon Phnom (one district), Yasothon, and Amnat Charoen*
[f] *Surat Thani and Nakorn Srithamaraj*
[g] *Lopburi*
[h] *Chiang Mai, Utraradit, Nan, Phitsanulok (one district), Petchaboon, and Tak*
[i] *Roi-Et, Nong Khai, Yasothon, Amnat Charoen; and Srisaket, Ubon Ratchathani, and Mukdaharn (one district each)*
[j] *Surat Thani, Nakorn Srithamaraj, and Krabi*

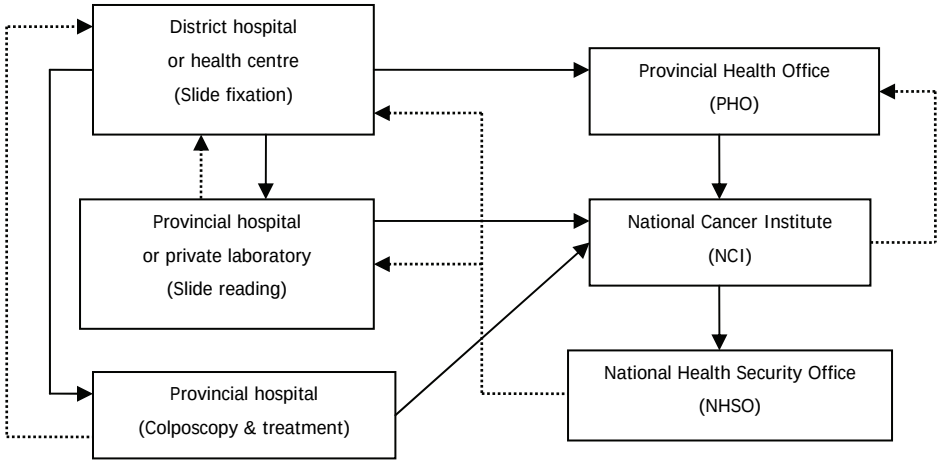


FIGURE 2.2 Flow of Pap smear reporting system

For CPIStm, all VIA screening and cryotherapy records are transferred to the DOH's Division of Reproductive Health through the PHO (Figure 2.3). Since the screening and treatment is combined into a single visit, there is no need to wait for the confirmed result from laboratory units. Only the suspicious cancer cases are referred to colposcopy at the provincial hospital for a confirmed diagnosis and proper treatment.

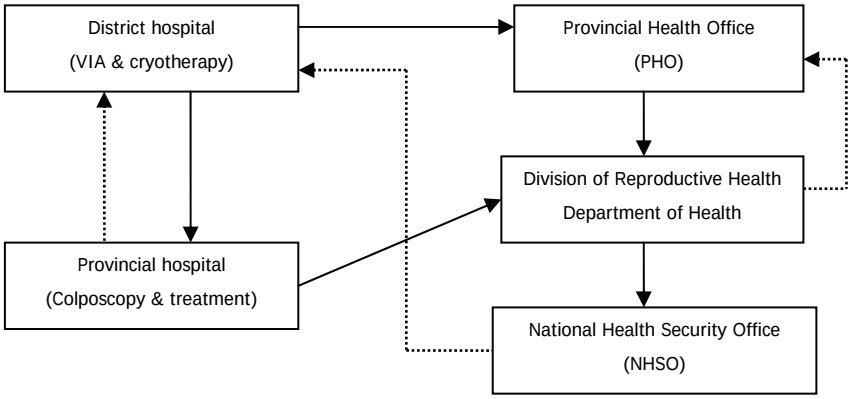


FIGURE 2.3 Flow of the VIA reporting system

As of June 2007, the Pap Registry and CPIStm databases contained the records of Pap smear and/or VIA screenings of 472,966 and 307,442 service encounters (or number of

visits) in total, respectively (Table 2.5). The Pap smear data in the Pap Registry is, however, only available for 2005 and 2006 (Note: 2006 data is incomplete), whereas the CPIStm covers VIA (and Pap smear in certain cases) data from 2002 to 2006.

TABLE 2.5 Number of screening encounters by years of service and regions of health facilities as reported in PapRegistry and CPIStm

		PapRegistry (N = 472,966)	CPIStm (N = 307,442)[a]
Year	2002	17	14,788
	2003	39	45,397
	2004	324	62,075
	2005	234,866	107,392
	2006	187,681	68,670
	Unknown	50,039	9,120
Region	Central	76,850 (18.0%)	535 (0.2%)
	North	110,928 (26.0%)	60,645 (19.7%)
	Northeast	191,970 (45.0%)	202,972 (66.0%)
	South	47,206 (11.1%)	43,233 (14.1%)
	Unknown	45,740	57

[a] *Most are VIA visits though some include Pap smear for those not eligible to VIA at the service encounter*

By geographic region, it is noticeable that most of the CPIStm data (66.0%) came from the northeast region which was the first region where VIA/SVA was adopted and implemented. Less than 1% of the records were from the central region since the VIA/SVA set its priority on remote areas. Only one province (Lopburi) in the central region has implemented the VIA/SVA program.[4]

Since the CPIStm data also contains information about certain women whose ages were within the VIA target range, but could not be screened by VIA and received Pap smear instead, there is a need to consolidate the Pap Registry and CPIStm data sets. Each record of CPIStm was linked to that in the Pap Registry using the 13-digit identification numbers of Thai citizens to generate a unified dataset. The combined CPIStm-Pap Registry dataset is also useful for examining any repetition of the screening services that may occur either within or across the screening methods over the study period.

[4] *According to the NHSO-MOPH agreement, the target women in all 11 districts of Lopburi are eligible to VIA. However, only 4 districts choose to provide VIA screening services.*

Figure 2.4 shows the results from consolidating the cervical cancer screening data by linking the Pap Registry and CPIStm databases. The combined Pap Registry-CPIStm dataset consists of 780,408 visits in total. To further estimate the population coverage and determine its variation, 59,159 visits with an unknown year of the screening services were excluded. In addition, 380 records of Pap smear incorrectly recorded for the years 2002-2004 in the Pap Registry were deleted. This leaves 720,869 visits in total to be included in a final analysis of the consolidated dataset.

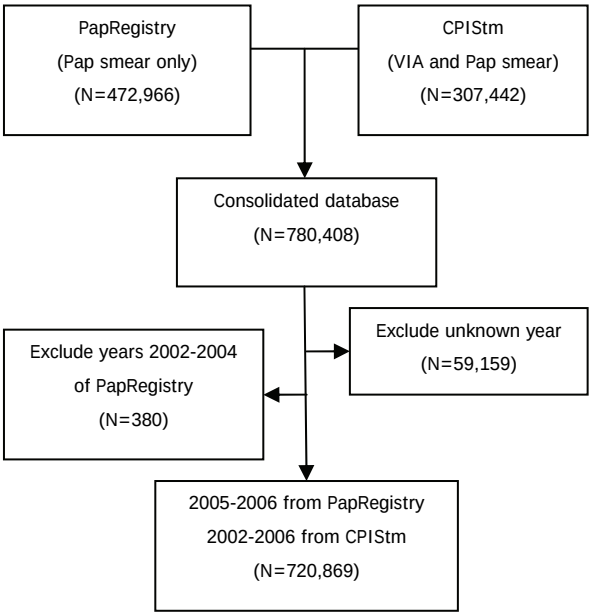


FIGURE 2.4 Consolidation of databases between PapRegistry and CPIStm

Number of visits and cases

Table 2.6 shows the total number of service encounters (or visits) and the number of women (cases) undergoing Pap smear or VIA during the years 2002-2006. The data in 2002-2004 generated from the CPIStm revealed that only about 1% of the cases (of which nearly all were the VIA recipients) had multiple visits over a one year period. During the last two years (2005-2006), the number of cases having multiple visits increased considerably (3.4% in 2005 and 23.9% in 2006), mostly in the Pap smear recipients.

TABLE 2.6 Number of service encounters and women reported screening

Year	Number of visits	Number of cases	Cases with repeated visits	New cases
2002	14,788[a]	14,657[a]	125[c] (0.9%)	14,657[d]
2003	45,397[a]	44,714[a]	677[c] (1.5%)	44,676[d]
2004	62,075[a]	61,358[a]	721[c] (1.2%)	61,345[d]
2005	342,258[b]	330,929[b]	11,353[c] (3.4%)	330,811[d]
2006	256,351[b]	205,917[b]	49,136[c] (23.9%)	205,356[d]
Total	720,869	657,574		656,845[d]

[a] *From CPIStm only: most are VIA but some include Pap smear for those not eligible to VIA*
[b] *From both CPIStm and PapRegistry*
[c] *Number of women who have repeated visits within the same year regardless of screening methods*
[d] *Number of women who have their first visit regardless of screening methods during 2002-2006*

The rightmost column in Table 2.6 shows the number of women who had their screening, regardless of screening method, for the first time during this five-year period. In sum, the 720,869 visits recorded in the combined Pap Registry-CPIStm dataset belonged to a total of 656,845 women. The disparity in the numbers between the service encounters, the yearly cases and the new cases signals the possibility of repeated screenings within a year, or over the 5-year period, in some women. This requires an account for potential duplication when estimating the true coverage of the national screening program.[5]

Coverage in target population

Table 2.7 presents the number of the newly screened cases broken down by screening method, either Pap smear or VIA. In total, more than a half million (640,455) women had their uterine cervix screened by either Pap smear (N=407,478 during 2005-2006) or VIA (N=232,977 during the period 2002-2006). The Pap smear coverage in the defined target female population was approximately 11% in 2005.[6] During the 2-year period 2005-2006, the average Pap smear coverage in the target population was only 8.8%. A partly completed report of the Pap Registry may explain the lower coverage (6.6%) in 2006.

[5] *For those visiting private clinics, the fraction of repeated screening is probably higher. However, health facilities making contracts with NHSO are mostly in the public sector.*
[6] *The figures cover only those reported by the national screening program which includes mostly the screening services provided by health facilities in public sectors. Nearly all Pap smear cases are obtained from PapRegistry. Those from CPIStm included those ineligible to VIA (such as incomplete SCJ).*

TABLE 2.7 Population coverage by screening methods

Year	Pap smear			VIA		
	Target	New cases	Coverage	Target	New cases	Coverage
2002	-	(51)[b]	-	148,207[e]	14,606	9.9%[d]
2003	-	(4,903)[b]	-	255,352[e]	39,773	15.6%[d]
2004	-	(11,436)[b]	-	317,408[e]	49,909	15.7%[d]
2005	2,288,253[a]	255,004	11.1%[d]	952,393[e]	75,807	8.0%[d]
2006	2,322,187[a]	152,474	6.6%[d]	1,213,337[e]	52,882	4.4%[d]
Total	4,610,440	407,478[c]	8.8%[d]	1,239,965[f]	232,977	18.8%[d]

[a] *Number of women aged 35, 40, 45, 50 ,55, and 60 years in 75 provinces under the NHSO-MOPH contract*
[b] *Number of women receiving Pap smear, obtained from CPIStm data*
[c] *Exclude cases in 2002-2004 obtained from CPIStm since PapRegistry has not been implemented until 2005*
[d] *Number of new cases (regardless of target ages) per number of target population for each screening method*
[e] *Number of women aged 30-44 years (except 35 and 40 years) in the VIA implemented provinces*
[f] *Summation of the provincial annual average of target population across 17 VIA provinces*

The VIA/SVA program gives quite a different picture. The VIA screening program covered approximately 10% of its target population in 2002. It was implemented in the first VIA province, Roi-Et, in the northeast. Two years later, in 2003 and 2004, the population coverage increased to 15.6% and 15.7%; all activities were still in the northeastern region. Then in 2005 and 2006, the coverage declined to 8.0% and 4.4%, respectively. Two factors might explain this phenomenon. In 2005, the VIA program was expanded to new provinces in other regions. This might have unintentionally limited the initial-year target by giving a priority to the population living inside the hospital catchment's area (i.e., within the district centre). For those northeastern provinces that had implemented the VIA program previously, they might have already exhausted the easy target group during the early period. Then the hard-to-reach group remained in this later period. In total, the screened cases have accumulated since 2002 to cover 18.8% of the average population in the 17 VIA provinces.[7]

In terms of the VIA uptake, we can see that the number of newly screened women rises dramatically in 2003 with a relative increase of 172.3%. The annual growth rates of the VIA screened cases dropped to 25.5% and 51.9% in 2004 and 2005, respectively. The number of new women obtaining VIA was reduced by 30.2% in 2006. This might be due to the fact that those provinces that adopted the program early on (Roi-Et, Nong Khai, Yasothon) tended to implement the VIA/SVA program in all of their districts, whereas

[7] *Notably, only one province (Roi-Et) reached the 5-year period of the VIA program, while other provinces may have the program implemented only for the first couple years.*

some of the later provinces may have been cautious. They may have implemented the program in only selected districts, and hence scaled down the total target population (see Table 2.4 and Table 2.13).[8]

It is noticeable that even though the annual VIA coverage is not higher than the Pap smear coverage, the performance of VIA seems to be better than Pap smear. First, the overall coverage of VIA is larger (18.8% vs. 8.8%). Second, the number of women screened by VIA is greater than the Pap smear cases when the population at risk, as reflected by the implementing districts and provinces (186 vs. 800+ districts in 17 vs. 75 provinces for VIA vs. Pap smear, respectively), is taken into account.

There is still a big gap in the estimation of the population coverage of cervical cancer screening between the demand-side, national household survey data (RHS 2006) and the supply-side, national databases (Pap Registry and CPIStm). Apart from case inflation from a social desirability bias that may have been introduced by the survey respondents to the household survey, the reporting system is limited to only health care facilities in public sectors, most of which are under the NHSO-MOPH agreement.

(2) Variation by women's ages

Table 2.8 and Table 2.9 show respectively the distribution of women screened by Pap smear and VIA in each year according their ages. The cut-off point is based on the target age criteria as set in the national program under the NHSO-MOPH agreement (see details before the last paragraph of the Introduction Section).

[8] One province in 2005-2006 (Phitsanulok) and three provinces in 2006 (Srisaket, Ubon Ratchathani, and Mukdaharn) have only one district each that adopted VIA as a screening strategy.

TABLE 2.8 Age distribution of women screened by Pap smear, 2005-2006

	2005	2006	Total
35 years	37,286	24,341	61,627
	(14.6%)	(16.0%)	(15.1%)
40 years	41,575	27,552	69,127
	(16.3%)	(18.1%)	(17.0%)
45 years	38,834	25,690	64,524
	(15.2%)	(16.8%)	(15.8%)
50 years	35,025	24,567	59,592
	(13.7%)	(16.1%)	(14.6%)
55 years	26,793	17,451	44,244
	(10.5%)	(11.4%)	(10.9%)
60 years	16,161	11,540	27,701
	(6.3%)	(7.6%)	(6.8%)
Target[a]	195,674	131,141	326,815
	(76.7%)	(86.0%)	(80.2%)
Non-target[b]	51,075	18,662	69,737
	(20.0%)	(12.2%)	(17.1%)
Other/unknown[c]	8,255	2,671	10,926
	(3.2%)	(1.8%)	(2.7%)
Total	255,004	152,474	407,478
	(100%)	(100%)	(100%)

[a] *Women aged 35, 40, 45, 50, 55, and 60 years*
[b] *Women at risky ages (30-60 years) not in the national target: 30-34, 36-39, 41-44, 46-49, 51-54, and 56-59 years*
[c] *Women aged < 30 years or > 60 years or missing record on age*

TABLE 2.9 Age distribution of women screened by VIA, 2002-2006

	2002	2003	2004	2005	2006	Total
30-34 years	4,859	12,652	14,789	21,842	14,273	68,415
	(33.3%)	(31.8%)	(29.6%)	(28.8%)	(27.0%)	(29.4%)
36-39 years	3,584	9,781	12,654	20,964	15,218	62,201
	(24.5%)	(24.6%)	(25.4%)	(27.7%)	(28.8%)	(26.7%)
41-44 years	2,619	7,780	9,888	18,350	14,690	53,327
	(17.9%)	(19.6%)	(19.8%)	(24.2%)	(27.8%)	(22.9%)
Target[a]	11,062	30,213	37,331	61,156	44,181	183,943
	(75.7%)	(76.0%)	(74.8%)	(80.7%)	(83.5%)	(79.0%)
Non-target[b]	2,949	8,117	10,466	12,713	7,515	41,760
	(20.2%)	(20.4%)	(21.0%)	(16.8%)	(14.2%)	(17.9%)
Other/unknown[c]	595	1,443	2,112	1,938	1,186	7,274
	(4.1%)	(3.6%)	(4.2%)	(2.6%)	(2.2%)	(3.1%)
Total	14,606	39,773	49,909	75,807	52,882	232,977
	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100%)

[a] *Women aged 30-44 years (excluding 35 and 40 years): 30-34, 36-39, and 41-44 years*
[b] *Women at risky ages (30-60 years) not in the national target: 35, 40, 45, 50, 55, and 60 years*
[c] *Women aged < 30 years or > 60 years or missing record on age*

It is difficult for a health care provider to refuse to provide the screening service to women, even if they are not in the target age groups. The analysis shows approximately 15-20% of

the women receiving the cervical cancer screening were not in the national target ages. This non-target fraction is similar between Pap smear and VIA. However, there is a tendency to increase the target age share screening for both Pap smear and VIA.

For the Pap smear target groups, the first four age categories (35, 40, 45, and 50 years) showed a higher rate of screening (approximately 15-17%) than the last two older categories (55 and 60 years) (approximately 7-10%) (Table 2.8). This pattern of target age distribution is consistent for both 2005 and 2006.

For the VIA target, the number of women screened in the oldest age range (41-44 years) increases over time, from approximately 18% in 2002 to 28% in 2006; whereas the youngest group (30-34 years) declines from 33% in 2002 to 27% in 2006 (Table 2.9).

Table 2.10 and Table 2.11 present the corresponding population coverage in the target population as stratified by ages. Though it can be seen that Pap smear were performed more in the younger women more than the older, the coverage does not follow this trend. Over the two-year period, the Pap smear coverage in 35-year old women is the lowest (6.0%), while the highest (7.9%) is found in 50-year old women (Table 2.10). This is because the age structure of the Pap smear target population is in a pyramid shape.

The overall VIA coverage during the years 2002-2006 for the target population (30-34, 36-39, and 41-44) is 15.2% (Table 2.11). The coverage in the youngest age group (14.6% in 30-34 years) is comparable to its oldest counterpart (14.7% in 41-44 years).

TABLE 2.10 Pap smear coverage in target population by age groups, 2005-2006

	2005		2006		Total	
	Population	Coverage	Population	Coverage	Population	Coverage
35 years	507,307	7.3%	518,556	4.7%	1,025,863	6.0%
40 years	497,784	8.4%	492,908	5.6%	990,692	7.0%
45 years	438,511	8.9%	434,345	5.9%	872,856	7.4%
50 years	373,600	9.4%	383,814	6.4%	757,414	7.9%
55 years	285,069	9.4%	286,629	6.1%	571,698	7.7%
60 years	185,982	8.7%	205,935	5.6%	391,917	7.1%
Total	2,288,253	8.6%	2,322,187	5.6%	4,610,440	7.1%

TABLE 2.11 VIA coverage in target population by age groups, 2002-2006

	2002		2003		2004		2005		2006		Cumulative cases	Final coverage[a]
	Population	Coverage	Population	Coverage	Population	Coverage	Population	Coverage	Population	Coverage		
30-34 years	67,143	7.2%	111,295	11.4%	137,158	10.8%	357,855	6.1%	469,273	3.0%	68,415	14.6%
36-39 years	44,730	8.0%	79,278	12.3%	99,524	12.7%	301,466	7.0%	380,523	4.0%	62,201	16.3%
41-44 years	36,334	7.2%	64,779	12.0%	80,726	12.2%	293,072	6.3%	363,541	4.0%	53,327	14.7%
Total	148,207	7.5%	255,352	11.8%	317,408	11.8%	952,393	6.4%	1,213,337	3.6%	183,943	15.2%

[a] *Ratio between cumulative number of women screened during 2002-2006 and number of target population in 2006*

(3) Variation of health care facilities by geographic region

There was variation in the health care facilities that provided cervical cancer screening services across different geographic regions. For Pap smear, in as many as 35,019 women in total (or 8.6% of all Pap smear cases) health facility records could not be found. Hence, the region could not be verified. Among those identified regions, the Pap smear coverage was highest in the northeast in both years (12.9% in 2005 and 7.9% in 2006) (Table 2.12). The lowest coverage was found in the central region (7.5% in 2005 and 2.8% in 2006).

For VIA coverage, Table 2.13 does not present a complete picture of the country since only 17 provinces had implemented the VIA program up until 2006. In the central region, only one VIA province (Lopburi) started the program in 2006 (see Table 2.14). The overall (2002-2006) coverage by region is not estimated since only one province (Roi-Et) adopted the program for the full five years. Some other provinces conducted the VIA programs for a couple of years. Table 2.13 presents the number of VIA target population by years of program implementation. These annual population figures are used for estimating the annual VIA coverage. The provincial average population is then used as the basis for calculating the overall coverage of VIA.

TABLE 2.12 Pap smear coverage by geographic regions, 2005-2006

	2005		2006		Total	
	Population	Coverage	Population	Coverage	Population	Coverage
Central	641,918	7.5%	650,914	2.8%	1,292,832	5.2%
North	503,525	10.3%	507,283	7.1%	1,010,808	8.7%
Northeast	838,877	12.9%	850,781	7.9%	1,689,658	10.4%
South	303,933	8.6%	313,209	5.0%	617,142	6.8%
Bangkok	-	22 cases	-	246 cases	-	268 cases
Unknown	-	20,137 cases	-	14,882 cases	-	35,019 cases

TABLE 2.13 VIA coverage by geographic regions, 2002-2006

	2002		2003		2004		2005		2006	
	Population	**Coverage**	**Population**	**Coverage**	**Population**	**Coverage**	**Population**	**Coverage**	**Population**	**Coverage**
Central	-	-	-	-	-	-	-	-	84,058	0.5%
North	-	-	-	-	-	-	317,948	7.0%	431,860	6.5%
Northeast	148,207	9.9%	255,352	15.6%	317,408	13.5%	362,510	11.0%	391,575	4.2%
South	-	-	-	-	-	-	271,935	5.0%	305,844	2.6%

TABLE 2.14 Number of target population in provinces implementing VIA program

	2002	2003	2004	2005	2006
Roi-Et	148,207	153,132	151,016	152,810	152,982
Nong Khai	-	99,810	101,316	102,226	102,535
Nakhon Phnom[a]	-	2,410	2,398	2,493	-
Yasothon	-	-	62,678	62,890	63,153
Chiang Mai	-	-	-	206,798	163,524
Utraradit	-	-	-	54,398	53,414
Nan	-	-	-	53,160	52,331
Phitsanulok[a]	-	-	-	3,592	3,490
Amnat Charoen	-	-	-	42,091	41,968
Surat Thani	-	-	-	105,894	107,343
Nakorn Srithamaraj	-	-	-	166,041	156,193
Lopburi[b]	-	-	-	-	84,058
Petchaboon	-	-	-	-	111,845
Tak	-	-	-	-	47,256
Srisaket[a]	-	-	-	-	20,136
Ubon Ratchathani[a]	-	-	-	-	6,755
Mukdaharn[a]	-	-	-	-	4,046
Krabi	-	-	-	-	42,308
Total	148,207	255,352	317,408	952,393	1,213,337

[a] *Based on one district that implemented the VIA program*
[b] *Based on all 11 districts under the NHSO-MOPH contract though 4 districts actually implemented the VIA program*

(4) Trends in VIA and Pap smear coverage for provinces implementing both VIA and Pap smear

Table 2.15 and Table 2.16 shed light on the screening uptake and coverage performance for those provinces that adopted both Pap smear and VIA programs as their cervical cancer control and prevention strategies. In Roi-Et, five years of VIA implementation yielded a total number of 82,649 cases, accounting for 54.5% of the total target population. This made Roi-Et the highest performing of all the provinces in the program (Table 2.15). Two other provinces, Nong-Khai and Yasothon, which commenced the VIA program in the second phase (2003-2004) had 36.2% and 40.0% of the population coverage, respectively. Interestingly, Nakhon Phnom, which conducted a VIA pilot in one district ('Nathom') in 2003, rarely performed the activities and decided to withdraw from the program in 2006.[9]

The coverage in those third-phase provinces that started the VIA program in 2005 ranged from 12.0% to 22.1%, except in Nakorn Srithamaraj in the south (3.7%) and in one district of Phitsanulok in the north (37.6%). Those provinces that implemented the program in the final year year (2006) had a relatively low coverage. Three provinces in the northeast, Srisaket, Ubon Ratchathani, and Mukdaharn, and one in the central region (Lopburi), reported abnormally few VIA cases.

Notably, those provinces that performed relatively well on the VIA coverage also showed an above average performance on Pap smear screening. Two exceptions were Phitsanulok and Amnat Charoen, where Pap smear coverage stood at only 0.1% and 6.3%, respectively (Table 2.16).

Those provinces that only adopted VIA in 2006, and had relatively low VIA coverage, also showed below-average Pap smear coverage. One exception was Lopburi. Even though the VIA coverage was only 0.5% (only 4 out of 11 districts actually implemented the program), its performance on the Pap smear coverage was relatively high, at 24.8%.

Findings like this suggest that the VIA uptake does not occur at the expense of Pap smear. This is probably due to the fact that their targets have been set as a complement rather than a substitute. Health managers and facilities in those provinces that are very proactive in VIA also actively engage in Pap smear implementation.

[9] There was a problem on the referral of the VIA-positive cases to the provincial hospital for colposcopic examination.

TABLE 2.15 Trend in VIA coverage for provinces implementing both VIA and Pap smear, 2002-2006

	2002		2003		2004		2005		2006		Average Population	Cumulative cases	Final coverage
	Cases	Coverage	Cases	Coverage	Cases	Coverage	Cases	Coverage	Cases	Coverage			
Roi-Et	14,591	9.8%	23,759	15.5%	15,405	10.2%	19,711	12.9%	9,026	5.9%	151,629	82,492	54.4%
Nong Khai			14,519	14.5%	13,254	13.1%	7,339	7.2%	1,631	1.6%	101,472	36,743	36.2%
Nakhon Phnom[a]			(1)		(1)		(3)		(2)		2,434	7	0.3%
Yasothon			(748)		10,902	17.4%	8,403	13.4%	5,130	8.1%	62,907	25,183	40.0%
Chiang Mai			(1)		(2)		10,041	4.8%	12,039	7.3%	185,161	22,083	11.9%
Utraradit					(3)		7,689	14.1%	4,096	7.7%	53,906	11,788	21.9%
Nan	(1)				(1)		3,834	7.2%	5,247	10.0%	52,746	9,083	17.2%
Phitsanulok[a]							880	24.5%	453	13.0%	3,541	1,333	37.6%
Amnat Charoen			(796)		(3,393)		4,473	10.6%	611	1.5%	42,030	9,273	22.1%
Surat Thani			(1)		(6,925)		10,049	9.5%	3,026	2.8%	106,619	20,001	18.8%
Nakorn Srithamaraj	(1)				(44)		3,834	2.3%	2,097	1.3%	161,117	5,976	3.7%
Lopburi[b]									433	0.5%	84,058	433	0.5%
Petchaboon			(2)		(4)		(12)		4,312	3.9%	111,845	4,330	3.9%
Tak			(1)				(4)		1,910	4.0%	47,256	1,915	4.1%
Srisaket[a]	(1)		(1)		(2)		(6)		(2)		20,136	12	0.1%
Ubon Ratchathani[a]	(1)		(2)		(8)		(7)		(7)		6,755	25	0.4%
Mukdaharn[a]	(1)		(1)		(2)		(0)		(1)		4,046	5	0.1%
Krabi							(6)		2,843	6.7%	42,308	2,849	6.7%

[a] Based on one district that implemented the program
[b] Based on all 11 districts adopting the NHSO-MOPH contract though 4 districts actually implemented the program
() Abnormally sparse data, coverage not calculated

TABLE 2.16 Trend in Pap smear coverage for provinces implementing both VIA and Pap smear, 2005-2006

	2005		2006		Total		
	Cases	Coverage	Cases	Coverage	Population	Cases	Coverage
Roi-Et	10,172	19.2%	6,536	12.0%	107,368	16,708	15.6%
Nong Khai	10,992	32.8%	4,276	12.3%	68,171	15,268	22.4%
Nakhon Phnom	5,215	19.9%	4,019	14.9%	53,089	9,234	17.4%
Yasothon	6,806	31.2%	2,278	10.2%	44,092	9,084	20.6%
Chiang Mai	7,113	10.5%	7,803	11.3%	136,374	14,916	10.9%
Utraradit	3,019	14.5%	1,742	8.3%	41,946	4,761	11.4%
Nan	4,304	21.6%	3,329	16.6%	39,933	7,633	19.1%
Phitsanulok	30	0.1%	71	0.2%	72,363	101	0.1%
Amnat Charoen	1,680	11.8%	150	1.0%	28,896	1,830	6.3%
Surat Thani	9,228	26.4%	4,949	13.7%	71,151	14,177	19.9%
Nakorn Srithamaraj	8,010	14.6%	1,053	1.9%	110,309	9,063	8.2%
Lopburi	13,789	43.0%	2,179	6.7%	64,364	15,968	24.8%
Petchaboon	10	0.0%	2,359	5.8%	81,966	2,369	2.9%
Tak	1,015	6.0%	190	1.1%	34,479	1,205	3.5%
Srisaket	2,035	3.7%	2,698	4.9%	109,784	4,733	4.3%
Ubon Ratchathani	710	1.1%	3,441	5.2%	131,536	4,151	3.2%
Mukdaharn	866	7.0%	1,641	12.7%	25,221	2,507	9.9%
Krabi	948	7.2%	584	4.2%	27,187	1,532	5.6%

(5) Screening results

Previous sections (1 – 4) describe the number of women screened by either Pap smear or VIA, the overall coverage in a defined target population, and variations in the coverage with respect to screening recipients and geographic regions. In this section, the performance of the national cervical cancer prevention and control program is determined through the end-results of the population-based screening program. These include the ability to detect the cytologic abnormality of epithelium of cervix uteri by Pap smear screening and acetowhite positive findings from VIA.

Findings in this section were drawn from the national program data (Subsection 5.1) and the case study in three selected provinces: Nakhon Phnom, Roi-Et, and Chiang Mai (Subsection 5.2).

5.1 National results

Table 2.17 shows three different aspects of the performance of Pap smear screening. First, whether the smeared slides from health care providers (cytoscreeners) actually reached the laboratories (cytologists/cytotechnicians) for further reading was determined. Second, the quality of the obtained sample preparation (smeared slide) was assessed by cytologists or cytotechnicians. Third, the incidence of cytologic abnormality, as interpreted by the cytologists/cytotechnicians, was reported.

TABLE 2.17 Pap smear screening results

	2005	2006	Other year	Unknown	Total
Total	234,866	187,681	434	49,985	472,966
Slide unmatched	49,130 (20.9%)	12,829 (6.8%)	199 (45.9%)	18,203 (36.4%)	80,361 (17.0%)
Slide quality assessed	185,736	174,852	235	31,782	392,605
- Unsatisfactory	1,681 (0.9%)	1,168 (0.7%)	5 (2.1%)	222 (0.7%)	3,080 (0.8%)
- Satisfactory	184,055	173,684	230	31,560	389,525
Test result					
Not reported	143	0	1	59	199
Reported	183,912	173,684	229	31,501	389,326
- Not interpreted[a]	22	12	0	2	36
- Interpreted	183,890	173,672	229	31,499	389,290
• Abnormal	3,888 (2.1%)	2,767 (1.6%)	0	686 (2.2%)	7,341 (1.9%)
• Normal	180,002	170,905	229	30,813	381,949

[a] *Other malignancy found*

A total of 472,966 recorded Pap smear service encounters were analyzed for their screening performance looking towards the end results. Missing slides is a typical concern for the continuity of the Pap smear service. On average, 17.0% (N=80,361) of the slides prepared by initial health care providers were not obtained by the reading units or laboratories. The proportion of unmatched slides identified in 2005 was as high as 20.9%. This figure, however, then declined dramatically to 6.8% in 2006. Whether this problem is due to the actual physical loss of slides or incorrect records in the Pap Registry itself is not known. A decreasing trend in the numbers of unmatched slides probably reflects an improvement in the recording and reporting systems.

As for the quality of the slide preparation, only 0.8% of the matched slides were deemed to be of an unsatisfactory quality by the cytologists or cytotechnicians.[10] The quality of the remaining slides was deemed to be adequate for further reading. This relatively low proportion of unsatisfactory slides was further confirmed by in-depth interviews with cytotechnicians in the provincial hospitals of the three study provinces (See Table 2.17). Regarding the issue of internal quality assurance on slide reading, cytotechnicians may consult pathologists from higher level facilities such as university teaching hospitals in the regions, or the NCI in Bangkok.

For the interpretable test results (i.e., excluding the non-reported and other types of malignancy found), 1.9% of the slides were determined as suffering epithelial abnormalities.[11] The trend in this abnormality dropped slightly from 2.1% in 2005 to 1.6% in 2006. However, the slides with an unknown year of service showed 2.2% as the abnormality test finding.

Of 307,442 service encounters obtained from the CPIStm database, 12.4% could not perform VIA because the SCJ was not completely visible (Table 2.18). The fraction of those who came to seek VIA but had an incomplete SCJ became quite stable over time. However, in the first year (2002) it was very low. Others might change their minds at the service encounter and choose not to take VIA voluntarily. Those who received Pap smear instead accountted for 19.2% of the initial VIA-intent visits, on average, with an increasing trend from 11.1% in 2003 to 25.4% in 2005 and 21.6% in 2006.

[10] An unsatisfactory rate of the quality of the prepared slides in Finland (0.01%), US (0.6%), and the Netherlands (1.0%) was reported. If the unreported quality from this analysis was ignored, the slide quality in Thailand was considered within an acceptable limit (i.e., less than 1%).

[11] The high end was reported in the UK (6.4%), the US (6.4%), and Finland (7.3%), whereas the low end was in the Netherlands (2.3%) and Sweden (1.5%). In Thailand, a university hospital 'Ramathibodi' reported a positive rate of 2.23%. A relatively lower detection rate in Thailand, as compared with certain developed countries, does not imply a less severe problem. Instead, it might signal an under-representation of the high risk population regarding accessibility to the screening.

TABLE 2.18 VIA screening results

	2002	2003	2004	2005	2006	Other	Total
Total	14,788	45,397	62,075	107,392	68,670	9,120	307,442
• Incomplete SCJ	168 (1.1%)	6,445 (14.2%)	8,646 (13.9%)	12,813 (11.9%)	9,829 (14.3%)	250 (2.7%)	38,151 (12.4%)
• Complete SCJ	14,620	38,952	53,429	94,579	58,841	8,870	269,291
Pap smear	51 (0.3%)	5,046 (11.1%)	11,554 (18.6%)	27,271 (25.4%)	14,824 (21.6%)	248 (2.7%)	58,994 (19.2%)
VIA	14,737	40,351	50,521	80,121	53,846	8,872	248,448
VIA test result							
• Not interpreted	122	388	302	312	152	17	1,293
• Interpreted	14,615	39,963	50,219	79,809	53,694	8,855	247,155
Positive	597 (4.1%)	1,695 (4.2%)	1,693 (3.4%)	3,093 (3.9%)	2,580 (4.8%)	731 (9.0%)	10,389 (4.2%)
Negative	14,018	38,268	48,526	76,716	51,114	8,124	236,766
Following treatment							
• Referred	42 (7.0%)	384 (22.7%)	603 (35.6%)	849 (27.4%)	886 (34.3%)	197 (26.9%)	2,961 (28.5%)
• Cryotherapy	555 (93.0%)	1,309 (77.2%)	1,075 (63.5%)	2,210 (71.5%)	1,684 (65.3%)	533 (72.9%)	7,366 (70.9%)
• Other/Unknown	0	2	15	34	10	1	62

The positive (Aceto-white) rate of VIA was 4.2% on average. The VIA-positive rate dropped slightly in 2004 and 2005, then increased to 4.8% in 2006. Among these positive findings, nearly all underwent the treatment. About one-third (28.5% on average) of the women have been referred to a higher level of care, for example, provincial hospitals for further cryotherapy or other appropriate treatments. The referral rate went up to 35.6% in 2004 and down to 27.4% in 2005, and then rose again to 34.3% in 2006. The majority of the VIA positive cases (70.9%) still adhered to the SVA concept, i.e., received the cryotherapy immediately after the VIA screening. SVA occurred in as many as 93% of the positive cases in 2002 in Roi-Et.

It is noticeable from Table 2.17 and Table 2.18 that positive findings (4.2%) of VIA visits as reported by the (nurse) screeners were over two times greater than the instances of cytologic abnormality of the epithelium of the cervix uteri (1.9%) as interpreted by the cytologists from the Pap smear slides. The consequence was not only the increased potential for the need of immediate treatment, but also an increased service load from the referred positive cases that had to be shouldered by high-level health facilities, such as provincial hospitals, for a final confirmed diagnosis.

5.2 Case study provinces

5.2.1 Screening results

From the in-depth interview of health managers at the PHO's NCD departments in the three provinces, it became apparent that there were no formal the follow up procedures of the screened women, especially for those seeking the screening service in private hospitals and clinics.

The test results of both the Pap smear and VIA screenings in the study provinces are presented in Table 2.19 and Table 2.20, respectively. Even though these three study provinces are quite different in the number of health care facilities and population at risk to cervical cancer, the number of Pap smear services provided was similar (approximately 5-6 thousand visits a year). In Roi-Et and Chiang Mai, the majority of the cervical cancer screenings were performed through VIA clinics with a service load of over 10 thousand visits a year. Notably, the proportion of women who visited the VIA clinics primarily with the intention of receiving VIA screening but ended up getting a Pap smear (due to the inappropriateness of VIA for various reasons) increased to more than 15% during the years 2005-2006 in both provinces.

TABLE 2.19 Pap smear screening test results –Study provinces

	Nakhon Phnom		Roi-Et		Chiang Mai	
	2005	**2006**	**2005**	**2006**	**2005**	**2006**
Total	5,304	6,095	5,918	4,604	5,245	6,196
• Unmatched slides	14.7%	12.5%	7.0%	26.1%	22.9%	4.3%
• Unsatisfactory slides	2.3%	0.2%	0.4%	0.1%	0.4%	0.5%
• Epithelial abnormality	0.6%	0.6%	1.1%	1.2%	1.1%	0.8%

The epithelial abnormality detected by Pap smear in Nakhon Phnom was consistently low (0.6%) in both years (2005 and 2006). This is much lower than the national average of 1.9% (see Table 2.17). For Roi-Et and Chiang Mai, the reported abnormality was also at a consistently lower rate and is similar between these two provinces (i.e., approximately 1% of the total visits).

During the period 2002-2004, the positive rate of VIA in Roi-Et was 4.1-4.3%, which is close to the national average of 4.2%. In 2005-2006, the VIA screening in Chiang Mai yielded a little higher positive rate of 6.0-6.4%, whereas in Roi-Et the rate declined a little bit to 3.1-3.9%. There were no obvious reasons for this.

TABLE 2.20 VIA screening test results –Study provinces

	Roi-Et					Chiang Mai	
	2002	**2003**	**2004**	**2005**	**2006**	**2005**	**2006**
Total	14,772	24,314	17,022	24,690	12,407	12,409	16,170
• Incomplete SCJ	1.1%	25.7%	31.6%	6.7%	8.3%	12.4%	20.6%
• Pap smear	0.3%	1.0%	8.3%	18.0%	24.4%	16.9%	24.6%
• VIA	99.7%	99.0%	91.7%	82.0%	75.6%	83.1%	75.4%
• Positive result	4.1%	4.2%	4.3%	3.1%	3.9%	6.0%	6.4%
• Referral	7.5%	21.9%	36.6%	32.7%	41.9%	15.0%	15.9%

The referrals of VIA-positive cases for further appropriate treatment in Roi-Et varied from year to year (7.5% in 2002, 22-37% in 2003-2004, and 33-42% in 2005-2006), whereas in Chiang Mai the referral rate was relatively stable at 15-16% a year. Compared with the national average over the same period, the first two years (2005-2006) of VIA implementation in Chiang Mai experienced a higher rate of a single visit approach (SVA) with immediate cryotherapy, while the SVA in Roi-Et slowed down in the fourth and the fifth years.

Table 2.21-Table 2.23 present Pap smear test results by district in these three study provinces. The epithelial abnormality detected varied both across districts and over time. It is interesting to note that two districts, Tha-uthen in Nakhon Phnom and Suwannaphum in Roi-Et, had an epithelial abnormality rate consistently higher than the provincial average.

TABLE 2.21 Pap smear test results by district -Nakhon Phnom

	2005		2006	
	Total tests	Abnormality (%)	Total tests	Abnormality (%)
Muang	486	0.4	992	1.0
Thatphanom	862	1.2	1,147	0.9
Banphaeng	74	1.4	386	0
Nakae	925	0.3	410	0.2
Srisongkhram	259	0.4	241	0
Renunakhon	212	1	0	0
Plapak	182	0.6	183	1.7
Tha-uthen	166	1.8	45	2.3
Nawa	579	0.9	828	0
Phonsawan	509	0	975	0.6
Nathom	136	0	116	0

TABLE 2.22 Pap smear test results by district – Roi-Et

	2005		2006	
	Total tests	Abnormality (%)	Total tests	Abnormality (%)
Muang	621	1.4	402	1.5
Selaphum	754	1.5	50	0
Suwannaphum	154	4.5	210	4.3
Phonthong	708	0.4	304	2
Kasetwisai	467	0.2	17	5.9
Pathumrat	356	0.6	315	1.3
Chaturaphakphiman[a]	570	0.9	341	1.2
Thawatburi	163	1.2	276	0
Phanomphrai	211	1.9	313	1
Phochai	40	0	71	0
Nongphok	244	0.4	98	2
Mueangsuang	17	5.9	125	0
Phonsai	388	1	203	0
Atsamat[b]	584	1.2	132	1.5
Moeiwadi	31	0	48	0
Sisomdet	123	1.6	62	0
Changhan	47	0	431	0.9

TABLE 2.23 Pap smear test results by district - Chiang Mai

	2005		2006	
	Total tests	Abnormality (%)	Total tests	Abnormality (%)
Muang	247	0.8	194	1
Chomthong	0	0	185	1.1
Sanpatong	73	4.1	40	0
Fang	0	0	378	0
Chiangdao	214	0.9	387	1.6
Maechaem	69	0	0	0
Doisaket	137	2.9	890	0.7
Maetaeng	0	0	195	1
Maerim	359	1.4	0	0
Samoeng	78	0	370	0
Mae-ai	97	2.1	334	1.5
Phrao	513	1.4	0	0
Sankamphaeng	715	0.8	754	0.5
Sansai	209	1	114	1.8
Hangdong	38	5.3	194	1.5
Hod	1	0	0	0
Doitao	345	0.3	0	0
Omkoi	56	0	16	0
Saraphi	29	6.9	1,097	0.8
Wianghaeng	147	0	126	0
Chaiprakan	311	1.6	216	0.5
Maewang	212	1.4	0	0
Mae-on	177	0	405	1.7
Doilor	0	0	0	0

The VIA positive rate within the same district (Table 2.24-Table 2.25) is found to be more consistent over time than the epithelial abnormality as detected by Pap smear (Table 2.22-Table 2.23). This may stem from the relatively higher sensitivity of VIA as compared with Pap smear.

TABLE 2.24 VIA test results by district – Roi-Et

	2002		2003		2004		2005		2006	
	Total tests	Positive (%)	Total tests	Positive (%)	Total tests	Positive (%)	Total tests	Positive (%)	Total tests	Positive (%)
Muang	5	0	1,376	6.9	1,502	4.3	1,255	6.6	982	5.4
Selaphum	1,024	7.9	3,152	6.7	1,253	4.6	3,011	4.4	603	3
Suwannaphum	2,242	2.8	3,939	4.9	711	3.9	1,790	2.1	572	1.2
Phonthong	1,917	4.6	1,258	3.9	1,506	5.4	2,120	1.4	560	1.6
Kasetwisai	1	0	654	0.2	2,162	1.4	1,976	0.6	211	0.9
Pathumrat	506	2.4	873	2.4	937	2.5	942	1.9	429	2.6
Chaturaphakphiman	125	1.6	806	3.8	214	6.1	177	1.7	77	0
Thawatburi	426	4.5	1,755	1.8	1,248	5.7	677	6.4	720	1.9
Phanomphrai	665	3.9	2,412	2.5	1,444	8.2	2,908	4.8	2,221	6.7
Phochai	1,153	5.5	1,806	8.7	1,183	6.1	793	4.9	1,131	0.6
Nongphok	649	4.5	490	6.7	943	5.3	690	5.1	815	10.4
Mueangsuang	338	0.9	481	1	504	3.8	86	2.3	137	0.7
Phonsai	778	0.9	437	0	291	1.7	988	2	20	0
Atsamat	2,751	5.7	2,887	2.3	266	1.5	1,330	0.6	25	0
Moeiwadi	319	0.6	217	0	234	0	232	1.3	52	1.9
Sisomdet	1,209	3.6	251	2.8	445	1.3	694	1.2	296	0
Changhan	493	0.2	996	4.1	710	3.4	477	1.7	491	0.6

TABLE 2.25 VIA test results by district - Chiang Mai

	2005		2006	
	Total tests	Positive (%)	Total tests	Positive (%)
Muang	23	0	12	0
Chomthong	2,273	10.2	1,529	8.8
Sanpatong	1,128	8.8	1,773	7.3
Fang	294	13.9	832	4.1
Chiangdao	1,481	3.3	510	2.7
Maechaem	1,132	5.3	943	3
Doisaket	1	0	129	5.4
Maetaeng	218	0.5	2	0
Maerim	578	2.2	376	3.7
Samoeng	0	0	0	0
Mae-ai	66	9.1	169	5.9
Phrao	2	0	83	7.2
Sankamphaeng	49	10.2	907	14.8
Sansai	368	0.3	49	2
Hangdong	8	12.5	237	0.8
Hod	133	4.5	1,248	4.3
Doitao	2	0	65	0
Omkoi	0	0	137	8
Saraphi	63	9.5	682	5.6
Wianghaeng	3	0	65	6.2
Chaiprakan	53	3.8	1,042	12.9
Maewang	1,318	4.8	677	1.2
Mae-on	0	0	115	0
Doilor	1,095	2.7	572	3.1

As mentioned previously, a relatively high sensitivity of VIA results in not only an increased potential for the immediate of cryotherapy, but also an increased service load due to the referred positive cases for a confirmed diagnosis. In such cases, part of the confirmed diagnostic procedure would have been conducted unnecessarily. A relatively higher sensitivity of VIA as compared with Pap smear will result in a greater tendency for false positive rates.

Among the three study provinces, neither colposcopes nor colposcopists are available in Nakhon Phnom Hospital. Since the VIA program does not exist in Nakhon Phnom province, women who were found to have abnormalities, as detected by Pap smear screening, were referred for a final diagnosis using tissue biopsy instead. This procedure was conducted by Nakhon Phnom Hospital. Table 2.26 presents the confirmed diagnoses based on colposcopy and colposcopic directed biopsies of those VIA-positive women who were referred to the provincial hospitals in Roi-Et and Chiang Mai.

TABLE 2.26 Confirmed diagnosis of the VIA positive cases who were referred for colposcopic examination

	Roi-Et[a] (N=313)	**Chiang Mai[b] (N=142)**
Normal colposcopy or no epithelial lesion	39.3%	35.9%
Cervicitis	23.0%	31.0%
HPV infection	3.8%	
CIN I/II/III or LSIL/HSIL and others	12.1%	31.0%
CIS, invasive cancer	1.0%	2.1%
Further biopsy (not known result)	20.8%	

[a] *Roi-Et Hospital (2005), review of individual patient medical records*
[b] *Nakornping Hospital (July 2005 – June 2006), obtained from Maneerat C. (2007) (19)*

Approximately three quarters (75.6%) of the referrals to Roi-Et Hospital, the only public general hospital in Roi-Et, were associated with lesion size > 75% of cervix or larger than the cryoprobe edge > 2 mm. Other reasons for referrals included a suspicion of cervical cancer (3.5%), one-year follow up after cryotherapy (15.8%), and other problems (5.1%). All of the 316 referred patients underwent colposcopy but 3 cases received neither a final diagnosis nor were recommended for further action. Approximately one-fifth (20.8%) of the 313 patients whose latest status was known were transferred to biopsy for a confirmed diagnosis. However, no results were reported in these patients.

Among the rest, almost 40% had the normal colposcopic finding. The final diagnosis for 23.0% of the referred patients was normal cervicitis and for 3.8% was HPV infection. With regard to precancerous lesions, 7.0%, 2.6%, 1.0%, and 1.6% were diagnosed CIN I, CIN II, CIN III, and CIS, respectively. Those referred VIA-positive patients who were confirmed with invasive cancer accounted for 1.0%.

From a study of 142 VIA-positive patients referred to Nakornping Hospital, the provincial hospital in Chiang Mai, 98% of the cases had the large acetowhite lesion and 1.4% were reported with suspected cancer (19). All patients underwent colposcopy and the final diagnosis for the abnormal colposcopic findings was confirmed by biopsy. Only 14.1%, 11.3%, and 2.1% were found with LSIL, HSIL, and invasive cancer, respectively. Almost 30% had normal colposcopic results while 6.3%, despite showing an abnormal result, having been confirmed as having no epithelial lesion. Of the rest, 31% had chronic cervicitis and 5.6% had atypical immature squamous metaplasia and intraepithelial lesions that could not be excluded.

The results from the two hospitals show a similarly high rate of false positives among those referred VIA cases where all patients to have a further biopsy in Roi-Et Hospital had the precancerous lesions or invasive cancer (66.1% in Roi-Et Hospital and 66.9% in Nakornping Hospital were not found to have precancerous lesions or invasive cancer).[12] The positive predictive value (PPV) of HSIL as reported by the study in Nakornping Hospital was 11.2% (19). This is within the range of 10-35% as reported in other studies (20). The PPV of Pap smear screening has been reported at 22%-33% (20-22). Colposcopic referral of the VIA-positive cases is a burden to the referred health facilities and this may trigger antagonism from OB-GYN physicians (or colposcopists) towards the VIA program. To effectively scale up the VIA program, an empowerment of the colposcopic follow-up as a continuation of the care process should be seriously considered.

[12] *Not all VIA-positive cases were taken as the denominator. Only the screened women that were referred to these two general hospitals for confirmed diagnosis or proper treatment were counted. The rest of the VIA-positive cases, i.e., those who underwent immediate cryotherapy (during a single 'see and treat' visit) were not accounted for in the final diagnosis. The overall false positive rate of VIA can be lower than, equal to, or higher than this finding (66-67%).*

5.2.2 Follow up of the screening outcomes

Sanpatong Hospital, a 120-bed district hospital in Chiang Mai, has maintained the follow-up records of women who have been screened by Pap smear and VIA and found to have an abnormality of the uteri cervix. This prospective data can be used to shed light on the performance of cervical cancer screening methods based on their final outcomes.

In 2005 and 2006, a total of 207 screened women (Pap smear41.1% and VIA 58.9%) were recorded for their follow-up results (Table 2.27). Almost three quarters (71.4%) of the women in these records were referred to the provincial hospital (Nakornping Hospital), while 18.1% were admitted to the Hospital's obstetric-gynecology department; 8.5% were referred to the university teaching hospital in Chiang Mai. Based on information specific to Sanpatong Hospital on the positive screening rates of Pap smear (0-4%, see Table 2.23) and VIA (7-9%, see Table 2.25) and the referral rate of VIA-positive cases (34-36%), these records were exhaustively drawn from the Hospital's total number of screened women.

TABLE 2.27 Abnormality detected by Pap smear or VIA of women who were recorded by Sanpatong Hospital for their follow-up results

	2005	2006	Total
Total recorded cases	*99*	*108*	*207*
• Pap smear	48 (48.5%)	37 (34.3%)	85 (41.1%)
• VIA	51 (51.5%)	71 (65.7%)	122 (58.9%)
Pap smear	*48*	*37*	*85*
• Cervicitis	1 (2.1%)	0	1 (1.2%)
• ASC-US	20 (41.6%)	25 (67.6%)	45 (52.9%)
• LSIL	10 (20.8%)	3 (8.1%)	13 (15.3%)
• HSIL	11 (22.9%)	3 (8.1%)	14 (16.5%)
• Atypical glandular cell	1 (2.1%)	0	1 (1.2%)
• Unknown type of epithelial abnormality	0	1 (2.7%)	1 (1.2%)
• CIS	5 (10.4%)	5 (13.5%)	10 (11.8%)
VIA	*51*	*71*	*122*
• Suspected cancer	17 (33.3%)	15 (21.1%)	32 (26.2%)
• Polyp	2 (3.9%)	1 (1.4%)	3 (2.5%)
• Positive	32 (62.7%)	55 (77.5%)	87 (71.3%)

Of the 85 women screened by Pap smear and where an abnormality was found, approximately half (52.9%) were reported ASC-US. Intraepithelial lesions: low-grade (LSIL), high-grade (HSIL), or unknown accounted for another 33%, with CIS accounting for 11.8%. Of 122 women who showed VIA abnormality but did not receive an immediate cryotherapy, as high a figure as 26.2% were suspected of having cervical cancer.

Distribution of the final outcomes based on confirmed diagnoses of the screening abnormality results in the women who have been followed up is presented in Table 2.28. In almost 30% of these cases the follow up results were not known; nearly all (52 out of 56 women) were Pap smear cases. Of the known diagnoses (N=151), approximately 29-30% had normal colposcopy or no epithelial lesion; cervicitis or hyperkeratosis or metaplasia; and intraepithelial lesions (either LSIL or HSIL). The rest (12%) were CIS, invasive cancer, or death. This final diagnosis distribution, however, does not inform predictive values of Pap smear or VIA screening.

TABLE 2.28 Final diagnosis of women with abnormality screening results who were followed up by Sanpatong Hospital

	2005	2006	Total
Total recorded cases	*99*	*108*	*207*
• Unknown follow up results	28	28	56[a]
• Known follow up results	71	80	151
– Normal colposcopy or no epithelial lesion	19 (26.8%)	25 (31.3%)	44 (29.1%)
– Cervicitis, hyperkeratosis, metaplasia	25 (35.2%)	28 (35.0%)	45 (29.8%)
– LSIL/HSIL	16 (22.5%)	20 (25.0%)	44 (29.1%)
– CIS, invasive cancer, death	11 (15.5%)	7 (8.8%)	18 (11.9%)

[a] *Re-screened in Sanpatong Hospital (N=21), terminated due to transfer to other hospitals (N=27), unavailable data (N=8)*

The extent to which abnormality based on cytological interpretation and visual inspection was confirmed by the final diagnosis is presented in Table 2.29 (Pap smear) and Table 2.30 (VIA).

TABLE 2.29 Pap smear abnormality vs. known final diagnosis, 2005-2006

Screening result	Total	Final diagnosis				
		Unknown	Normal, no lesion	Cervicitis, hyperkeratosis, metaplasia	LSIL /HSIL	CIS, invasive cancer, death
Cervicitis	1	–	–	1	–	–
ASC-US	45	35 (77.8%)	3	–	4	3
LSIL/HSIL, atypical, unknown	29	13 (44.8%)	2	1	8	5
CIS	10	4 (40.0%)	–	–	3	3

TABLE 2.30 VIA abnormality vs. known final diagnosis, 2005-2006

Screening result	Total	Final diagnosis				
		Unknown	Normal, no lesion	Cervicitis, hyperkeratosis, metaplasia	LSIL /HSIL	CIS, invasive cancer, death
Suspected cancer	32	1 (3.1%)	5 (15.6%)	19 (59.4%)	4 (12.5%)	3 (9.4%)
Polyp	3	2	1	-	-	-
Positive	87	1 (1.1%)	33 (37.9%)	28 (32.2%)	21 (24.1%)	4 (4.6%)

Findings from the prospective data on the cervical cancer screening hints at the problems with the follow-up of Pap smear cases. More than three quarters (77.8%) of the women reported ASC-US by cytology interpretation did not obtain confirmed information regarding their final diagnoses. Interestingly, five women (3 with ASC-US and 2 with intraepithelial lesions based on cytology) who were later confirmed as having a normal cervix can be considered as the false positive cases. At the same time, 11 women (3 with ASC-US, 5 with intraepithelial lesions, and 3 with CIS based on cytology) developed cancerous lesions (CIS, invasive cancer, or death).

Of the 32 women who were suspected of having cervical cancer from the visual inspection, only 3 cases (9.4%) were later confirmed with CIS, invasive cancer, or death; whereas 12.5% had precancerous lesions (LSIL or HSIL), 15.6% were normal or had no lesions, and more than half (59.4%) had other problems including cervicitis, hyperkeratosis, or metaplasia. The false positive cases were accounted for by normal cervixes or no lesions in 37.9% and cervicitis, hyperkeratosis, or metaplasia in 32.2% of the total 87 VIA-positive cases. One quarter (24.1%) of the VIA-positive cases were confirmed as having precancerous lesions and 4.6% had CIS or invasive cancer, or were dead.

(6) Demand-side characteristics

Three national surveys: the HWS2003, NHES 2003-04, and RHS 2006 shed light on important demographic and socio-economic factors that were associated with cervical cancer screening, based on the recalls on prior exposure to the screening of women aged 35 years and over (Table 2.31).

TABLE 2.31 Cervical cancer screening status by women's characteristics

	2003[a]		2003-04[b]			2006[c]		
	Population	**Screened**	**Population**	**Screened Beyond 5 yr**	**Screened within 5 yr**	**Population**	**Screened beyond 5 yr**	**Screened within 5 yr**
All groups	10,747,794	4,048,587 (37.7%)	9,966,414	854,455 (8.6%)	4,575,161 (45.9%)	11,410,819	1,543,738 (13.5%)	5,684,661 (49.8%)
Age group								
35-40 years	2,504,617	1,213,814 (48.5%)	3,174,321	263,353 (8.3%)	1,623,115 (51.1%)	3,502,402	415,617 (11.9%)	1,796,765 (51.3%)
41-45 years	1,741,084	784,641 (45.1%)	2,321,626	194,387 (8.4%)	1,150,422 (49.6%)	2,580,033	359,170 (13.9%)	1,371,249 (53.1%)
46-50 years	1,727,987	730,964 (42.3%)	1,927,471	171,395 (8.9%)	853,708 (44.3%)	2,443,950	335,919 (13.7%)	1,238,432 (50.7%)
51-55 years	1,273,708	492,454 (38.7%)	1,549,930	129,637 (8.4%)	626,408 (40.4%)	1,785,203	256,822 (14.4%)	836,206 (46.8%)
56-60 years	1,014,956	310,875 (30.6%)	993,066	95,683 (9.6%)	321,508 (32.4%)	1,099,231	176,210 (16.0%)	442,009 (40.2%)
> 60 years	2,485,442	515,839 (20.8%)	--	--	--	--	--	--
Marital status								
Never married	625,549	143,024 (22.9%)	641,416	17,707 (2.8%)	129,575 (20.2%)	952,711	82,882 (8.7%)	254,396 (26.7%)
Married[d]	10,107,729	3,903,944 (38.6%)	9,301,904	829,771 (8.9%)	4,443,642 (47.8%)	10,458,108	1,460,856 (14.0%)	5,430,265 (51.9%)
Unknown	14,516	1,619 (11.2%)	23,094	6,977 (30.2%)	1,944 (8.4%)			
Education level								
Uneducated	1,144,097	201,257 (17.6%)	585,871	43,883 (7.5%)	185,766 (31.7%)	652,947	67,913 (10.4%)	225,227 (34.5%)
Primary school	7,924,814	2,852,265 (36.0%)	7,741,470	649,780 (8.4%)	3,534,130 (45.7%)	8,010,988	1094091 (13.7%)	3,894,009 (48.6%)
Secondary school	847,691	432,681 (51.0%)	1,185,563	126,899 (10.7%)	600,171 (50.6%)	1,429,790	228,264 (16.0%)	740,016 (51.8%)
Higher education	818,854	561,350 (68.6%)	433,526	32,692 (7.5%)	244,514 (56.4%)	1,282,374	150,226 (11.7%)	810,350 (63.2%)
Other	5,553	174 (3.1%)	6,359	776 (12.2%)	1,342 (21.1%)	15,422	1,755 (11.4%)	6,946 (45.0%)
Unspecified	6,785	860 (12.7%)	13,625	425 (3.1%)	9,238 (67.8%)	19,298	1,489 (7.7%)	8,113 (42.0%)
Income per capita								
Lowest	2,367,607[e]	699,042 (29.5%)	2,267,336[j]	183,182 (8.1%)	996,218 (43.9%)			
Low	2,054,955[f]	726,496 (35.4%)	5,112,415[k]	381,117 (7.5%)	2,322,479 (45.4%)			
Middle	2,099,426[g]	724,521 (34.5%)						
High	2,049,262[h]	796,502 (38.9%)	1,602,356[l]	221,593 (13.8%)	696,338 (43.5%)			
Highest	2,176,544[i]	1,102,026 (50.6%)	140,845[m]	14,314 (10.2%)	79,688 (56.6%)			
Health insurance								
Uninsured	969,815	335,764 (34.6%)						
CSMBS	1,359,404	747,914 (55.0%)						
SSS	600,809	283,710 (47.2%)						
UC	7,660,652	2,580,577 (33.7%)						
Other	157,114	100,622 (64.0%)						

[a] *Health Welfare Survey 2003*
[b] *National Health Examination Survey 2003-04*
[c] *Reproductive Health Survey 2006*
[d] *Include women living with male, widowed, divorced, separated, and those married but unknown current status*
[e – i] *By quintiles of the monthly household income per capita: e (0-720 Baht); f (721-1,400 Baht); g (1,401-2,333 Baht) ; h (2,334-4,249 Baht); i (4,250+ Baht)*
[j – m] *By ranges of the monthly individual income: j (0-999 Baht); k (1,000-4,999 Baht); l (5,000-9,999 Baht); m (10,000+ Baht)*

Women in the relatively younger ages have been exposed to cervical cancer screening in a greater proportion than their older counterparts. The within 5-year coverage is found in approximately half of the women aged up to 45 years (in NHES 2003-04) or 50 years (RHS 2006). Beyond the ages of 45-50 years, the cervical cancer screening coverage declines with respect to an increase in the age of the female population. This age-reversing trend in the screening coverage was consistent in all geographic regions. Women aged 55-59 years living in the southern and the central regions were the lowest screened population (67.1% and 63.6%, respectively have not been screened within the last 5 years based on RHS 2006).

By marital status, those women who have never been married were less likely (22.9% in HWS 2003, 20.2% in NHES 2003-04, and 26.7% in RHS 2006) to be screened for cervical cancer. This implies an increased recognition of the fact that cervical cancer is a disease that can be transmitted through sexual contact among the group of at risk women. At the same time, it stresses the critical role of the reproductive health program in cervical cancer prevention and control.

Education is found to be an important predictor of cervical cancer screening. As evidenced in all three periods of the national surveys, the screening coverage increases proportionally with respect to education levels. Women who had the higher education were exposed to cervical cancer screening in the highest proportion.

The HWS 2003 and NHES 2003-04 surveys also reported a link between screening exposure and income levels. Women in the top income level (the fifth quintile of household income per capita in HWS or those earning over 10,000 Baht a month in NHES) had the largest coverage. Though cervical cancer screening is deemed a basic benefit package under the UC policy, UC beneficiaries and uninsured women were less likely (33.7% and 34.6%, respectively) to receive the service as compared with CSMBS (55.0%) and SSS (47.2%) beneficiaries. Again, this finding signals an implicit barrier to achieving

full coverage due to the indirect costs of obtaining the service, especially in women with low economic status.

(7) Cervical cancer admission

In-depth interviews with gynecologists working in the provincial hospitals in the three study provinces revealed that the number of patients admitted to the hospitals due to invasive cervical cancer had not declined over time. They believed that the invasive cancer cases tend to be the hard-to-reach women who had never been exposed to the screening service. It was found that those who were screened once were more likely to be in the subgroup that would be screened repeatedly and frequently.

7.1 Nation-wide admissions

Table 2.32 and Table 2.34 present the distribution patterns of patients admitted to hospitals in 2004-2006 due to invasive cervical cancer (ICD-10 code 'C53') (Table 2.32) and carcinoma in situ (CIS) of cervix uteri and cervical intraepithelial neoplasia (CIN) grade III (ICD-10 code 'D06') (Table 2.34) by age groups, and regional locations and type of hospital. This information was obtained from the electronic administrative data that the contracted hospitals nation-wide submitted to the NHSO and Social Security Office (SSO). Hence, the denominator represents the populations who were the beneficiaries of the two major public health insurance schemes: the UC and Social Security Scheme (SSS) during this three-year period.

TABLE 2.32 Number of patients who were beneficiaries of UC and SSS and admitted to hospitals due to invasive cervical cancer[a], 2004-2006

	UC				SSS			
	2004	**2005**	**2006**	**Total**	**2004**	**2005**	**2006**	**Total**
Total	6,568	7,147	7,257	20,972	495	547	674	1,716
Age group								
< 35 years	5.3%	5.1%	5.0%	5.1%	16.4%	15.5%	16.0%	16.0%
35-39 years	9.6%	9.2%	9.3%	9.4%	23.6%	23.4%	21.4%	22.7%
40-44 years	15.9%	15.5%	15.0%	15.5%	26.5%	27.2%	22.3%	25.1%
45-49 years	18.1%	18.3%	17.3%	17.9%	14.3%	16.3%	18.7%	16.7%
50-54 years	14.6%	15.3%	15.8%	15.2%	12.3%	11.2%	12.6%	12.1%
55-59 years	12.3%	13.0%	12.3%	12.5%	5.7%	5.3%	6.4%	5.8%
60-64 years	9.4%	8.9%	8.6%	8.9%	0.8%	0.9%	1.5%	1.1%
≥ 65 years	15.0%	14.7%	16.6%	15.4%	0.4%	0.2%	1.2%	0.6%
Region								
Bangkok	11.7%	11.9%	12.7%	12.1%	28.3%	32.0%	28.3%	29.5%
Central	25.8%	26.7%	24.2%	25.6%	44.8%	43.1%	42.6%	43.4%
North	26.0%	24.8%	26.0%	25.6%	15.2%	12.6%	13.1%	13.5%
Northeast	27.0%	26.0%	26.4%	26.5%	5.3%	5.3%	6.5%	5.8%
South	9.5%	10.6%	10.7%	10.3%	6.5%	6.9%	9.5%	7.8%
Type								
District hospital	18.3%	16.4%	17.5%	17.4%	0.8%	1.6%	1.3%	1.3%
Other govt. hospital	80.3%	82.0%	80.2%	80.8%	47.1%	43.5%	49.6%	46.9%
Private hospital	1.4%	1.6%	2.3%	1.8%	52.1%	54.8%	49.1%	51.8%

[a] *ICD-10 code of C53 for principal diagnosis*

For invasive cancer, the number of hospital-admitted patients increased from 6,568 and 495 in 2004 to 7,257 and 674 in 2006 for the UC and SSS schemes, respectively (Table 2.32). However, the admission distributional pattern with respect to patient ages and hospital characteristics remained consistent over time.

In 2005, the number of UC and SSS patients admitted to hospitals due to cervical cancer and reported to the NHSO and SSO, respectively in total (N=7,694) was approximately 9% lower than that (N=8,483) recently projected by the NCI. The figures projected by the NCI were based on the registered cases in the 1989-1997 and 1998-2000 population-based registries in 5 and 9 provinces[13] (23) (Table 2.33). It should be noted that the differences in provincial cervical cancer cases between the NCI's population registries and the NHSO-SSO's hospital admission databases can be classified into three groups. For two

[13] *Chiang Mai and Lampang in the north; Khon Kaen, Udon Thani, and Nakhon Phnom in the northeast; Songkhla in the south; Rayong and Prachuap Khiri Khan in the central regions; and Bangkok. The number of cervical cancer cases per year was calculated by pooling together the annual cases expected at the middle of the periods from registries in each region, using a statistical adjustment.*

provinces that have a MOPH cancer centre, Lampang and Udon Thani, the figures are similar (4.6% vs. 2.9-4.5% in Lampang and 5.5% vs. 4.3-5.2% in Udon Thani). For three provinces and Bangkok that have university hospitals, the NCI figure is approximately twice that of hospital admissions (28.8% vs. 12.8-13.8% in Bangkok; 11.3% vs. 5.7-7.8% in Chiang Mai; 6.3% vs. 2.3-3.7% in Khon Kaen; and 5.7% vs. 2.7-3.0% in Songkhla). For the three provinces (Rayong, Prachuap Khiri Khan, and Nakhon Phnom) that participated in the national registries recently, the provincial figures of cervical cancer admissions were less than 1%. This was much lower than the number of total registered cases.

TABLE 2.33 Number of cervical cancer cases by projection and by admission

	1999		2002	2004		2005		2006		2008
	Cases	%		Cases	%	Cases	%	Cases	%	
Whole country										
Projected cases	6,746[a]	100%	7,419[a]	-	-	8,483[a]	-	-	-	9,747[a]
Hospital-admitted cases	-	-	-	7,063[c]	100%	7,694[c]	100%	7,931[c]	100%	-
Province with registry										
Bangkok	1,941[b]	28.8 %	-	901	12.8 %	1,026[c]	13.3%	1,098	13.8%	-
Rayong	207[b]	3.1%	-	20	0.3%	56[c]	0.7%	116	1.5%	-
Prachuap Khiri Khan	142[b]	2.1%	-	34	0.5%	40[c]	0.5%	48	0.6%	-
Chiang Mai	763[b]	11.3 %	-	549	7.8%	469[c]	6.1%	452	5.7%	-
Lampang	313[b]	4.6%	-	206	2.9%	314[c]	4.1%	359	4.5%	-
Khon Kaen	427[b]	6.3%	-	163	2.3%	276[c]	3.6%	291	3.7%	-
Udon Thani	374[b]	5.5%	-	367	5.2%	331[c]	4.3%	343	4.3%	-
Nakhon Phnom	114[b]	1.7%	-	34	0.5%	36[c]	0.5%	28	0.4%	-
Songkhla	385[b]	5.7%	-	189	2.7%	204[c]	2.7%	234	3.0%	-

[a] Projection using population-based cancer registries in 1989-1997 (5 provinces) and in 1998-2000 (9 provinces)
[b] Incidence cases reported by 9 cancer registries (1998-2000)
[c] UC and SSS patients admitted to hospitals and reported to NHSO and SSO, respectively by fiscal years (2004-2006)
Source: Cancer in Thailand (1998-2000) and IHPP calculation

For those cases admitted to hospital, most of the UC patients were aged between 40-54 years (approximately 15-18% of each 5-year range in these three age groups). The 5-year age interval at the younger and older extremes (except in those above 65 years) each made up less than 10% of total admissions. Notably, hospitals in the southern region admitted the smallest percentage (approximately 10%) of cervical cancer admissions, whereas those in the central, north, and north-eastern regions admitted similar proportions (approximately 25% each). Over 80% were admitted to government

hospitals where the level of care was higher than the district hospitals (i.e., general and university hospitals).

The SSS patients tended to be in a relatively younger age group (approximately half were aged 35-44 years), which reflects the age structure of SSS beneficiaries. Since hospital contractors for the SSS scheme (private employees) are mostly located in Bangkok and the central region, the distribution of the hospital-admitted cases followed accordingly (30-45%). Private hospitals played a dominant role in treating those cervical cancer patients who were the beneficiaries of SSS.

For the CIS and CIN III, the total number of hospital-admitted cases was less (each year approximately 1,600-1,800 for UC and 270-300 for SSS) (Table 2.34). The distribution of CIS and CIN III admissions was consistent over time and followed a similar pattern to invasive cancer. However, the admissions tended to concentrated in the relatively younger patients.

7.2 Leading causes of admission

The medical history records of women admitted with cervical cancer[14] to three provincial hospitals: Nakhon Phnom Hospital (N=82), Roi-Et Hospital (N=114), and Nakornping Hospital (N=262) during the fiscal years of 2004-2006 were reviewed to find the leading causes of admission, whether by the screening results or by clinical symptoms. More than half of the reviewed cases belonged to two age groups: 40-49 years (23.2%, 29.0%, and 36.6% in Nakhon Phnom, Roi-Et, and Chiang Mai, respectively) and 50-59 years (37.8%, 29.0%, and 21.4%, respectively) (Table 2.35). The age distribution in this case study dataset is similar to that of the UC patients admitted to other public hospitals nation-wide (see Table 2.32 and Table 2.34).

[14] Based on ICD10 codes: C53 (invasive cancer) or D06 (carcinoma in situ -CIS of cervix uteri and cervical intraepithelial neoplasia -CIN grade III). Final diagnosis in Nakhon Phnom Hospital was based on pathology results from conization or biopsy because of no colposcopic service. For Roi-Et Hospital, only the invasive cancer from the 2005-2006 Hospital's cancer registry was analyzed.

TABLE 2.34 Number of patients who were beneficiaries of UC and SSS and admitted to hospitals due to carcinoma in situ (CIS) of cervix uteri and cervical intraepithelial neoplasia (CIN) grade III[a], 2004-2006

	UC				SSS			
	2004	**2005**	**2006**	**Total**	**2004**	**2005**	**2006**	**Total**
Total	1,573	1,741	1,795	5,109	269	268	304	841
Age group								
< 35 years	14.0%	12.4%	11.3%	12.5%	34.6%	33.2%	30.6%	32.7%
35-39 years	20.5%	16.9%	16.2%	17.8%	29.7%	28.4%	25.3%	27.7%
40-44 years	22.5%	22.5%	23.8%	23.0%	20.4%	23.1%	25.0%	22.9%
45-49 years	17.2%	19.1%	19.2%	18.6%	8.2%	10.1%	12.8%	10.5%
50-54 years	11.4%	13.8%	12.4%	12.6%	5.2%	4.1%	3.6%	4.3%
55-59 years	7.0%	7.3%	9.0%	7.8%	1.9%	0.4%	2.6%	1.7%
60-64 years	3.4%	3.8%	5.0%	4.1%	0.0%	0.4%	0.0%	0.1%
≥ 65 years	3.9%	4.2%	3.2%	3.8%	0.0%	0.4%	0.0%	0.1%
Region								
Bangkok	5.7%	7.2%	5.6%	6.2%	24.2%	31.3%	24.7%	26.6%
Central	19.0%	23.7%	27.6%	23.6%	46.5%	42.2%	44.7%	44.5%
North	37.3%	35.3%	31.0%	34.4%	15.6%	11.2%	15.1%	14.0%
Northeast	30.7%	25.9%	28.0%	28.1%	6.3%	9.0%	10.9%	8.8%
South	7.3%	7.9%	7.8%	7.7%	7.4%	6.3%	4.6%	6.1%
Type								
District hospital	5.3%	5.1%	6.0%	5.5%	0.7%	1.1%	0.3%	0.7%
Other govt. hospital	93.0%	93.6%	92.7%	93.1%	53.9%	59.7%	55.3%	56.2%
Private hospital	1.7%	1.2%	1.3%	1.4%	45.4%	39.2%	44.4%	43.0%

[a] *ICD-10 code of D06 for principal diagnosis*

TABLE 2.35 Patients admitted to provincial hospitals due to cervical cancer by age groups, study provinces

Age group	Nakhon Phnom (N=82)[a]	Roi-Et (N=114)[b]	Chiang Mai (N=262)[c]
<30 year	1 (1.2%)	1 (0.9%)	4 (1.5%)
30-39 year	17 (20.7%)	15 (13.2%)	49 (18.7%)
40-49 year	19 (23.2%)	33 (29.0%)	96 (36.6%)
50-59 year	31 (37.8%)	33 (29.0%)	56 (21.4%)
60-69 year	10 (12.2%)	24 (21.1%)	16 (6.1%)
70-79 year	3 (3.7%)	6 (5.3%)	11 (4.2%)
≥ 80 year	1 (1.2%)	2 (1.8%)	2 (0.8%)
Unknown	--	--	28 (10.7%)

[a] *2004-2006 admissions for the ICD-10 codes of C53 (N=61) and D06 (N=21)*
[b] *2005-2006 admissions for the ICD-10 codes of C53 only (N=114)*
[c] *2004-2006 admissions for the ICD-10 codes of C53 (N=167), D06 (N=67), and unknown ICD (N=28)*

In terms of cancer severity, the majority (44-55%) of the patients admitted to the three provincial hospitals were in stage 1 invasive cancer, while only 3 patients in total were in stage 4 (Table 2.36). Stages 2 and 3 each accounted for 11-25% of the patients admitted to the provincial hospitals in Nakhon Phnom and Roi-Et. The percentage of patients in stages 2 and 3 in Nakornping Hospital in Chiang Mai was even less. With a number of patients, however, the cancer stage was not defined. This was for a variety of reasons, including admission for other illness.

TABLE 2.36 Severity of invasive cervical cancer admission, study provinces

Severity of cancer	Nakhon Phnom (N=61)	Roi-Et (N=114)	Chiang Mai (N=167)
Stage 1	27 (44.3%)	54 (47.4%)	91 (54.5%)
Stage 2	11 (18.0%)	25 (21.9%)	8 (4.8%)
Stage 3	15 (24.6%)	13 (11.4%)	10 (6.0%)
Stage 4	1 (1.6%)	--	2 (1.2%)
Biopsy	--	--	28 (16.8%)
Unspecified	7[a] (11.5%)	22 (19.3%)	28[b] (16.8%)

[a] *Care for complications (N=3) and unknown stage (N=4)*
[b] *Palliative care (N=13), referral (N=5), dead (N=3), and unknown stage (N=7)*

The leading causes of cervical cancer admission varied in three of the provinces. In Nakhon Phnom, 43.9% of the women admitted to the provincial hospital were admitted as a result of test results from Pap smear screening, whereas 40.2% were admitted by individual clinical symptoms. In 15.9% of cases the leading causes were not known.[15] (Table 2.37). In contrast, the leading cause of hospital admissions in Roi-Et was clinical symptoms (64.0%), whereas Pap smear and VIA screenings accounted for only 29.8% and 4.4%, respectively (Table 2.38). In Chiang Mai, the evidence generated by Pap smear and VIA screenings stood at 47.3% and 5.3%, respectively, of the total admissions. In 26.3% of the cases the information regarding the cause of admission was not obtained[16], and only 21.0% were led by clinical symptoms (Table 2.39). Noticeably, the younger age groups tended to be admitted from screening results, whereas the admission of older patients was led mostly by clinical symptoms.

[15] *Eleven patients had a previous diagnosis of invasive cancer and were admitted due to its complications, such as anemia, lower gastrointestinal bleeding, bleeding from vagina, renal failure, and systemic shock. Information not recorded in the medical charts could not be reviewed.*
[16] *Includes 28 patients whose medical charts were not accessible and 36 patients with previous invasive cancer diagnosis and admission due to anemia, active bleeding, and metastatis.*

TABLE 2.37 Screening vs. symptom leading to admissions by age groups –Nakhon Phnom (N=82)

Age group	Pap smear	Clinical symptom	Unknown
<30 year	0	1 (100%)	0
30-39 year	10 (58.8%)	4 (23.5%)	3 (17.7%)
40-49 year	11 (57.9%)	6 (31.6%)	2 (10.5%)
50-59 year	10 (32.3%)	16 (51.6%)	5 (16.1%)
60-69 year	3 (30.0%)	5 (50.0%)	2 (20.0%)
70-79 year	2 (66.7%)	0	1 (33.3%)
≥ 80 year	0	1 (100%)	0
All ages	36 (43.9%)	33 (40.2%)	13 (15.9%)

TABLE 2.38 Screening vs. symptom leading to admissions by age groups –Roi-Et (N=114)

Age group	Pap smear	VIA	Clinical symptom	Unknown
<30 year	0	0	1 (100%)	0
30-39 year	7 (46.7%)	0	8 (53.3%)	0
40-49 year	9 (27.3%)	4 (12.1%)	20 (60.6%)	0
50-59 year	8 (24.2%)	0	24 (72.7%)	1 (3.0%)
60-69 year	9 (37.5%)	1 (4.2%)	13 (54.2%)	1 (4.2%)
70-79 year	1 (16.7%)	0	5 (83.3%)	0
≥ 80 year	0	0	2 (100%)	0
All ages	34 (29.8%)	5 (4.4%)	73 (64.0%)	2 (1.8%)

TABLE 2.39 Screening vs. symptom leading to admissions by age groups –Chiang Mai (N=262)

Age group	Pap smear	VIA	Clinical symptom	Unknown
<30 year	3 (75.0%)	0	0	1 (25.0%)
30-39 year	28 (57.1%)	6 (12.2%)	7 (14.3%)	8 (16.3%)
40-49 year	52 (54.2%)	7 (7.3%)	19 (19.8%)	18 (18.8%)
50-59 year	35 (62.5%)	1 (1.8%)	13 (23.2%)	7 (12.5%)
60-69 year	5 (31.3%)	0	8 (50.0%)	3 (18.8%)
70-79 year	0	0	7 (63.6%)	4 (36.4%)
≥ 80 year	1 (50.0%)	0	1 (50.0%)	0
Unknown	0	0	0	28 (100%)
All ages	124 (47.3%)	14 (5.3%)	55 (21.0%)	69 (26.3%)

The relatively lower proportion of admission by VIA should be interpreted with caution since the majority of the positive findings from the visual inspection method is followed by an immediate cryotherapy with a relatively high efficacy rate, 92.5% (10).

2.5 Summary

The current situation of the national cervical cancer prevention and control program in Thailand can be concluded as follows:

(1) Population screening coverage

Based on three national surveys (HWS2003, NHES2003, and RHS2006), cervical cancer screening coverage in adult female respondents was 37.7%, 54.5%, and 63.3%, respectively. The central and southern regions and the non-municipal areas in most regions had population coverage below the national average. Much of the coverage increase in 2006 was found in women living in the north and northeastern regions or outside municipal areas.. Whether this is as a result of the recent financial incentive initiated by the NHSO for health workers is too early to conclude.

As of June 2007, the figures for screening encounters, as recorded in two facility-based, national databases were: 472,966 (PapRegistry, 2005-2006) and 307,442 (CPIStm, 2002-2006) in total. Pap smear coverage in the defined target population stood at 11.1% in 2005. The 2006 PapRegistry data was incomplete. In 2002, VIA covered 9.9% of the target population in the first province to implement this program in the northeastern region. In 2003 and 2004, the coverage increased to 15.6% and 15.7%, respectively. All were confined to the northeastern provinces. In 2005 and 2006, when the VIA programs were extended to some other provinces in the north and south, the coverage declined to 8.0% and 4.4%, respectively. The VIA coverage accrued to 18.8% in 17 provinces between 2002 and 2006. The relatively lower screening coverage obtained from the supply-side data, as compared with the demand-side data, may come from a social desirability bias from the survey respondents and the scope of the facility-based data, which is mostly restricted to the public sector under the MOPH-NHSO contract.

The programmatic structures of the cervical cancer control and prevention program at the national level and operation strategies at the provincial and facility levels may explain variations in the population coverage and potential for the program to be scaled up. The National Cancer Institute, of the Department of Medical Services is the national manager

of the Pap smear program, while the Department of Health is the national manager of VIA.

In the provinces that implemented both Pap smear and VIA, those performing quite well with regard to VIA also showed an above average performance with Pap smear. Those provinces which only adopted VIA in 2006 showed a relatively low VIA coverage, and also showed below-average Pap smear performance. It was found that health facilities that are very proactive in VIA are also actively engaged in Pap smear implementation.

(2) Screening test results

On average, 17.0% of the Pap smear slides prepared by health workers did not reach the cytology laboratories for interpretation. The unmatched slides in 2005 accounted for 20.9% of the total number. This figure, however, then declined dramatically to 6.8% in 2006. This decreasing trend reflects an improvement in the recording and reporting system of Pap smear screening. Only 0.8% of the Pap smear prepared slides were evaluated as being of an unsatisfactory quality by cytology laboratories. The epithelial abnormality detected by Pap smear was 1.9% on average. The abnormality rate dropped slightly from 2.1% in 2005 to 1.6% in 2006.

Of the 307,442 encounters in women who came to seek VIA in the beginning, 12.4% could not take VIA mostly because of an incomplete SCJ and needed to get a Pap smear instead. The Pap smear substitution accounted for 19.2% of the total VIA visits on average, with an increasing trend from 11.1% in 2003 to 25.4% in 2005 and 21.6% in 2006.

The VIA-positive (aceto-white) rate was 4.2% on average, dropping slightly in 2004 and 2005, and then increasing to 4.8% in 2006. Most (70.9%) positive cases received immediate cryotherapy, while 28.5% were referred to provincial hospitals for appropriate treatments. The referral rate went up to 35.6% in 2004 and down to 27.4% in 2005. It then rose again to 34.3% in 2006.

The consequences of a relatively high positive rate of VIA is two fold. First, it increases the potential for the immediate treatment and prevention of the cancer. Second, it increases the service load to the provincial hospitals for the final diagnosis. Several of

these VIA-positive cases were in fact falsely detected at the initial screening. Based on confirmed colposcopy results from the VIA-referred patients in two case-study provinces, in 66.1% of cases in Roi-Et Hospital, 66.9% in Nakornping Hospital, and 70.1% in Sanpatong Hospital, neither precancerous lesions nor invasive cancer were found.

The three-province case study revealed whether the screening could help to lead to admission for cervical cancer. In Nakhon Phnom, 43.9% of the women admitted to the provincial hospital were admitted from results from Pap smears, whereas 40.2% were admitted due to individual clinical symptoms. In15.9% of the cases, the leading causes were unknown. In contrast, the major leading cause of hospital admission in Roi-Et was clinical symptoms (64.0%), whereas Pap smear and VIA screenings accounted for only 29.8% and 4.4%, respectively. In Chiang Mai, the evidence generated by Pap smear and VIA screenings stood at 47.3% and 5.3%, respectively, of the total admissions, whereas in 26.3% of cases no information concerning the cause was obtained. Only 21.0% of the cases were led by clinical symptoms. Noticeably, the younger age groups tended to be admitted by the screening results, whereas the admission of older patients was led mostly by the clinical symptoms.

CHAPTER 3
Economic Evaluation of the Policy Options for Prevention and Control of Cervical Cancer in Thailand

3.1 Introduction

Similar to other developing settings cervical cancer has been prioritised as a major cause of morbidity and mortality among Thai women (2). Despite the fact that effective screening and subsequent treatment options have been available through publicly funded programmes for all Thai women for more than 40 years, the mortality of cervical cancer remains high (24). It was reported that only 5% of women in Thailand were screened for cervical cancer at any point in the previous five years, compared with up to 70% in industrialised countries. As a result, cervical cancer is the leading cause of female cancer deaths.

The establishment of a strong link between the high-risk persistent infections that are known as Human Papilloma viruses (HPV) and the occurrence of cervical cancer resulted in the recent development of HPV related technologies for the prevention and control of cervical cancer. These include HPV DNA testing and prophylaxis HPV vaccines, which were approved by the Thai Food and Drug Administration, and are now available to the public. Although the vaccines appear to be a new hope for bringing cervical cancer under control, they are still very expensive and there is no clear national policy or plan regarding the use of these technologies.

A purpose of this research is, therefore, to make a comprehensive assessment of health technology related to the screening and prevention of cervical cancer in Thailand. The study aims to explore the value for money of each health technology and their combinations, with the hope that the findings will be used for guiding policy decisions regarding resource allocation for cervical cancer at both the national and sub-national levels. It is also expected that lessons learned from this study would also be useful for decision makers in other developing settings to make the most efficient use of health care resources to overcome cervical cancer problems.

3.2 Objectives

This work package aims to determine the optimal strategy for the prevention and control of cervical cancer in Thailand using the efficiency criteria underpinning economic evaluation.

Specifically, a cost-utility analysis, which allows for a direct comparison between interventions with different health outcomes, was conducted for this purpose. It compared the additional costs and benefits of moving from a 'do nothing' scenario to a number of alternative policy options for the prevention and control of cervical cancer, including Pap smears every 3, 5 and 10 years, VIA every 3, 5 and 10 years, and HPV vaccination for women aged 15, 16, 17,...,60 years and the various combinations of these policies. The low specificity in excluding the absence of high-grade cervical intraepithelial neoplasia (CIN) compared to cytology screening has discouraged the use of HPV DNA testing as a source of primary screening for cervical cancer and pre cancer (25). However, in conjunction with cytology screening, the HPV test may bring a higher probability of detecting high-grad lesions. The HPV DNA test is not widely used in Thailand and so is not yet included in the clinical practice guidelines recommended by the Royal Thai College of Obstetricians and Gynecologists (26). For this reason it was excluded from this study.

3.3 Design and Methods

A model-based cost-utility analysis was carried out within the Thai health care setting, and adopted both societal and health care provider's (or the third party payer's) perspectives. The outcomes were measured in terms of both Life Years (LY) and Quality Adjusted Life Years (QALY) gained from the interventions. The Time horizon used was people's lifetime.

Overview of competing strategies

Pap smears, the cytology-based screening, have been a standard test for the early detection of cervical cancer in Thailand for more than 40 years. The service is planned and supervised by the Ministry of Public Health (MOPH), and is widely available at every health centre and hospital throughout the country though the cytologists and pathologists who make the diagnoses are available only at secondary or tertiary hospitals or private laboratories. The women identified as having precancerous lesions need to have the lesions treated before these lesions progress to an invasive cancer. The screen-and-treat

coverage is claimed to be more effective for reducing the incidence of cervical cancer than the screening frequency alone.

VIA was first introduced in Thailand in 2001 as one of the alternatives for cervical cancer screening (10). The technique involves an examination of the cervix with the naked eye, using a bright light source, after one minute of 3-5% diluted acetic being applied using a cotton swab or spray. The technique eliminates the need for cytologists and colposcopies. Detection of well-defined aceto-white areas close to the squamocolumnar junction indicates a positive test and this allows the treatment to be performed e.g. cryosurgery to be performed during the same screening visit. In 2006, VIA existed in a total of 17 out of 76 provinces, mostly at the district health system (DHS) level in the rural areas (a total of 186 districts).

With the recent approval of the two currently available HPV vaccines: Gardasil® of Merck, Sharpe and Dohme (MSD) and Cervarix® of GlaxoSmithKline, by the Thai Food and Drug Administration (FDA) for prevention of high-risk HPV type 16 and 18, the vaccines have the potential to greatly reduce the burden of cervical cancer. It is recommended that the prophylactic vaccines should be given in three doses at 0, 1-2 and 6 months for women aged between 15 and 26 years. The vaccines are only available for those who can afford them at a total cost of 15,000 Baht. To achieve health benefits across the population, HPV vaccination needs to be part of a publicly funded, universal vaccination programme.

Analyses and model

This is a simulation study using a semi-markov model, where the transitional probability of changing from one health state to another depends on the amount of time that has elapsed since entry into the current state. This is in contrast to the traditional markov model, where there is a constant probability of changing state given survival in that state up to that time. Because the time-horizon of the analysis was people's lifetime, the model used a 1-year-cycle length.

The model structure is illustrated in Figure 3.1. The states of health are denoted in square boxes while an arrow indicates that movement from one state to another is possible. In the model, all women who start with no infection--healthy state, can get an HPV infection or remain in the same state for the next cycle. For those having the infection, they can

move to the precancerous states, CIN-1 and CIN-2 or CIN-3, accordingly, and they can also move back to the previous states or a healthy state for the next cycle. However, if they entered to a cancerous stage, stage I, II, III or IV, they will have no chance to return to the previous states or a healthy state. For each of the cancerous states, the patients can enter into the persistence, remission or recurrence states, or may die from the cervical cancer. All hypothetical cohort women can also die from other causes, such as accidents, diabetes or breast cancer, at the end of each cycle.

The Monte Carlo simulation was used to model costs and events over a 100-year period to cover the total period over which the whole cohort would be expected to survive. To comply with the guidelines for conducting health technology assessment in Thailand, all costs and outcomes were discounted at the rate of 3%. We, however, also explored results with discounted rates of 0, 5, and 10%.

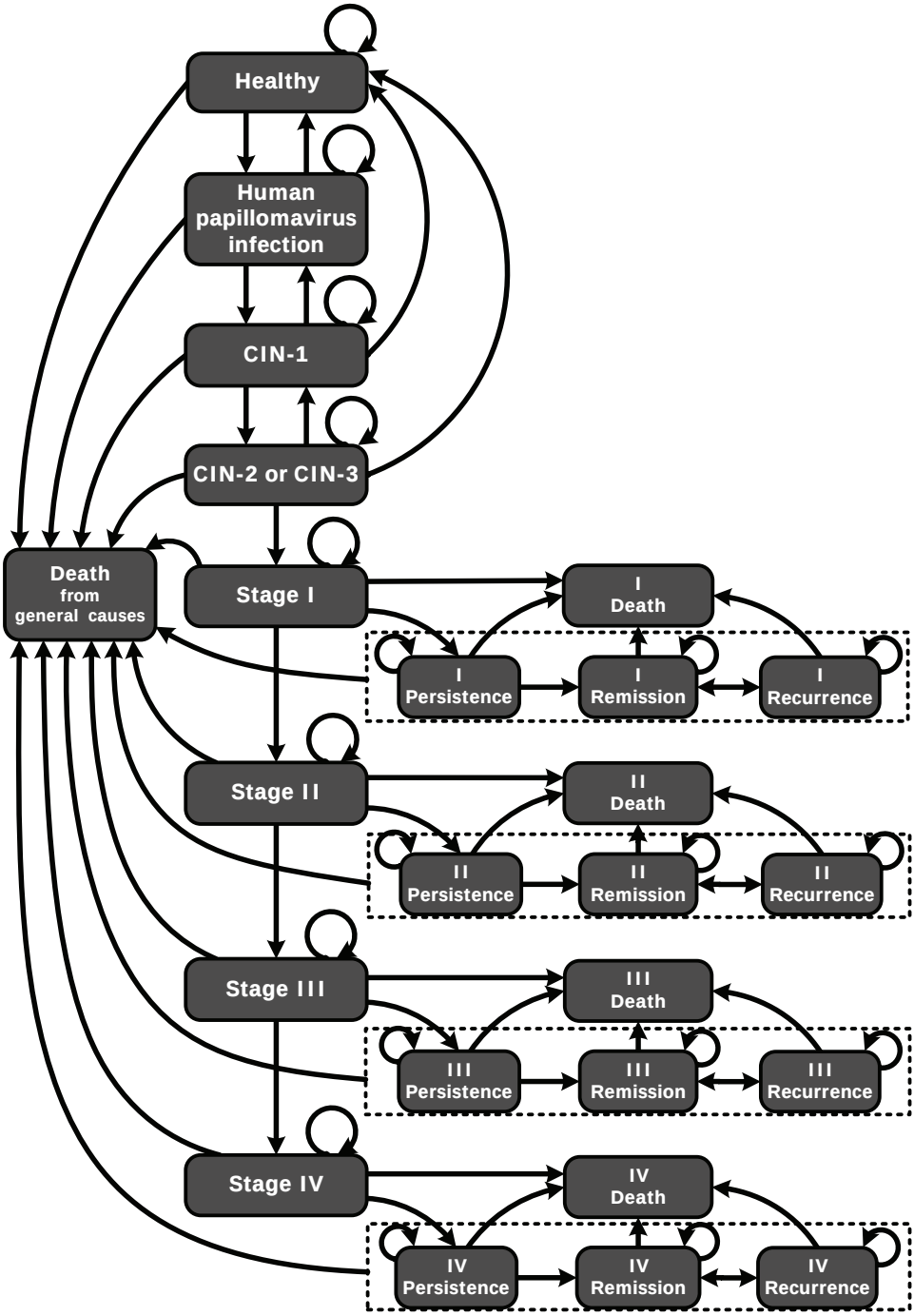


FIGURE 3.1 Schematic diagram of the semi-markov model

Outcome measures

The probability of transitions between health states for the unscreened population were mainly taken from the work of Myers et al (27) who developed a markov model of the natural history of HPV infections and cervical cancer based on their previous works and published data (Table 3.1). The transitional probability used in the model was validated using the observed data from a community survey in Thailand (28). Figure 3.2 illustrates that the predicted age-specific annual prevalence of HPV infection obtained from the model was similar to the observed data. This was true for all groups except for the young age group (15-24 years) in which the survey data was very limited (28).

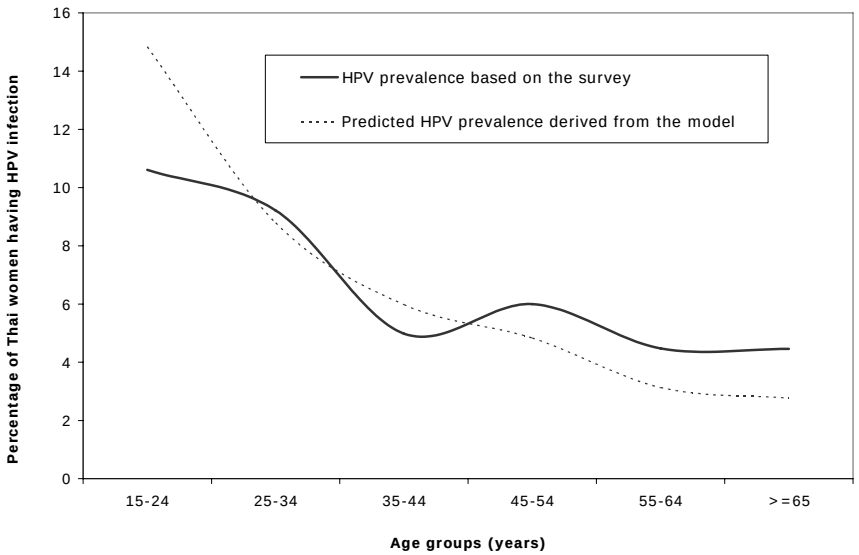


FIGURE 3.2 Observed and predicted prevalence of HPV infection among Thai women

The baseline mortality for the general population and the mortality for patients with cervical cancer were derived from the Thai cohorts. First, vital registration data, which had been verified by a verbal autopsy study, was used to obtain the number of deaths by age and sex among the general population for the year 2004 (2). Second, the survival of cervical cancer patients with particular disease staging, i.e. I, II, III and IV, were derived from the tumor registry database of the Thai Gynecologic Oncology Collaborative Group (TGOC). This database was comprised of 799 patients observed over a 4-year period (2000-2003). The survival rate of each patient group was obtained by parametric analysis, using a Weibull probability distribution.

For the Weibull distribution, the survival function, which describes the probability of survival as a function of age, is:

$$S(t) = \exp\{-H(t)\},$$

and

$$H(t) = \lambda t^{\gamma}$$

where H(t) is cumulative hazard; λ (lambda) is the scale parameter; t is time in days; and γ (gamma) is the shape parameter that describes the instantaneous death rate, the hazard rate--h(t), which increases with age if γ > 1. λ depends on the covariate, age (years), according to the formula:

$$\lambda = \exp\{(age\_coefficient \times Age) + cons\}$$

The transitional probability of dying during the cycle, tp(c), is therefore estimated from the formula ('c'--number of cycle):

$$tp(c) = 1 - \exp\{H(t-c) - H(t)\}$$

Because a more precise estimate can be attained from combining outcome data from a number of studies and also to avoid bias from the selective use of information, the model parameters relating to the effectiveness of the screening interventions were derived only from systematic reviews and meta-analyses of clinical trials. Detailed information about the systematic reviews and meta-analyses were reported elsewhere (29). Briefly, the Medline database was searched using the following key search words.

1. 'uterine cervical neoplasms [Mesh]' with subheading 'diagnosis';
2. 'sensitivity' or 'specificity' ;
3. 'Pap smear' or 'visual inspection with acetic acid'.

The search strategy was: #1 AND #2, limited to the English language. Only journal articles published between 1 January 1996 and 28 February 2007 were included.

The title and abstract of each article were initially assessed and, if they appeared to be relevant, full-texts were retrieved, reviewed and extracted by two independent reviewers. The studies were included if they compared the sensitivity and specificity of Pap smears or VIA to one of the reference standards, namely the histological pathology and colposcopy, on the same patient. We excluded studies that did not provide information about the true positive, false positive, true negative and false negative.

Abnormality of Pap smear was defined as a high grade of squamous intraepithelial lesion (HSIL) or worse, or equivalent by other classifications. However, atypical squamous cells of undertermined significance (ASCUS) or low grade of squamous intraepithelial lesion (LSIL), or equivalent categories by other classifications, could be used as the threshold if data of HSIL was not available. Abnormal VIA or VIA with magnifying device (VIAM) was defined as white plaques, ulcer or cancerous-like lesions by naked-eye visual inspection of the cervix after applying 3-5% acetic acid with a cotton swab and by using a magnifying device, respectively. The histology threshold for a positive outcome from screening tests was CIN2 or worse (or equivalent categories by other classifications). Histological confirmation by tissues obtained by colposcopy-directed biopsy, loop excision, or endocervical curettage was used to determine abnormalities of the colposcopy.

Results from random effects meta-analyses of 12 studies regarding the accuracy of VIA and 15 studies concerning the accuracy of Pap smears are revealed in Table 3.1. The sensitivity and specificity of Pap smears at the pre-invasive stage were 0.552 (SE=0.070) and 0.915 (SE=0.013), respectively. Based on expert opinion we assumed a sensitivity of 0.800 and 1.00 of Pap smears for detecting invasive cervical cancer stages I, and II or higher, respectively. We also assumed that all false positive cases will be detected eventually after undertaking a colposocpy with tissue biopsy. The sensitivity of VIA at the pre-invasive stage was relatively higher than Pap smears (0.716, SE=0.025) but its specificity was lower (0.793, SE=0.011). We assumed a sensitivity of 0.900 and 1.00 of VIA for detecting invasive cervical cancer stages I, and II or higher, respectively. For the efficacy of the HPV vaccine, it was obtained from a recent systematic review and meta-analysis published by Rambout et al (30). They reported a 79% vaccine efficacy (relative risk = 0.213, SE= 0.318).

Based on the performance assessment conducted in work package 1, the target population coverage of cervical cancer screenings, either by Pap smear or VIA, was derived from two national representative surveys; namely the Health and Welfare Survey (2003) and the Reproductive Health Survey (2006), both conducted by the National Statistical Office. They revealed that the self-reported coverage of cervical cancer screening was between 38% and 63%. However, the target population coverage estimated from the reported cases screened by health care facilities against the preset target was unacceptably low; 11% for Pap smears and 19% for VIA (which is mostly

confined to rural provincial areas). As a result, we assumed an equal coverage of 20% for both Pap smears and VIA to ensure that the difference, in terms cost-effectiveness, between these interventions resulted from screening accuracy and costs. In the threshold analysis, a programme coverage of 50%, 80% and 100% were assigned to both Pap smears and VIA.

Because HPV vaccination is not standard practice in Thailand, there was no information about the coverage for those members of the target population who were included in a basic health service package. We assumed 100% coverage of the HPV vaccine among eligible groups. If this intervention was cost-ineffective under these assumptions, then we can clearly discard their values for money. However, if it was cost-effective with 100% coverage, then we would further explore, using threshold analysis and the level of coverage.

TABLE 3.1 Model parameters

Parameters	Mean	SE**	Distribution	Ref
Baseline parameters				
Discount rate for both costs and outcomes	0.03			
Epidemiological parameters				
Prevalence of HPV infection; age 15	0.100	0.064	Beta	(27)
Prevalence of CIN-1; age 15	0.010	0.010	Beta	(27)
Age (years)-specific incidence of HPV infection				
15	0.100	0.038	Beta	(27)
16	0.100	0.038	Beta	(27)
17	0.120	0.046	Beta	(27)
18	0.150	0.057	Beta	(27)
19	0.170	0.065	Beta	(27)
20	0.150	0.057	Beta	(27)
21	0.120	0.046	Beta	(27)
22	0.100	0.038	Beta	(27)
23	0.100	0.038	Beta	(27)
24	0.050	0.019	Beta	(27)
30	0.010	0.004	Beta	(27)
50	0.005	0.002	Beta	(27)
Progression rate; HPV infection => CIN-1	0.072	0.015	Beta	(27)
Progression rate (age); CIN-1 => CIN-2 or CIN-3				
15	0.017	0.010	Beta	(27)
35	0.069	0.013	Beta	(27)
Progression rate; CIN-2/3 => invasive cancer	0.050	0.008	Beta	(27)
Progression rate; stage I => stage II	0.438	0.351	Beta	(27)
Progression rate; stage II => stage III	0.536	0.351	Beta	(27)
Progression rate; stage III => stage IV	0.684	0.140	Beta	(27)

Parameters	Mean	SE**	Distribution	Ref
Age (years)-specific probability of regression*; HPV infection=>Healthy				
15	0.552	0.084	Beta	(27)
25	0.370	0.033	Beta	(27)
30	0.103	0.018	Beta	(27)
Age (year) specific regression rate; CIN-1 => HPV infection or Healthy				
15	0.161	0.024	Beta	(27)
35	0.082	0.021	Beta	(27)
Regression rate from CIN-2/3 to CIN-1or Healthy	0.069	0.013	Beta	(27)
Proportion of CIN-1 reverting to Healthy	0.900	0.128	Beta	(27)
Proportion of CIN-2/3 reverting to Healthy	0.500	0.128	Beta	(27)
Proportion of stage I having symptoms	0.150	0.150	Beta	(27)
Proportion of stage II having symptoms	0.225	0.225	Beta	(27)
Proportion of stage III having symptoms	0.600	0.600	Beta	(27)
Proportion of stage IV having symptoms	0.900	0.900	Beta	(27)
Weibull survival by cancer stage and the patient age (year)				
Stage I				
constant	-8.749	1.259	Lognormal	a
Age	0.041	0.020	Lognormal	a
gamma	0.589	1.139	Lognormal	a
Stage II				
constant	-7.066	0.934	Lognormal	a
Age	-0.014	0.011	Lognormal	a
gamma	0.919	1.120	Lognormal	a
Stage III				
constant	-6.778	0.891	Lognormal	a
Age	0.023	0.011	Lognormal	a
gamma	0.675	1.098	Lognormal	a
Stage IV				
constant	-3.863	1.217	Lognormal	a
Age	-0.055	0.022	Lognormal	a
gamma	1.004	1.226	Lognormal	a
Programme effectiveness parameters				
Pap smear				
Sensitivity of pre-invasive	0.552	0.070	Beta	(29)
Sensitivity of stage I	0.800			b
Sensitivity of stage II, III, IV	1.000			b
Specificity	0.915	0.013	Beta	(29)
VIA				
Sensitivity	0.716	0.025	Beta	(29)
Sensitivity of stage I	0.900			b
Sensitivity of stage II, III, IV	1.000			b
Specificity	0.793	0.011	Beta	(29)
HPV Vaccine				
Relative risk	0.213	0.318	Beta	(30)
Programme acceptability				
Pap smear	0.200	A coverage of 50, 80 and 100% were used in the threshold analysis		(29)b
VIA	0.200			(29)b
HPV vaccine	1.000			b

Parameters	Mean	SE**	Distribution	Ref
Proportion of the patient with CIN2/3 receiving cryosurgery	1.000	1.000	Beta	(31)
Proportion of the patient with CIN2/3 receiving cold knife conization	0.125	0.125	Beta	(31)
Proportion of the patient with CIN2/3 receiving simple hysterectomy	0.125	0.125	Beta	(31)
Incidence of OP visit for treating minor complications from cryosurgery	0.05	0.05	Beta	(31)
Incidence of IP visit for treating major complications from cryosurgery	0.01	0.01	Beta	(31)
Probability of the patient with initial stage to be treated at OPD	0.856	0.017	Beta	a
Probability of the patient with remission stage to be treated at OPD	0.993	0.004	Beta	a
Probability of the patient with persistence stage to be treated at OPD	0.786	0.063	Beta	a
Probability of the patient with recurrence stage to be treated at OPD	0.715	0.041	Beta	a
Annual rate of OP visits for initial stage	25.48	1.41	Gamma	a
Annual rate of OP visits for remission stage	7.14	0.59	Gamma	a
Annual rate of OP visits for persistence stage	38.53	7.77	Gamma	a
Annual rate of OP visits for recurrence stage	13.37	2.02	Gamma	a
Annual rate of IP visits for initial stage	0.77	0.10	Gamma	a
Annual rate of IP visits for remission stage	0.15	0.04	Gamma	a
Annual rate of IP visits for persistence stage	0.87	0.43	Gamma	a
Annual rate of IP visits for recurrence stage	1.64	0.31	Gamma	a
Annual hospitalization days for initial stage	5.44	0.85	Gamma	a
Annual hospitalization days for remission stage	1.17	0.33	Gamma	a
Annual hospitalization days for persistence stage	3.60	1.81	Gamma	a
Annual hospitalization days for recurrence stage	6.64	1.25	Gamma	a
Costing parameters				
Direct medical costs of screening (Baht/visit)				
by PAP smear	60	60	Gamma	(31)
by VIA	30	30	Gamma	(31)
Cost of follow up for Pap screening	32	32	Gamma	(31)
Patient time spent for Pap/VIA (minutes)	15	15	Gamma	(31)
Cost of HPV vaccination (Baht, for 3 doses)	15,000	1,500	Gamma	a
Unit cost of colposcopy / biopsy	1,169	1,169	Gamma	(31)
Patient time spent for colposcopy/biopsy (minutes)	20	20	Gamma	(31)
Patient traveling cost for a visit of primary facility (Baht/visit)	7	7	Gamma	(31)
Patient traveling cost for a visit of secondary facility (Baht/visit)	40	40	Gamma	(31)
Patient traveling cost for a visit of tertiary facility (Baht/visit)	146	146	Gamma	(31)
Patient wage rate (Baht/hour)	26	26	Gamma	(31)
Patient waiting time at primary facility (minutes)	30	30	Gamma	(31)
Patient waiting time at secondary facility (minutes	35	35	Gamma	(31)
Patient waiting time at tertiary facility (minutes)	50	50	Gamma	(31)
Patient one-way traveling time to primary facility (minutes)	15	15	Gamma	(31)

Parameters	Mean	SE**	Distribution	Ref
Patient one-way traveling time to secondary facility (minutes)	44	44	Gamma	(31)
Patient one-way traveling time to tertiary facility (minutes)	53	53	Gamma	(31)
Cost of cryotherapy	650	650	Gamma	(31)
Cost of LEEP	4,677	4,677	Gamma	(31)
Cost of cold-knife conization	7,015	7,015	Gamma	(31)
Cost of simple hysterectomy	14,030	14,030	Gamma	(31)
Cost of hospitalization day	351	351	Gamma	(31)
Hospitalization days for cold knife conization	4	4	Gamma	(31)
Hospitalization days for simple hysterectomy	7	7	Gamma	(31)
Medical cost of follow up of cryosurgery	32	32	Gamma	(31)
Medical cost of follow up of LEEP/cold knife conization /simple hysterectomy	1,201	1,201	Gamma	(31)
Patient time spent for cryosurgery (minutes)	20	20	Gamma	(31)
Patient time spent for LEEP (minutes)	30	30	Gamma	(31)
Patient time spent for cold-knife conization (minutes)	45	45	Gamma	(31)
Patient time spent for simple hysterectomy (minutes)	130	130	Gamma	(31)
Cost of cervical cancer staging	4,801	4,801	Gamma	(31)
Cost of treating minor complications from cryosurgery	585	585	Gamma	(31)
Cost of treating major complications from cryosurgery	3,509	3,509	Gamma	(31)
Annual costs for treatment of invasive cancer				
Direct medical costs occurred at public hospitals for treatment of				
initial stage of cervical cancer stage I	26,816		Gamma	a
initial stage of cervical cancer stage II	27,610		Gamma	a
initial stage of cervical cancer stage III	29,163		Gamma	a
initial stage of cervical cancer stage IV	22,268		Gamma	a
remission stage of cervical cancer stage I	5,690		Gamma	a
remission stage of cervical cancer stage II	5,714		Gamma	a
remission stage of cervical cancer stage III	5,652		Gamma	a
remission stage of cervical cancer stage IV	5,716		Gamma	a
persistence stage of cervical cancer stage I	38,600		Gamma	a
persistence stage of cervical cancer stage II	33,064		Gamma	a
persistence stage of cervical cancer stage III	32,441		Gamma	a
persistence stage of cervical cancer stage IV	24,656		Gamma	a
Recurrence stage of cervical cancer stage I	22,665		Gamma	a
Recurrence stage of cervical cancer stage II	22,602		Gamma	a
Recurrence stage of cervical cancer stage III	22,892		Gamma	a
Recurrence stage of cervical cancer stage IV	23,281		Gamma	a
Direct medical costs occurred outside public hospitals for treatment of				
initial stage of cervical cancer stage I	2,073		Gamma	a
initial stage of cervical cancer stage II	2,101		Gamma	a
initial stage of cervical cancer stage III	2,157		Gamma	a
initial stage of cervical cancer stage IV	1,910		Gamma	a
remission stage of cervical cancer stage I	2,193		Gamma	a
remission stage of cervical cancer stage II	2,197		Gamma	a
remission stage of cervical cancer stage III	2,187		Gamma	a
remission stage of cervical cancer stage IV	2,197		Gamma	a
persistence stage of cervical cancer stage I	14,493		Gamma	a
persistence stage of cervical cancer stage II	11,979		Gamma	a
persistence stage of cervical cancer stage III	11,697		Gamma	a

Parameters	Mean	SE**	Distribution	Ref
persistence stage of cervical cancer stage IV	8,162		Gamma	a
Recurrence stage of cervical cancer stage I	3,466		Gamma	a
Recurrence stage of cervical cancer stage II	3,418		Gamma	a
Recurrence stage of cervical cancer stage III	3,640		Gamma	a
Recurrence stage of cervical cancer stage IV	3,939		Gamma	a
Direct non-medical costs and indirect costs for treatment of				
initial stage of cervical cancer stage I	30,036		Gamma	a
initial stage of cervical cancer stage II	30,905		Gamma	a
initial stage of cervical cancer stage III	32,605		Gamma	a
initial stage of cervical cancer stage IV	25,055		Gamma	a
remission stage of cervical cancer stage I	7,492		Gamma	a
remission stage of cervical cancer stage II	7,514		Gamma	a
remission stage of cervical cancer stage III	7,457		Gamma	a
remission stage of cervical cancer stage IV	7,516		Gamma	a
persistence stage of cervical cancer stage I	47,314		Gamma	a
persistence stage of cervical cancer stage II	38,881		Gamma	a
persistence stage of cervical cancer stage III	37,932		Gamma	a
persistence stage of cervical cancer stage IV	26,071		Gamma	a
Recurrence stage of cervical cancer stage I	15,151		Gamma	a
Recurrence stage of cervical cancer stage II	15,297		Gamma	a
Recurrence stage of cervical cancer stage III	14,621		Gamma	a
Recurrence stage of cervical cancer stage IV	13,714		Gamma	a
Utility parameters				
Utility for healthy stage or CIN1-3 without complication	1.00	1.00	Beta	a
Utility for initial stage of cervical cancer stage I	0.74	0.01	Beta	a
Utility for initial stage of cervical cancer stage II	0.76	0.01	Beta	a
Utility for initial stage of cervical cancer stage III	0.72	0.02	Beta	a
Utility for initial stage of cervical cancer stage IV	0.63	0.03	Beta	a
Utility for remission stage of cervical cancer stage I	0.79	0.01	Beta	a
Utility for remission stage of cervical cancer stage II	0.79	0.01	Beta	a
Utility for remission stage of cervical cancer stage III	0.81	0.01	Beta	a
Utility for remission stage of cervical cancer stage IV	0.85	0.05	Beta	a
Utility for persistence stage of cervical cancer stage I	0.80	0.20	Beta	a
Utility for persistence stage of cervical cancer stage II	0.80	0.04	Beta	a
Utility for persistence stage of cervical cancer stage III	0.65	0.05	Beta	a
Utility for persistence stage of cervical cancer stage IV	0.45	0.05	Beta	a
Utility for recurrence stage of cervical cancer stage I	0.80	0.03	Beta	a
Utility for recurrence stage of cervical cancer stage II	0.68	0.02	Beta	a
Utility for recurrence stage of cervical cancer stage III	0.66	0.04	Beta	a
Utility for recurrence stage of cervical cancer stage IV	0.81	0.08	Beta	a

All costs were presented in Thai Baht 2007
** Rates from references are converted to annual probabilities in model*
*** SE refers to standard error of mean*
a : analysis of primary data collected by the authors
b : assumption
VIA : Visual Inspection with Acetic acid
LEEP : Loop Electrosurgical Excision Procedure
IP : inpatient
OP : outpatient
OPD : outpatient department
IPD : inpatient department

Utility estimates

The health state values used in this study were derived from a Thai cohort of 1,035 patients with invasive cervical cancer. They sought health care at four university hospitals and eight regional cancer centres throughout the country. Two types of preference measurement were applied for the patient survey conducted between May 1st, 2007 and February, 29th 2008. First, a 'visual analogue scale' (VAS), which is a vertical line anchored by word descriptors i.e. 'perfect health' at the top end and 'worst health' at the bottom end, was used and the cohort was asked to mark on the line the point that they feel represents their perception of their current state.

Second, the cohort was requested to complete the Thai version of the EQ-5D, which is one of the multi-attribute utility measures. This instrument includes five dimensions; namely morbidity, self-care, usual activity, pain/discomfort and anxiety/depression. Three levels, reflect 'no health problems', 'moderate health problems', and 'extreme health problems'. A scoring algorithm based on the preference of the UK general population was used to translate EQ-5D scales to the utility weight for each health state. The weight can range from -0.59 to 1.00, with 1.00 indicating 'full health', 0 representing 'death' and negative values indicating states 'worse than death'.

Figures 3.3 and 3.4 present the health state values using different preference elicitation methods. It can be seen that both methods gave similar results. The remission of every cancer stage yielded the highest utility and the persistence of cancer stage IV produced the lowest value. We applied the visual analogue scale utility values in the analysis based on the reasoning that the EQ-5D values were not derived from the preference of the Thai population but the UK residents. Detailed information about means and standard errors of each health state are revealed in Table 3.1.

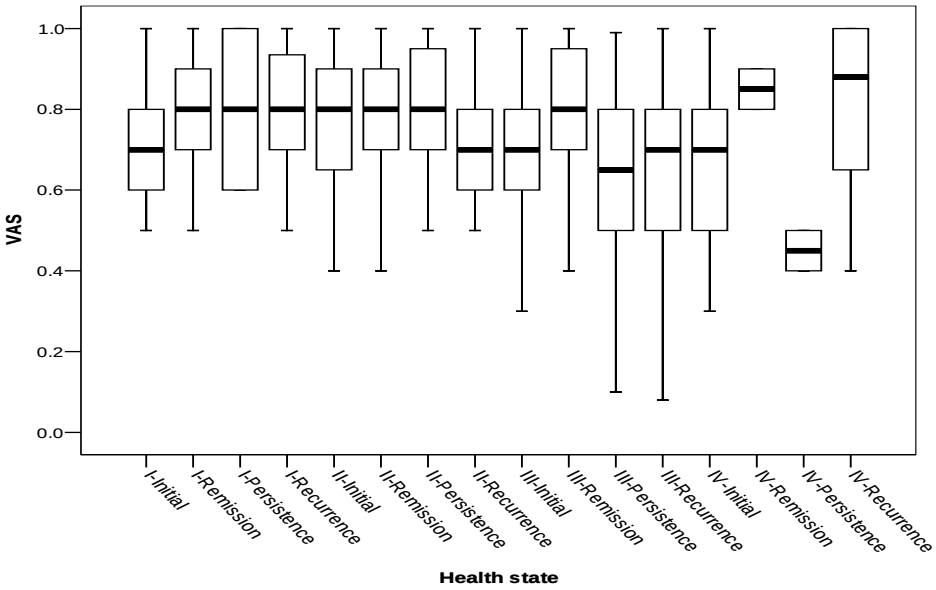


FIGURE 3.3 Box-plot for visual analogue scale valuations classified by health state in the study model

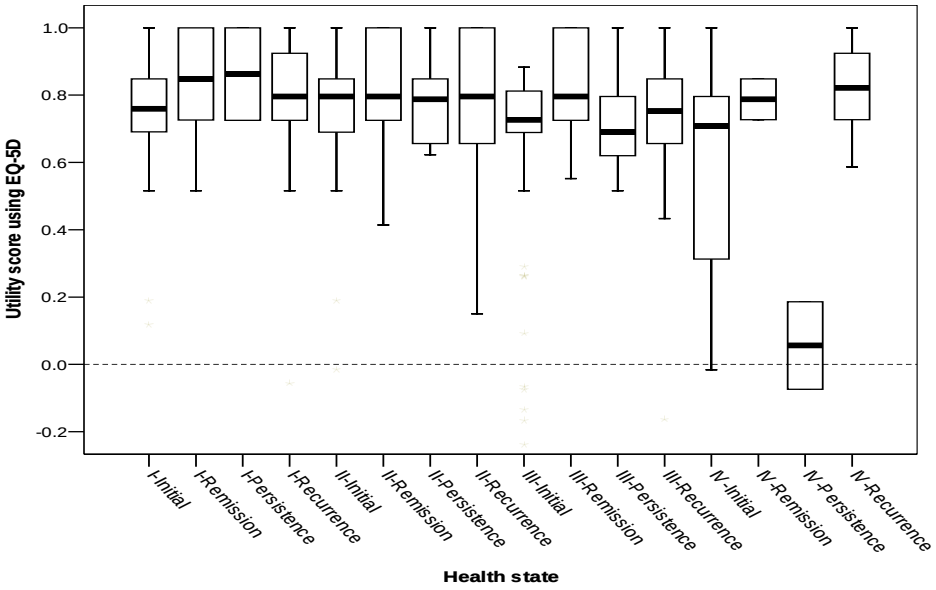


FIGURE 3.4 Box-plot for EQ-5D valuations classified by health state in the study model

Cost

The costs included i) direct medical costs, ii) direct non-medical costs, and iii) indirect costs. The costs included all resources used for screening and treatments, real and opportunity costs lost by patients e.g. patient time spent for visits to health care facilities. Briefly, screening costs for Pap smears and VIA were identified from the published literature mainly by Goldie et al (31). The costs provided in the literature were converted to 2007 values using the consumer price index (see Table 3.1).

Data regarding the costs for the treatment of cervical cancer were collected using a structured questionnaire from the same patient cohort at four university hospitals and eight regional cancer centres. Table 3.1 reports the annual treatment costs for each health state of cervical cancer; provides disaggregate information on direct medical costs occurred at both public hospitals and outside public hospitals e.g. private clinics, drug stores and traditional healers, and reports direct non-medical costs and indirect costs. This information allows the estimates of both health care provider's and societal perspectives. Figure 3.5 illustrates that the costs of persistence states were the highest, and higher for the lower cervical staging. The treatment costs of the initial stage were the second highest, followed by the costs of the recurrence and remission stages. These costs were not much different among different cancer stages.

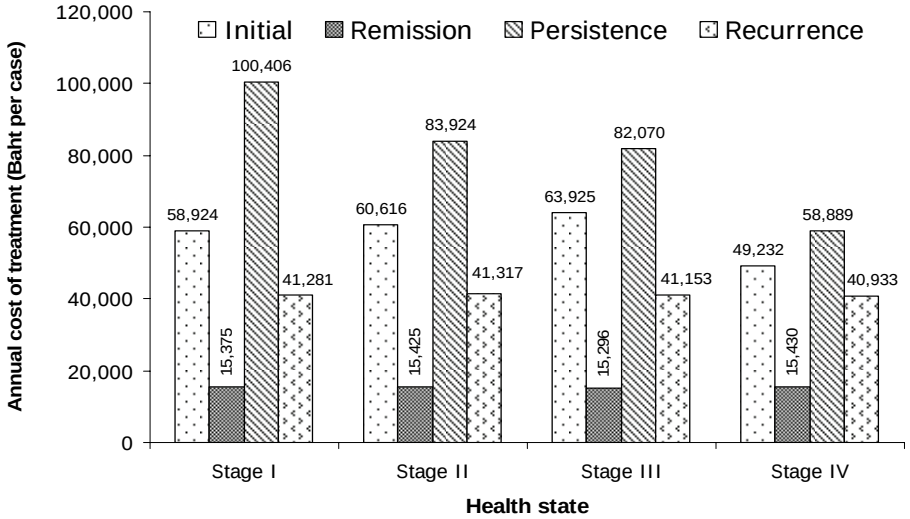


FIGURE 3.5 Annual costs of cervical cancer treatment by health state used in the model

Uncertainty analyses

Two types of uncertainty were extensively explored in this study. First, parameter uncertainty refers to the variability inherent in the input variables or in the measurements. For example, the imprecision surrounding the estimations of a particular transitional probability, mean cost or mean utility. This uncertainty is a result of the fact that input parameters are estimated for the target population on the basis of limited available information e.g. selected samples (32).

This type of uncertainty can be overcome using probabilistic sensitivity analysis (PSA) when input parameters are assigned a probability distribution to reflect the feasible range of values that each input parameter can attain (33). Beta-distribution was the choice of distribution for probability and utility parameters, which were bounded zero-one. Gamma distribution, which ensures positive values, was modelled for all rate and unit cost parameters. Normality on a log-odds scale with covariance matrix and Cholesky decomposition (34), was applied for survival parameters.

Based on the PSA, the simulation drew one value from each parameter distribution simultaneously and calculated cost and effectiveness pairs. This process was repeated 1,000 times to provide a range of possible values given the specified probability distributions. Cost-effectiveness acceptability curves based on the net benefit approach were provided to illustrate the relationship between the values of the ceiling ratio (willingness to par for a unit of outcome i.e. LY or QALY gained) and the probability of favoring each policy option.

Second, generalisability describes the extent to which research findings can be applied to situations other than that assigned or assumed in the original assumption. A threshold analysis was performed to determine the level of selected input parameters required to render a particular policy option cost-effective. For example, if the HPV vaccine is cost-ineffective at the current price, a threshold analysis is applied to determine at what price the vaccine becomes cost-effective or what is the incremental cost-effectiveness ratio of the cervical cancer screening programme given the different level of programme coverage. This particular information is useful for policy decision makers or programme managers to consider whether, or under which situations, the results can be applicable for their own settings.

3.4 Results

For the baseline or 'do nothing' scenario there was no cost of cervical cancer prevention but it has the highest treatment costs for invasive cancer (Table 3.2). The costs of cervical cancer prevention were relatively low for options with VIA and/or Pap smears. However, the costs were significantly higher if the options involved HPV vaccination. In contrast, the treatment costs of invasive cervical cancer were lowest for options with HPV vaccination. In comparison to the health care provider's perspective, the societal perspective offers slightly higher costs for cervical cancer prevention but more than double for the costs of treating invasive cancer. This could reflect the fact that the household paid a substantial amount of money for patients with invasive cervical cancer.

Table 3.3 reveals incremental LYs and QALYs gained from providing different cervical cancer prevention programmes. Note that the incremental QALYs gained from the interventions were slightly greater than the incremental LYs gains because the interventions averted the future incidences of cervical cancer which results in a worsened health state preference.

Table 3.4 presents the incremental cost-effectiveness ratio (ICER) of each policy option. The negative ratios indicate that the options were cost-saving, saving costs and gaining more health benefits, in comparison to the baseline scenario. These include Pap smears, VIA and the combination, i.e. providing VIA for younger women (45-50 years or younger) and Pap smear for older ones (45-50 years or older). Using the societal viewpoint the ICERs range from 195,000 - 5,541,000 Baht/LY gained or 1,250,000 – 5,447,000 Baht/QALY gained if the options include HPV vaccination. Providing HPV vaccine to girls at the age of 15 years gives the lowest ICER compared to providing the vaccine to other age groups.

Using the health care provider's perspective yields higher ICERs than using the societal viewpoint. This indicates that all screening interventions and HPV vaccines have the potential to save household expenditures from treating invasive cervical cancer.

TABLE 3.2 Costs of cervical cancer prevention and treatment costs of invasive cancer by viewpoint of analysis (Thai Baht 2007)

Options	Health care provider's perspective			Societal perspective		
	Cost of cervical cancer prevention	Treatment costs of invasive cancer	Total	Cost of cervical cancer prevention	Treatment costs of invasive cancer	Total
Baseline (no prevention, treatment only)	-	3,820	3,820	-	9,610	9,610
Pap smear every 5 years (age 30-60)	140	3,510	3,650	200	8,840	9,030
Pap smear every 5 years (age 35-60)	110	3,550	3,650	150	8,930	9,090
Pap smear every 5 years (age 40-60)	80	3,590	3,680	120	9,050	9,170
Pap smear every 10 years (age 30-60)	80	3,640	3,720	120	9,160	9,280
Pap smear every 10 years (age 40-60)	50	3,680	3,730	70	9,270	9,340
VIA every 5 years (age 30-45)	100	3,530	3,620	120	8,880	9,000
VIA every 5 years (age 35-45)	70	3,580	3,650	80	9,010	9,090
VIA every 5 years (age 40-45)	40	3,640	3,680	50	9,170	9,220
VIA every 10 years (age 30-45)	50	3,670	3,720	60	9,230	9,290
VIA every 10 years (age 40-45)	20	3,720	3,740	30	9,370	9,390
HPV vaccination at the age of 15	15,000	1,010	16,010	15,000	2,550	17,550
HPV vaccination at the age of 16	14,550	1,110	15,670	14,550	2,810	17,360
HPV vaccination at the age of 17	14,120	1,200	15,320	14,120	3,030	17,150
HPV vaccination at the age of 18	13,700	1,310	15,000	13,700	3,290	16,990
HPV vaccination at the age of 19	13,290	1,430	14,720	13,290	3,590	16,880
HPV vaccination at the age of 20	12,890	1,560	14,450	12,890	3,930	16,820
HPV vaccination at the age of 21	12,500	1,670	14,180	12,500	4,210	16,720
HPV vaccination at the age of 22	12,130	1,770	13,900	12,130	4,460	16,580

Options	Health care provider's perspective			Societal perspective		
	Cost of cervical cancer prevention	Treatment costs of invasive cancer	Total	Cost of cervical cancer prevention	Treatment costs of invasive cancer	Total
HPV vaccination at the age of 23	11,760	1,860	13,620	11,760	4,680	16,440
HPV vaccination at the age of 24	11,410	1,970	13,370	11,410	4,950	16,360
HPV vaccination at the age of 25	11,060	2,040	13,100	11,060	5,130	16,190
HPV vaccination at the age of 30	9,450	2,840	12,290	9,450	7,140	16,590
HPV vaccination at the age of 40	6,860	3,380	10,250	6,860	8,510	15,370
HPV vaccination at the age of 50	4,910	3,710	8,620	4,910	9,320	14,230
HPV vaccination at the age of 60	3,370	3,790	7,160	3,370	9,520	12,890
VIA every 5 years (age 30-40) + Pap smear every 5 years (age 45-60)	140	3,460	3,590	180	8,710	8,890
VIA every 5 years (age 30-45) + Pap smear every 5 years (age 50-60)	130	3,440	3,570	170	8,660	8,830
VIA every 5 years (age 35-45) + Pap smear every 5 years (age 50-60)	110	3,490	3,590	140	8,790	8,930
VIA every 5 years (age 40-45) + Pap smear every 5 years (age 50-60)	80	3,550	3,630	110	8,940	9,050
VIA every 10 years (age 30-45) + Pap smear every 10 years (age 50-60)	80	3,600	3,680	100	9,070	9,170
VIA every 10 years (age 40-45) + Pap smear every 10 years (age 50-60)	50	3,660	3,710	70	9,210	9,270
HPV vaccination at the age of 15 + Pap smear every 5 years (age 30-60)	15,100	930	16,040	15,160	2,350	17,510
HPV vaccination at the age of 15 + Pap smear every 5 years (age 35-60)	15,080	940	16,020	15,120	2,380	17,500
HPV vaccination at the age of 15 + Pap smear every 5 years (age 40-60)	15,060	960	16,020	15,090	2,410	17,500
HPV vaccination at the age of 15 + Pap smear every 10 years (age 30-60)	15,060	970	16,030	15,090	2,440	17,530

Options	Health care provider's perspective			Societal perspective		
	Cost of cervical cancer prevention	Treatment costs of invasive cancer	Total	Cost of cervical cancer prevention	Treatment costs of invasive cancer	Total
HPV vaccination at the age of 15 + Pap smear every 10 years (age 40-60)	15,040	980	16,020	15,060	2,470	17,520
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45)	15,080	940	16,010	15,100	2,360	17,460
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45)	15,050	950	16,000	15,070	2,400	17,460
HPV vaccination at the age of 15 + VIA every 5 years (age 40-45)	15,030	970	16,000	15,040	2,440	17,480
HPV vaccination at the age of 15 + VIA every 10 years (age 30-45)	15,040	970	16,010	15,050	2,450	17,500
HPV vaccination at the age of 15 + VIA every 10 years (age 40-45)	15,020	990	16,010	15,020	2,490	17,510
HPV vaccination at the age of 15 + VIA every 5 years (age 30-40) + Pap every 5 years (age 45-60)	15,100	920	16,030	15,140	2,320	17,460
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45) + Pap every 5 years (50-60)	15,110	920	16,020	15,140	2,310	17,450
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45) + Pap every 5 years (age 50-60)	15,080	930	16,010	15,110	2,340	17,460
HPV vaccination at the age of 15 + VIA every 5 years (age 40-45) + Pap every 5 years (age 50-60)	15,060	950	16,010	15,090	2,390	17,470
HPV vaccination at the age of 15 + VIA every 10 years (age 30-40) + Pap every 10 years (age 50-60)	15,060	960	16,020	15,080	2,410	17,490
HPV vaccination at the age of 15 + VIA every 10 years (age 40) + Pap every 10 years (age 50-60)	15,040	970	16,010	15,050	2,450	17,500

TABLE 3.3 Health outcomes of each policy options for cervical cancer prevention and control

Options	Life Years gained	Quality Adjusted Life Years gained
Baseline (no prevention, treatment only)	Reference	Reference
Pap smear every 5 years (age 30-60)	0.005	0.010
Pap smear every 5 years (age 35-60)	0.005	0.008
Pap smear every 5 years (age 40-60)	0.004	0.007
Pap smear every 10 years (age 30-60)	0.003	0.006
Pap smear every 10 years (age 40-60)	0.002	0.004
VIA every 5 years (age 30-45)	0.005	0.008
VIA every 5 years (age 35-45)	0.004	0.007
VIA every 5 years (age 40-45)	0.003	0.005
VIA every 10 years (age 30-45)	0.003	0.004
VIA every 10 years (age 40-45)	0.002	0.003
HPV vaccination at the age of 15	0.031	0.060
HPV vaccination at the age of 16	0.030	0.057
HPV vaccination at the age of 17	0.029	0.055
HPV vaccination at the age of 18	0.027	0.053
HPV vaccination at the age of 19	0.026	0.050
HPV vaccination at the age of 20	0.024	0.047
HPV vaccination at the age of 21	0.023	0.045
HPV vaccination at the age of 22	0.022	0.042
HPV vaccination at the age of 23	0.021	0.040
HPV vaccination at the age of 24	0.020	0.038
HPV vaccination at the age of 25	0.019	0.036
HPV vaccination at the age of 30	0.010	0.019
HPV vaccination at the age of 40	0.004	0.008
HPV vaccination at the age of 50	0.001	0.002
HPV vaccination at the age of 60	0.000	0.001
VIA every 5 years (age 30-40)+ Pap smear every 5 years (age 45-60)	0.006	0.011
VIA every 5 years (age 30-45)+ Pap smear every 5 years (age 50-60)	0.006	0.011
VIA every 5 years (age 35-45)+ Pap smear every 5 years (age 50-60)	0.005	0.010
VIA every 5 years (age 40-45)+ Pap smear every 5 years (age 50-60)	0.004	0.008

Options	Life Years gained	Quality Adjusted Life Years gained
VIA every 10 years (age 30-45)+ Pap smear every 10 years (age 50-60)	0.004	0.007
VIA every 10 years (age 40-45)+ Pap smear every 10 years (age 50-60)	0.003	0.005
HPV vaccination at the age of 15 + Pap smear every 5 years (age 30-60)	0.033	0.062
HPV vaccination at the age of 15 + Pap smear every 5 years (age 35-60)	0.032	0.062
HPV vaccination at the age of 15 + Pap smear every 5 years (age 40-60)	0.032	0.062
HPV vaccination at the age of 15 + Pap smear every 10 years (age 30-60)	0.032	0.061
HPV vaccination at the age of 15 + Pap smear every 10 years (age 40-60)	0.032	0.061
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45)	0.032	0.062
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45)	0.032	0.062
HPV vaccination at the age of 15 + VIA every 5 years (age 40-45)	0.032	0.061
HPV vaccination at the age of 15 + VIA every 10 years (age 30-45)	0.032	0.061
HPV vaccination at the age of 15 + VIA every 10 years (age 40-45)	0.032	0.061
HPV vaccination at the age of 15 + VIA every 5 years (age 30-40) + Pap every 5 years (age 45-60)	0.033	0.063
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45) + Pap every 5 years (50-60)	0.033	0.063
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45) + Pap every 5 years (age 50-60)	0.032	0.062
HPV vaccination at the age of 15 + VIA every 5 years (age 40-45) + Pap every 5 years (age 50-60)	0.032	0.062
HPV vaccination at the age of 15 + VIA every 10 years (age 30-40) + Pap every 10 years (age 50-60)	0.032	0.062
HPV vaccination at the age of 15 + VIA every 10 years (age 40) + Pap every 10 years (age 50-60)	0.032	0.061

TABLE 3.4 Incremental cost-effectiveness ratio of each policy options for cervical cancer prevention and control

Options	Health care provider's perspective		Societal perspective	
	Baht / Life Year gained	Baht / QALY gained	Baht / Life Year gained	Baht / QALY gained
Baseline (no prevention, treatment only)	-	-	-	-
Pap smear every 5 years (age 30-60)	-32,000	-18,000	-106,000	-60,000
Pap smear every 5 years (age 35-60)	-35,000	-20,000	-112,000	-62,000
Pap smear every 5 years (age 40-60)	-37,000	-21,000	-114,000	-63,000
Pap smear every 10 years (age 30-60)	-31,000	-17,000	-103,000	-58,000
Pap smear every 10 years (age 40-60)	-37,000	-21,000	-114,000	-63,000
VIA every 5 years (age 30-45)	-42,000	-23,000	-129,000	-72,000
VIA every 5 years (age 35-45)	-46,000	-26,000	-136,000	-76,000
VIA every 5 years (age 40-45)	-48,000	-27,000	-138,000	-77,000
VIA every 10 years (age 30-45)	-40,000	-22,000	-125,000	-71,000
VIA every 10 years (age 40-45)	-48,000	-27,000	-139,000	-78,000
HPV vaccination at the age of 15	391,000	204,000	255,000	133,000
HPV vaccination at the age of 16	397,000	206,000	260,000	135,000
HPV vaccination at the age of 17	400,000	208,000	262,000	136,000
HPV vaccination at the age of 18	407,000	211,000	268,000	139,000
HPV vaccination at the age of 19	419,000	217,000	280,000	145,000
HPV vaccination at the age of 20	436,000	226,000	296,000	153,000
HPV vaccination at the age of 21	451,000	233,000	310,000	160,000
HPV vaccination at the age of 22	462,000	238,000	320,000	165,000
HPV vaccination at the age of 23	472,000	243,000	329,000	169,000
HPV vaccination at the age of 24	490,000	251,000	346,000	178,000
HPV vaccination at the age of 25	497,000	255,000	353,000	181,000
HPV vaccination at the age of 30	869,000	437,000	716,000	360,000
HPV vaccination at the age of 40	1,621,000	787,000	1,454,000	705,000
HPV vaccination at the age of 50	5,320,000	2,420,000	5,125,000	2,332,000
HPV vaccination at the age of 60	12,937,000	5,541,000	12,716,000	5,447,000
VIA every 5 years (age 30-40)+ Pap smear every 5 years (age 45-60)	-38,000	-21,000	-120,000	-67,000
VIA every 5 years (age 30-45)+ Pap smear every 5 years (age 50-60)	-40,000	-22,000	-124,000	-69,000
VIA every 5 years (age 35-45)+ Pap smear every 5 years (age 50-60)	-42,000	-23,000	-128,000	-71,000

Options	Health care provider's perspective		Societal perspective	
	Baht / Life Year gained	Baht / QALY gained	Baht / Life Year gained	Baht / QALY gained
VIA every 5 years (age 40-45)+ Pap smear every 5 years (age 50-60)	-43,000	-24,000	-128,000	-70,000
VIA every 10 years (age 30-45)+ Pap smear every 10 years (age 50-60)	-38,000	-21,000	-119,000	-67,000
VIA every 10 years (age 40-45)+ Pap smear every 10 years (age 50-60)	-42,000	-23,000	-125,000	-69,000
HPV vaccination at the age of 15 + Pap smear every 5 years (age 30-60)	376,000	196,000	243,000	127,000
HPV vaccination at the age of 15 + Pap smear every 5 years (age 35-60)	378,000	197,000	244,000	128,000
HPV vaccination at the age of 15 + Pap smear every 5 years (age 40-60)	380,000	198,000	246,000	128,000
HPV vaccination at the age of 15 + Pap smear every 10 years (age 30-60)	382,000	199,000	248,000	129,000
HPV vaccination at the age of 15 + Pap smear every 10 years (age 40-60)	384,000	200,000	249,000	130,000
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45)	377,000	197,000	242,000	127,000
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45)	379,000	198,000	245,000	128,000
HPV vaccination at the age of 15 + VIA every 5 years (age 40-45)	382,000	199,000	247,000	129,000
HPV vaccination at the age of 15 + VIA every 10 years (age 30-45)	383,000	200,000	248,000	129,000
HPV vaccination at the age of 15 + VIA every 10 years (age 40-45)	386,000	201,000	251,000	131,000
HPV vaccination at the age of 15 + VIA every 5 years (age 30-40)+ Pap every 5 years (age 45-60)	373,000	195,000	240,000	126,000
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45)+ Pap every 5 years (50-60)	373,000	195,000	239,000	125,000
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45)+ Pap every 5 years (age 50-60)	375,000	196,000	242,000	126,000
HPV vaccination at the age of 15 + VIA every 5 years (age 40-45)+ Pap every 5 years (age 50-60)	378,000	197,000	244,000	127,000
HPV vaccination at the age of 15 + VIA every 10 years (age 30-40)+ Pap every 10 years (age 50-60)	380,000	198,000	246,000	128,000
HPV vaccination at the age of 15 + VIA every 10 years (age 40)+ Pap every 10 years (age 50-60)	383,000	200,000	248,000	129,000

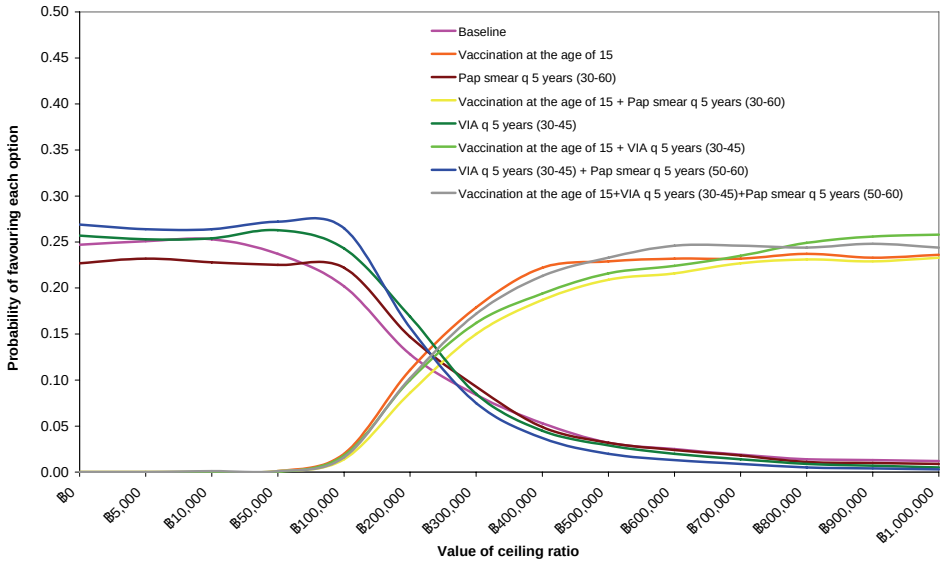
QALY = Quality Adjusted Life Year

Figure 3.6 present cost-effectiveness acceptability curves and a summary of the robustness of the model regarding the uncertainty surrounding the model input parameters for each policy option. We plotted only the best strategy for each screening option i.e. Pap smears every 5 years (age 30-60), VIA every 5 years (age 35-45), and VIA every 5 years for women aged 30-40 years plus sequential Pap smears every 5 years for women aged 45-60 years. The analysis also included the best strategy for HPV vaccination i.e. vaccination at the age of 15 and the combination between HPV vaccination and different screening strategies.

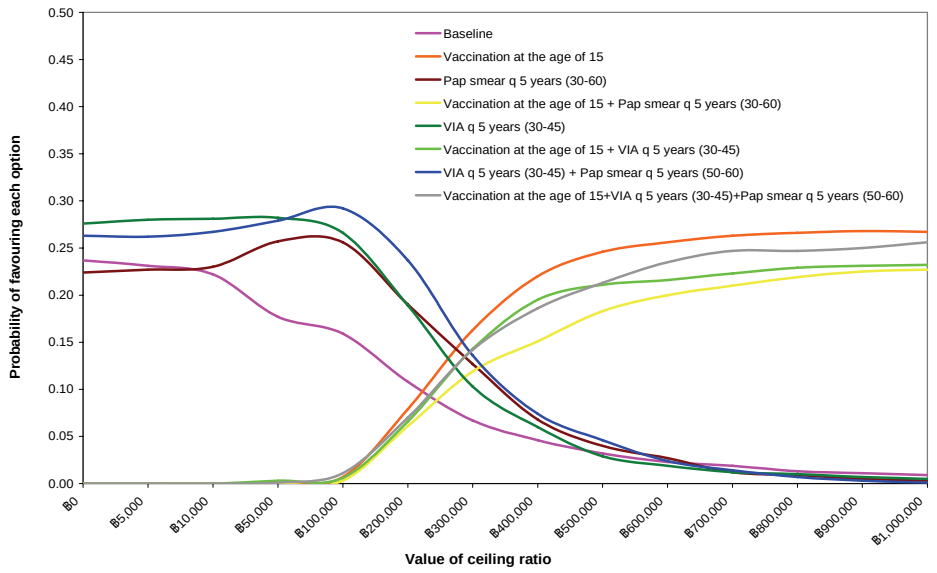
Figure 3.6 (A) illustrates the results of a base-case scenario with 20% Pap smear coverage, VIA and VIA every 5 years for women aged 30-45 years plus sequential Pap smears every 5 years for women aged 50-60 years, and 100% coverage of HPV vaccine. The different thresholds of the screening coverage i.e. 50%, 80% and 100% were also carried out and presented in Figure 3.6 (B), (C), and (D) respectively. At the base-case scenario it can be seen that if decision makers are willing to pay less than 300,000 Baht/QALY, the screening interventions i.e. Pap smear, VIA or VIA plus sequential Pap smear, are among the best policy options. With increased coverage VIA plus sequential Pap smears becomes comes to dominate other screening options (Figure 3.6 B-D). The vaccines can become a cost-effective option only if the willingness to pay threshold is higher than 300,000 Baht/QALY at the screening coverage of 20% (Figure 3.6 A) and 500,000 Baht/QALY at the screening coverage of 100% (Figure 3.6 D).

Figure 3.6 E, F, G show results from uncertainty analyses using different thresholds of HPV vaccine coverage. They reveal that at the lower coverage of HPV vaccine, the combination of HPV vaccination and cervical cancer screening is a better choice than providing HPV vaccination alone.

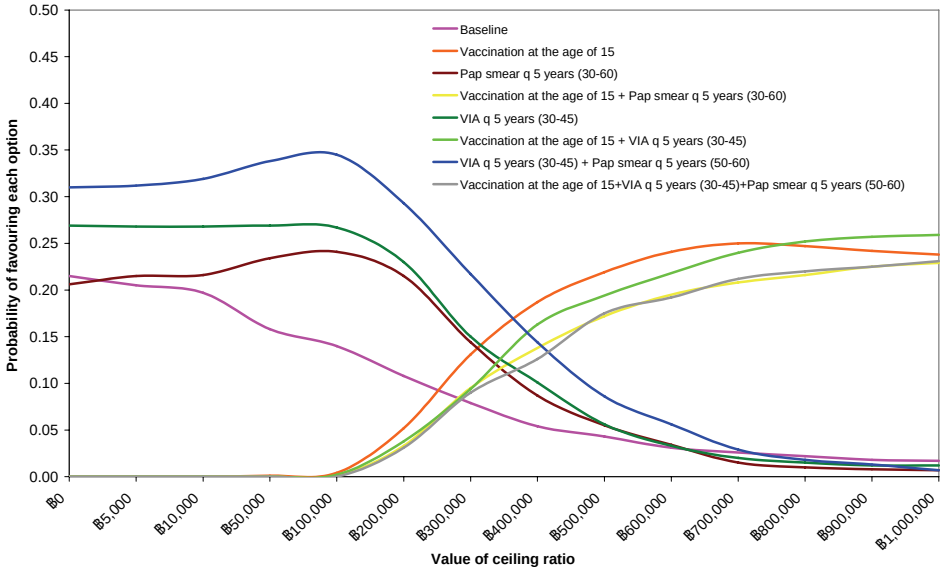
FIGURE 3.6 Cost-effectiveness acceptability curves (baseline= no screening and treatment only option)



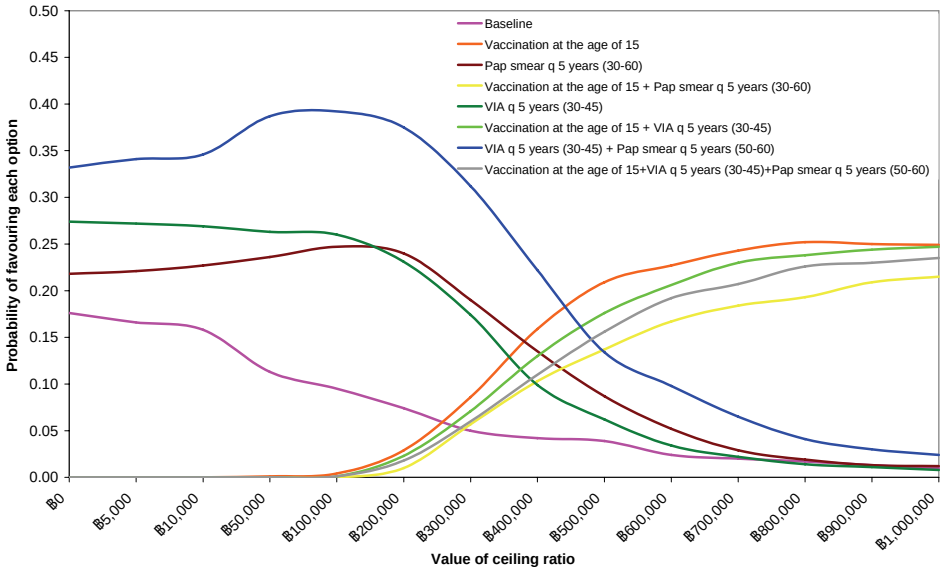
(A): with 20% coverage of Pap smear, VIA and VIA plus sequential Pap smear, and 100% coverage of the HPV vaccine at the age of 15 years (Base-case scenario)



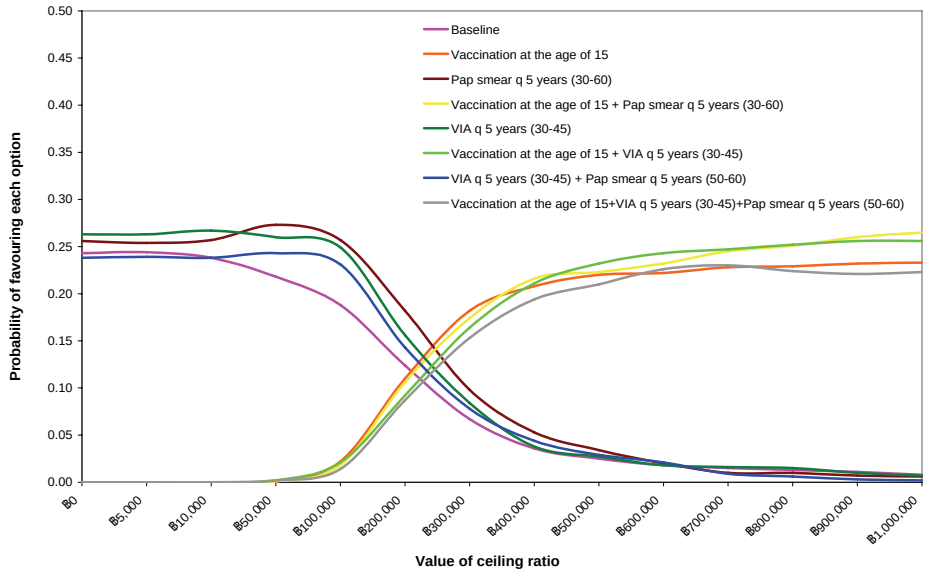
(B): with 50% coverage of Pap smear, VIA and VIA plus sequential Pap smear, and 100% coverage of the HPV vaccine at the age of 15 years



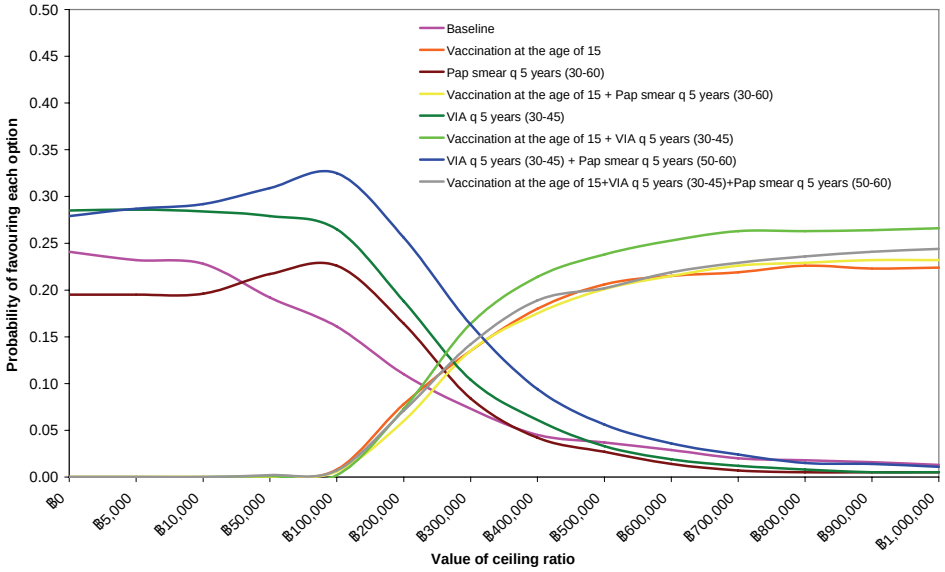
(C): with 80% coverage of Pap smear, VIA and VIA plus sequential Pap smear, and 100% coverage of the HPV vaccine at the age of 15 years



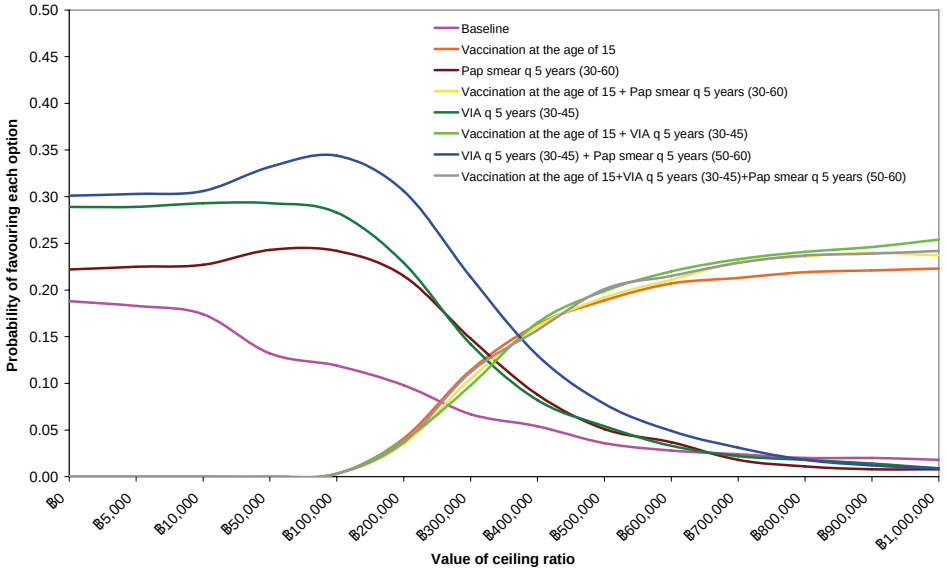
(D): with 100% coverage of Pap smear, VIA, VIA plus sequential Pap smear, and the HPV vaccine at the age of 15 years



(E): with 20% coverage of Pap smear, VIA, VIA plus sequential Pap smear, and the HPV vaccine at the age of 15 years



(F): with 50% coverage of Pap smear, VIA, VIA plus sequential Pap smear, and the HPV vaccine at the age of 15 years



(G): with 80% coverage of Pap smear, VIA, VIA plus sequential Pap smear, and the HPV vaccine at the age of 15 years

Furthermore, this study assessed the impact of alternative discount rates on the overall conclusions. Table 3.5 presents that ICERs of cervical cancer screenings and HPV vaccine versus 'do nothing' scenario were all effected by the discounting rate though the greater impact was on the HPV vaccination because the real effectiveness of the vaccines e.g. cancer cases averted, can only be observed in the remote future.

TABLE 3.5 Incremental cost-effectiveness ratio for each option using different discount rate

Options	0%	5%	10%
Pap smear every 5 years (age 30-60)	-68,000	-48,000	12,000
VIA every 5 years (age 35-45)	-74,000	-66,000	-26,000
VIA every 5 years (age 30-40)+ Pap smear every 5 years (age 45-60)	-71,000	-59,000	-18,000
HPV vaccination at the age of 15	-48,000	469,000	3,354,000
HPV vaccination at the age of 15 + Pap smear every 5 years (age 30-60)	-48,000	452,000	3,261,000
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45)	-48,000	452,000	3,253,000
HPV vaccination at the age of 15 + VIA every 5 years (age 30-45)+Pap every 5 years (50-60)	-48,000	448,000	3,240,000
HPV vaccination at the age of 15 + VIA every 5 years (age 35-45)+Pap every 5 years (age 50-60)	-48,000	451,000	3,271,000

QALY = Quality Adjusted Life Year

3.5 Discussion

With the availability of newly developed interventions for the prevention and control of cervical cancer, several countries are currently reviewing their strategies and are planning to strengthen systems for cervical cancer control. This study indicates that the currently available cervical cancer screenings i.e. Pap smear, VIA, and the combination; namely VIA plus sequential Pap smears are all cost-saving interventions, and must be supported across health care settings. Our analyses also highlight that HPV vaccines have good potential to avert incidences, and save the treatment costs of cervical cancer; though at the current price they are unlikely to be cost-effective relative to the recommended threshold of 3 times per capita Gross Domestic Product or 270,000 Baht/QALY made by the Commission on Macroeconomics and Health (35), or the agreeable threshold of 100,000 Baht/QALY set by the subcommittee for development of the National List of Essential Medicines in Thailand (36).

Although Pap smears and VIA are currently being offered for free to all Thai women, due to a lack of effective programme coordination for the two interventions they are managed separately by two Departments of the Ministry of Public Health. At present Pap smears are offered for women at five-year intervals between the ages of 35 and 60 years (i.e., at the age of 35, 40, 45, 50, 55, and 60 years). The target for VIA covers women aged between 30 and 44 years by excluding women aged 35 to 40 years from Pap smear services. This means that for women who are concerned about the disease are able to undertake either a Pap smear test or VIA screening every year. From a broad public health perspective, this leads to an inefficient use of resources because the additional benefits from the annual or biannual screenings are unlikely to outweigh their costs (37). Meanwhile, this will also lead a scarcity of resources needed for improving access to cervical cancer screening among the poor or marginal groups who are likely to be left out from the present prevention programme. Based on the performance assessment of work package 1, the target population coverage of cervical cancer screenings, either by Pap smear or VIA, fell well short of the desirable target of 80% coverage. It estimated a coverage of 11% for Pap smears and 19% for VIA (which is mostly confined to rural provincial areas).

The poor performance of the current cervical cancer screening, and findings from this study, prompt our recommendations that the capacity to provide appropriate screening

and improve levels of coverage should be urgently reviewed in the Thai health care setting. A policy to provide VIA for younger women aged 30-45 years and sequential Pap smears for older ones (aged 45-60 years) should be adopted because this option is superior in terms of value for money compared to Pap smear or VIA only options especially with a high level of screening coverage (Figure 3.6). The HPV vaccine should be introduced to the public health benefit package, only if its cost is reduced to the point where its ICERs are within an agreeable threshold and its budget impact is at an affordable level. This study estimates that at 25% of the current price the vaccine becomes a cost-effective option under the Thai health care system. Furthermore, this study reveals that the vaccines will be less favorable at a higher coverage of cervical cancer screening (Figure 3.6 A-D). At the lower level of vaccine coverage the study suggests that providing HPV vaccine to 15 year-old girls and VIA screening for women aged 30-45 years is more attractive than providing HPV vaccination alone (Figure 3.6 E-G).

The results of this study are in agreement with other previous studies which indicated that VIA and Pap smears are cost-effective, and should be widely supported in both developed and developing settings (37). However, to our knowledge this study is the first that incorporates the combination of VIA and Pap smear (VIA plus sequential Pap smear) in the economic analysis, and found the results promising. This study also extensively assessed the potential use of HPV vaccine alone or in combination with other screening options. Kulasingam et al found that adding a school based HPV vaccination programme for girls aged 12 years to the current practice of cervical cancer screening (i.e. liquid-based cytology or Pap smears) represents good value for money under the UK's health care system (38). The differences in the conclusions between the UK study and this study are not because of the differences in the estimated costs or benefits of the vaccines but the ceiling thresholds used to decide how much the government should pay for a QALY gained. A much higher ceiling threshold of £20,000-£30,000 or 1.26-1.89 million Baht was referred as a threshold to determine whether health interventions are worthwhile in the UK (39).

Because there is a lack of a comprehensive assessment in other middle-income settings, the results of this study can be used to guide discussions or policy dialogues, as well as to inform further exploration if decision makers in these settings share similar concerns

regarding the prevention and control of cervical cancer. The use of systematic reviews and meta-analyses for estimating the effectiveness of all screening interventions and HPV vaccines make the results of this study applicable to other settings because the costs of screenings, HPV vaccination and the costs of staging and treatment of invasive cancer are very similar in many developing countries (31).

This study is limited by a lack of data concerning the protection duration of the vaccines against HPV infection, and whether and how many booster doses are required in the future after the first three doses of the initial vaccination. This study took a crucial assumption that the vaccines offer a life-long protective effect which would have enormous implications on the estimations of cost and effectiveness of the vaccine. If this assumption is not valid, then the vaccines would be a less favorable choice. In addition, this study did not include other potential benefits of the vaccines e.g. prevention of genital warts, reduction of adenocarcioma, vulvar and vaginal intraepithelial neoplasia (40). Lastly, the model constructed in this study was based entirely on knowledge obtained from separate studies that did not take into account the interaction that one intervention can have on the others e.g. VIA on Pap smears, screening interventions on HPV vaccines.

CHAPTER 4
A Consultation with Policy Makers and Key Stakeholders

4.1 Introduction

As the burden of cervical cancer in terms of DALY loss and premature deaths among Thai women is remarkably high, the disease has been recognized as being a major public health problem in Thailand. Currently, three screening interventions to detect cervical cancer: Pap smear, visual inspection with acetic acid (VIA), and HPV DNA testing, are available in the country. Although a Pap smear screening programme has been implemented for 40 years, evidence indicates its poor performance, including limited coverage and inefficient management. The literature also shows a limited use of VIA, and that the provision of such screening and early treatment of precancerous lesions exists in only a few provinces. Financed by the universal health coverage plan (UC), Pap smear and VIA programmes are supervised by two different departments of the Ministry of Public Health (MOPH), namely the Department of Medical Service (DMS) and Department of Health (DOH), respectively. While the cytological and visual inspection approaches are delivered in MOPH hospitals, HPV DNA tests are mainly carried out in private health care settings, owing to the relatively high costs involved.

In 2007, an alternative technology to control cervical cancer, HPV vaccine, was launched in the Thai market. The HPV vaccine is claimed to be the most effective way to prevent this life-threatening disease. The emergence of the vaccine, and its misleading marketing strategies, called for a comprehensive assessment of all interventions for cervical cancer control in the country. The studies in work packages 1 and 2 of this project provide information regarding the performance of the existing screening services and also the cost-effectiveness of each program/technology to counter the disease. In particular, the analysis of the current situation of Pap smear and VIA services illustrates the poor performance of these services and the fact that there is substantial room for improvement. Meanwhile, the economic evaluation indicates that neither the HPV vaccine nor HPV DNA testing offer the best value for money. In the same vein, concomitant use of HPV DNA testing with a Pap smear does not enhance the cost-effectiveness of screening.

It has been found that the most optimal policy choice is to provide VIA, every five years, for women 30 to 45 years of age and introduce Pap smear every five years for those in the age group of 50 to 60 years old. As the said research findings and recommendations suggest the need for consideration by policy makers and respective organizations on the most appropriate policies against cervical cancer and how to diminish the current impediments in screening service provision, the researchers convened a consultation with the aims to brainstorm and solicit opinions among key stakeholders.

4.2 Objectives

This study aims to solicit the opinions of policy makers and key stakeholders concerning the need for reforms, and strategies to improve the coverage and performance of the national cervical cancer control programmes. This includes the assessment of their positions, for or against the policy options drawn on economic evaluation in work package 2.

4.3 Methods

A one-day consultation was convened, on 25 December 2007, among: health officials involved in cervical cancer control at the national level; clinical experts; and representatives from the national immunization programme, national vaccine regulatory authority, universal health benefit plan, science and technology development office, and vaccine companies. The names of key stakeholders, as organisations and individuals, were identified mainly by reviewing documents relating to cervical cancer programmes in Thailand. The snow-ball technique was employed to develop the list of invitees to the discussion. Despite prior confirmation of their availability via telephone calls, a number of them, including representatives from non-governmental organizations, did not participate in the event.

Attended by 26 experts and representatives from the DOH, the DMS, the Department of Disease Control, the Food and Drug Administration, the National Health Security Office (NHSO), the National Science and Technology Development Agency, and the vaccine industry (see Appendix 1), the meeting was conducted by the principal investigator, Dr. Viroj Tangcharoensathien. After the introduction to the research project, including the rationale, objectives, expected outcomes and policy utility, the researchers responsible for work packages 1 and 2 presented the research results and related recommendations.

During the presentations, all participants had the opportunity to comment and ask for clarification about the methods, assumptions and findings. Thereafter, the Chair led the discussion, which was structured into 3 major areas: the optimal strategies to curb cervical cancer in Thailand, impediments in the implementation of screening programmes for cervical cancer, and recommendations to strengthen the initiatives to control the disease. All participants were encouraged to freely express their opinions and concerns in relation to the three issues.

4.4 Results

(1) Appropriate strategy for cervical cancer control

It was agreed upon that responsible government agencies, including MOPH departments, should work in collaboration with the Royal College of Obstetricians and Gynaecologists, the Gynaecological Oncologists Society, the NHSO and academic institutes to strengthen the existing Pap smear and VIA programmes. It was also accepted that early detection of abnormal cells and precancerous lesions, and immediate treatment, were the most cost-effective strategies. It was further noted that given the cost and outcome profiles of each intervention under assessment, if the coverage of screening initiatives was improved, the role of the newly-launched technology, HPV vaccine, would decrease substantially.

However, the policy option proposed by researchers - the provision of VIA followed by cryoscopic therapy to 30-45 year-old women at five-year intervals, with the introduction of Pap smear testing in those between 50 and 60 years of age every five years, was universally agreed upon by the gynaecology and oncology experts, but considered impractical by some health officials. The supporters argued that the researchers' proposal was in line with suggestions made by specialists in many institutes, since VIA is highly effective when introduced in young women, as the lesions in the squamo-columnar junction (SCJ) of the cervix are visible. Nevertheless, health officials asserted that the difficulties in fostering changes, not only in the on-going programmes nationwide, but also in professional practice, would be important elements that might hinder the reforms. This was partly because the numbers of health care providers with VIA delivery experience were still inadequate if this screening were to be scaled up throughout the country. Moreover, the Pap smear test had long been adopted as the standard screening approach

for cervical cancer in the country, and most Thai physicians were trained in its use, and were therefore familiar with this intervention.

With regard to the HPV DNA test, some participants suggested that this technology might help to improve screening coverage, since it required different groups of health personnel, i.e. medical laboratory scientists rather than cytologists and nurses in the case of Pap smear and VIA, respectively. As one oncology expert pointed out, clinical studies in foreign settings suggested that when this technology was used alone, it extended the screening intervals or reduced the frequency of screening tests. It was noted that when the HPV DNA technique was introduced as a complement to Pap smear, this might slightly enhance the effectiveness of screening, and that in Thailand similar benefits could be anticipated. However, as shown in the economic evaluation undertaken in this project, doing so would not be cost-effective owing to the high cost of the test. Furthermore, this technique was complex and that to routinely employ it in the health delivery service the intervention would need to be simplified.

The adoption of the HPV vaccine as part of the national immunization programme was considered not to be a good policy option for three reasons. First, the two vaccine products available on the Thai market were sold at very high prices which made a publicly-funded vaccination for all eligible women unaffordable. Moreover, compared to administering EPI vaccines in infants and school children, a mass immunization against HPV in adolescents outside the school system would be difficult. Second, the use of the HPV vaccine did not rule out the need for regular screening tests for cervical cancer because at present, the vaccines can not protect against all forms of cervical cancer. It can be seen that their efficacy is only 70% on average. Third, the vaccines were recommended for children 9 to 11 years of age, with 2 booster doses later, since the vaccines could stimulate the highest immunological response in this age group. Moreover, the vaccination was proven beneficial only in those who had not been exposed to HPV, and therefore should be provided before a girl's or a woman's first experience of sexual activity. In addition to this, some argued that the vaccines might be useful in disease prevention among those who could bear the costs. As asserted by other discussants, however, those areas of the population at high risk of contracting cervical cancer, such as those having their first sexual activity at an early age or those engaging with multiple sex

partners, are low-income people who can not afford the costly vaccines. For all these reasons, the benefits of HPV vaccines in the public health perspective are very limited.

(2) Current impediments in the provision of cervical cancer screening

According to the discussion, there were several elements hampering the introduction of cervical cancer control programmes in Thailand. First and foremost, the national policies concerning the disease screening were not well harmonised, resulting in fragmented, competing services being delivered at the provincial level. Two key players, the DMS and DOH, provided technical and management support to different interventions: Pap smear tests and VIA, while the policy direction of the MOPH and NHSO was unclear. As a consequence, the method of screening practice varied across different regions, as some provinces adopted the VIA approach while others adhered to the conventional cytological intervention Pap smear. As maintained by front-line health workers in interviews in work package 1, without concrete policy guidance from the Health Ministry, the translation of policies into action was confusing. The perception of an ambiguous policy and its adverse effects on service delivery had also been reflected upon by a number of officials, including senior supervisors from the central departments. As a DOH official maintained, the department had no plan to extend its VIA initiative. This official also felt that to promote the service, which comprised cryoscopy, might conflict with the DOH's mandate, i.e. providing technical support to and overseeing health promotion activities. Meanwhile, a representative from the National Cancer Institute (NCI) accepted that his organisation was mainly responsible for the treatment of cancer, but that it was difficult to point out which agency should take a leading role in the screening and prevention of cervical cancer. In such a policy environment, an effective scaling-up of screening coverage is not feasible.

Second, it was pointed out that the lack of both a reliable and regularly updated database and an overall information system on cervical cancer prevention and screening was a crucial problem. This was in part because the data and reports required varied across organizations such as the NHSO and NCI. In the case of Pap testing, incomplete and inaccurate data entry might stem from the fact that the service was provided in a large number of health facilities, approximately 10,000 primary care units around the country. Moreover, cooperation from the private sector, including hospitals, clinics and laboratories, in reporting their service provision, was inadequate.

Third, the perceptions of competing roles and professional invasion were important at the health service delivery level, since some physicians thought that cryoscopy was classified as treatment, and thus should not be carried out by VIA nurses. This was a reason why the existing VIA programme was not accepted and put into practice by medical doctors in many settings. Other reasons for opposing VIA among physicians included the misunderstanding that it was a 'low-grade' intervention, recommended in and suitable for only poor countries; and that immediate cryoscopy when precancerous lesions were detected, without confirmation by cytological assessment, was clinically unacceptable. The familiarity with Pap smear as standard screening practice of cervical cancer along with a limited public-heath mind from some physicians might also have played a role in the resistance to VIA delivery. Such an argument was elaborated further: physicians usually valued providing curative treatment to individual patients, rather than delivering a population-based service to detect and prevent diseases.

The final point raised by discussants involved the future challenge in programming financing. In the fiscal year 2008, the NHSO instigated a policy to change the payment method for subsidising cervical cancer testing, from the current performance-based method to an area-based one. This meant that the budget for the screening service would be incorporated as part of a lump-sum amount for all disease prevention and health promotion (P&P) activities to be carried out in particular contracting units for primary heath care (CUPS). This allowed health workers to make their own decisions when allocating a budget to suit the health needs in each area. There is a possibility that the screening of cervical cancer might be considered as a low-priority service. Given that the financial incentive for screening service delivery had been abolished, the worsened programme performance could be anticipated.

(3) Recommendations to strengthen the cervical cancer control initiatives

As mentioned above, it was consensual among meeting attendants that the detection of cervical cancer in the pre-cancerous stage, by introducing screening tests, either Pap smear or VIA, was the most cost-effective way to combat the disease. In addition, if the screening programmes were well performed, the costly HPV vaccination would play only a limited role in the overall public health aspect. All these reasons suggested that the existing screening initiatives should be strengthened. In so doing, substantial shifts in the national policies towards a harmonization of the currently fragmented screening and

treatment initiatives were needed. It was suggested that policy makers in the MOPH, managers of Pap smear and VIA programmes, and the NHSO should establish dialogues and work together in a collaborative way to seek a consensus about the most appropriate policy direction to curb cervical cancer in the country. Experts maintained that a single authority to manage the national programme would be a key factor of success. Another issue to be taken into consideration was the financing mechanism of the screening initiative. This mechanism would have an impact on both coverage and quality. With respect to this, a major concern was the anticipated negative effects of an area-based allocation of the P&P budget in the UC scheme as mentioned earlier.

The second recommendation involved the improvement of information, evidence and knowledge to inform policies and strategies. It was recommended that information systems, including reporting and databases relating to the screening and treatment of cervical cancer, be strengthened to fulfil the needs for the monitoring and evaluation of the disease control programme at both the national and regional levels. Accurate, up-to-date and comprehensive information would be very useful as an input into an evidence-based policy decision and planning process. It was also argued that reforms in the information systems to foster a synchronised data set of patients who had obtained a Pap smear or VIA services required clear national policy guidance as a prerequisite.

Thirdly, as VIA had proven effective and practical in many provinces, the initiative should be extended as complementary to the conventional Pap smear. This required the introduction of education and information programmes to change the perceptions and attitudes of physicians towards such a screening alternative. In the absence of resistance from medical doctors as well as an improved understanding among Provincial Chief Medical Officers, it was anticipated that VIA could be scaled up. As experts pointed out, however, an increase in the number of well-trained nurses to deliver the service in different areas was indispensable in the initiative to broaden the screening coverage. To do so, the manager of the national cervical cancer control programme should seek technical support from relative institutions such as the Royal College and other professional associations.

Fourthly, it was recommended that in addition to screening services, Thailand had to pay more attention to treatment programmes for cervical cancer in order to ensure that all

detected cases received proper medical care. In this regard, well-trained human resources and efficient management needed to be in place. As argued by experts in this meeting, an inadequate number of colposcopists was one among several impediments. Currently, colposcopy was not included in the curriculum of either medical schools or the Royal College of Obstetrics and Gynaecology and it was unclear which organisations were responsible for training programmes, standards of practice and quality assurance. Furthermore, there was no formal definition of a colposcopist. It was, however, noted that short training courses on colposcopy provision were organised by the Thai Association of Gynaecological Cancer. It was also suggested that there was no need to decentralise this service, i.e. to set up colposcopy units in every province. This argument was raised on the condition that at least one colposcopy centre exists in each region, with well-organized referral systems and coordination with screening and treatment follow-up units.

Finally, concerning the two high-cost interventions, namely HPV DNA testing and HPV vaccine, it appeared that they could be helpful to some extent. The sensitivity of HPV DNA testing was relatively high so that it might be introduced effectively in a population-based screening programme. However, since this intervention was expensive and therefore unaffordable to provide to a large number of people, it was maintained that large-scale implementation of HPV DNA testing would be financially feasible only when cheaper versions were available. This required further development of the technology, in the next 2 to 3 years, until the cost is lowered significantly. For similar reasons, a publicly-funded HPV vaccination programme was considered impractical unless the price of vaccines decreased to an affordable level. Some suggested that the benchmark: cost of introducing a particular intervention per DALY averted should not exceed the country's GNI per capita was applied, and an acceptable price per course of HPV vaccine should be around the 4,400 baht mark, instead of the current 12,000-15,000 baht.

4.5 Discussion

Policy makers, either politicians or government officials, when deciding what public-health interventions should be adopted, usually take into account several facets of available policy alternatives including the effectiveness, adverse effects, budget impact, implementation feasibility and social acceptability (41). Economic evaluation is a tool to identify the most cost-effective choices among available alternatives (42). Nevertheless, evidence suggests that decision making in the health sector is not always rational (43), and the information on the cost-effectiveness of public policies/strategies may be ignored by administrative and legislative authorities (44). This paper not only confirms these arguments, but also suggests that policy making in the real world is complex.

As public health experts have pointed out, cervical cancer control programmes should aim to cover the population at risk, to provide women with high-quality screening services, and to ensure that women with positive results are properly treated (6). To achieve these policy goals, decision makers have to determine the most appropriate screening and treatment choices for the target population; screening coverage and intervals; screening test and treatment options; and facilities and types of health workers to be involved in service delivery. The discussion reported in this study indicates that the recommendations drawn on economic-evaluation evidence were accepted in the cases of HPV vaccines was not only significantly less cost-effective than Pap smear and VIA, but also unaffordable if implemented on a large scale. In addition to the concern over the high cost of HPV vaccination raised in the discussion, the literature suggests questionable elements relating to the use of this preventive modality of HPV infection. These included, for instance, the genders and age groups of people to be vaccinated, long-term efficacy and safety, and necessity for booster doses (45). There are also arguments regarding the issues of social and cultural acceptability, given that the immunisation may undermine abstinence education and encourage complacent sexual behaviour (46). All of these points should be taken into account by all concerned parties even though for the time being, the vaccine has been introduced only in the private sector. Furthermore, as emphasised by experts, policy makers have to bear in mind that the introduction of the HPV vaccine cannot protect women who have a viral infection, and thus regular cervical screening has to be maintained. The concomitant implementation of the HPV vaccine and the screening

service will incur a financial burden on the cervical cancer prevention programme (47, 48).

During the discussion, it seemed that representatives from the DMS and DOH were reluctant to agree with the researchers' proposal to reshuffle the existing screening programme, by providing VIA and immediate cryoscopy to women in the 30-45 year age group, and Pap tests to those between 50 and 60 years of age. The hesitation among these health officials was not surprising, because such a reform meant substantial changes in the service delivery system. Resistance to the new programme's configurations from medical doctors could be anticipated, but was not the sole obstacle. The literature asserts that to introduce innovations in existing initiatives is difficult. Baumgartner and Jones (49) argue that public policies in certain domains are usually stable for a long period, and dramatic reforms can occur only when there is a *'positive feedback'*, i.e. changes in the networks of decision makers that allow those with new ideologies, attitudes and interests to dominate the policy decisions. The concept of *'path dependency'* is also helpful to understand why big changes in public policies rarely happen (50). As Wilsford (51) points out, political shifts are tied to previous decisions and established institutions; therefore, policy movement tends to be incremental and considerable changes are exceptional phenomena, relying on occasional windows of opportunity. Given that the adoption of new policies requires a redistribution of resources which have long been allocated to some interests, strong objections to the innovations will be voiced by the old dominants if large amounts of important resources are diverted to other individuals or agencies. This means that leadership, a concerted effort and new ways of thinking among policy makers are necessary to foster the new features of the cervical cancer control service in Thailand and elsewhere.

Cervical screening is acknowledged as the most effective intervention to reduce the incidence and mortality from cervical cancer. According to the WHO (20), most screening initiatives in the developing world are ill performed and have to be reorganized in several ways. While the extension of the Pap smear programme has been hampered, not only by the constraints of resources and infrastructure, but also by the lack of political will, VIA has recently been proposed as an alternative approach (52). Although clinical studies suggest that VIA screening is an effective method to prevent cervical cancer in developing countries (11, 53), the limitations of this visual inspection technique, such as its low

specificity and associated high false positive rates, highly-subjective manner, and the lack of experienced professionals outside research settings, are often highlighted by international health institutes and non-governmental organisations (20, 54). Among others, a review of obstacles to successful cervical cancer in resource-poor countries by Suba and colleagues (55) maintains that such limitations and subsequent over cryosurgery treatment has problematic implications for provider acceptance. Such assertions have generated negative perspectives towards VIA among health practitioners and programme managers.

In Thailand, the need to improve the coverage, quality and management of Pap test services has long been recognized. However, actions to tackle the problems in implementing a cytological screening programme have only been under way for a couple of years. As shown in work package 1 of this project, success in improving the performance of the Pap-smear service in this country still requires a substantial effort from respective MOPH's departments, the NHSO and professional organisations. At the same time, a scaling-up of the potential alternative method VIA faces notable difficulties. In this regard, political commitment and support within the structure of health policy making to harmonize these fragile services into one national programme, as recommended in the consultation, are badly needed. However, the above mentioned notion of path dependency, and also the clash of perceptions among key stakeholders concerning the advantages and disadvantages of the VIA-cryoscopy method, indicate that a consensus regarding a cervical cancer control policy in Thailand may not be reached anytime soon.

It was suggested that given the anticipated slow progress in policy development aimed to achieve the ultimate goal of a well-integrated screening and treatment service for cervical cancer, what should be done in the mean time is for all concerned agencies to try their best to strengthen the existing initiatives, either Pap tests or VIA, and avoid conflicting ideas and practice at the service delivery level. Recommendations emerging during the consultation, including the improvement of information systems on prevention and treatment provisions, financing mechanisms, human resource development to meet the demand for cancer treatment, and education programmes to promote better understanding about VIA among physicians should be addressed promptly. An important limitation of the discussion convened by the researchers was that some groups of key

stakeholders, including women's rights and health NGOs, did not participate and exchange their opinions. As a consequence, the issues raised in the meeting were restricted to those from the providers' and experts' perspectives. It was stated that to counter the weaknesses in the cervical cancer control initiative, the country's experience, as seen through the lens of the demand side and civil society organizations, should be put under a comprehensive review.

CHAPTER 5

Resources and Facilities Needed to Scale up the Optimal Strategy for the Prevention and Control of Cervical Cancer in Thailand

5.1 Objective

This work package presents the analysis results to determine health resources and facilities required for the scaling up of the optimal strategy for the prevention and control of cervical cancer in Thailand. It focuses on the issue of health personnel in completing the screening process, from the initial service encounter (either Pap smear slide preparation or visual inspection with acetic acid) to the intermediate screening interpretation (cytology laboratory) and the confirmed diagnosis (colposcopy). The professional backgrounds of these human resources may range from health workers and nurses to physicians and medical specialists.

5.2 Method

Key resource factors on the screening performance were elaborated using the national Pap Registry and CPIStm databases (as in work package 1). A focal point of the initial screening service was identified through health facility type distribution. Subsequently, the district-level correlation between number of service providers and population screening coverage was determined each for Pap smear and VIA.

Types of health resources required for each step taken by the Pap smear and VIA procedures were described. The availability of human resources in the public sector, deemed a major limitation of the plan to scale up the program, was presented based on the current situation.

The final section estimates the human resource requirements for each critical step of cervical cancer screening under varying assumptions with respect to the potential service loads compared with the number of providers existing in the current systems.

5.3 Results and Discussion

(1) Key resource factors regarding the screening performance

To prepare health resources needed for scaling up the cervical cancer screening program, one needs to understand the key factors affecting the screening performance. This can be accomplished using two available facility-based national databases: the Pap Registry and the CPIStm. First, the focal points of Pap smear and VIA services in the existing public health infrastructure can be located. Then resources available at the identified focal points can be determine if there is a correlation with the screening coverage at the local levels. This knowledge would allow for future organization and management of health resources in a scaling up situation, especially when Pap smear and VIA have a different locus.

(1.1) Health facility distribution of the screening services

Distribution of number of the women screened by Pap smear and VIA by types of health care facility is shown in Table 5.1 and 5.2, respectively.

Pap smears were performed mostly (65-66%) at health centres (Table 5.1), while district hospitals and other types of facilities provided only a tiny fraction of the total Pap smear services. This facility distribution pattern is consistent for both 2005 and 2006.

TABLE 5.1 Distribution of Pap smear visits by health facilities, 2005-2006

Facility type	2005	2006	Other years	Unknown	Total
Health centre	171,766	132,266	280	35,743	340,055
	(65.5%)	(65.3%)	(41.1%)	(71.5%)	(66.0%)
District hospital	40,772	28,662	171	5,231	74,836
	(15.6%)	(14.2%)	(25.1%)	(10.5%)	(14.5%)
Other government hospital[a]	13,418	10,609	1	1,086	25,114
	(5.1%)	(5.2%)	(0.1%)	(2.2%)	(4.9%)
Other health facility[b]	1,707	1,036	0	39	2,782
	(0.7%)	(0.5%)	(0%)	(0.1%)	(0.5%)
Private hospital and clinic	13,792	9,148	43	4,050	27,033
	(5.3%)	(4.5%)	(6.3%)	(8.1%)	(5.2%)
Not specified	20,682	20,784	187	3,836	45,489
	(7.9%)	(10.3%)	(27.4%)	(7.7%)	(8.8%)
Total	262,137	202,505	682	49,985	515,309
	(100%)	(100%)	(100%)	(100%)	(100%)

In the provincial areas, the Ministry of Public Health (MOPH) owns approximately 90+ provincial hospitals, 800+ district hospitals, and 8000+ health centres. Under the UC resource allocation scheme, these health care facilities provide health services to the UC members in their catchments. The health care provider that is closest to the population is the district health system (DHS), each comprising one district hospital (located in the district centre) and some 5-10 health centres (in surrounding sub-districts). Unlike curative health services, whereby the district hospital shares most of the service loads, the health centres each have designated areas for public health services separate from the district hospital. Each health centre serves a similar sized population.

The dominant share of Pap smear services by health centres corresponds to the area distribution of the public health system. Health promotion and disease prevention programs in sub-district areas (outside the district centre) are typically the responsibility of the health centres. The district hospital provides a community-based service only for the population living inside the district centre. The skill required for smearing and slide fixation is not too difficult for health workers in the sub-district health centres to perform. It follows that if the slide reading and interpretation by cytologists is able to be followed up quickly and efficiently, the health centres will be a strategic focus for expanding the Pap smear service.

Even though the screening by the private sector was believed to be under-reported by the Pap Registry, the 27,033 women in total found in this analysis to have been screened by private hospitals and clinics is still quite a number.[17] Findings from an in-depth interview indicate the well-off population subgroup: civil servants or white collar employees preferred taking the cervical cancer screening (i.e., Pap smear) through private clinics, which are mostly located in urban areas or provincial cities. If the unspecified group (N=45,489) in Table 5.1 belonged to health facilities outside the public sector, then the figures on an overall coverage for Pap smear obtained from the Pap Registry database might not be that much lower than the reality.

[17] *Information from three private laboratories that provided the cytology services to health care facilities in two study provinces, Nakhon Phnom and Chiang Mai, revealed 2-5% and 49% of the Pap smear slides, respectively were obtained from private hospitals or clinics (see Table 24).*

For VIA, nearly all cases (97.4%) were screened at the DHS level, where health centres and district hospitals share a similar volume (47.6% vs. 49.8%, respectively) (Table 5.2). The district hospital share of VIA cases went down in 2003 and 2004, then up again in 2005 and 2006. This reveals one of the major obstacles in any attempt to scale up VIA screening towards the hard-to-reach areas. Since the screening technique requires a relatively high skill level from at least the registered nurse level, the initiation of VIA tends to be limited to within the hospital's catchment area (i.e., a static service at the hospital in the district centre).[18] In some provinces, the district hospitals might play a proactive role by expanding the mobile screening service through health centres at the sub-district level.

Since the district health system (DHS) was identified as the strategic focus in expanding the screening services, it is worth breaking down national level data to the district level (next subsection).

TABLE 5.2 Distribution of VIA visits by health facilities, 2002-2006

	2002	2003	2004	2005	2006	Other years	Total
Health centre	5,719	19,446	30,029	38,214	20,968	3,940	118,316
	(38.8%)	(48.2%)	(59.4%)	(47.7%)	(38.9%)	(44.4%)	(47.6%)
District hospital	9,018	20,297	19,923	40,065	30,921	3,522	123,746
	(61.2%)	(50.3%)	(39.4%)	(50.0%)	(57.4%)	(39.7%)	(49.8%)
Other government hospital[a]	0	152	245	1,141	1,238	1	2,777
		(0.4%)	(0.5%)	(1.4%)	(2.3%)	(0.01%)	(1.1%)
Other health facility[b]	0	455	297	100	13	0	865
		(1.1%)	(0.6%)	(0.1%)	(0.02%)		(0.3%)
Private hospital and clinic	0	0	27	598	706	0	1,331
			(0.1%)	(0.7%)	(1.3%)		(0.5%)
Not specified	0	1	0	3	0	1,409	1,413
		(0.002%)		(0.004%)		(15.9%)	(0.6%)
Total	14,737	40,351	50,521	80,121	53,846	8,872	248,448
	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

[a] *Provincial hospital, other MOPH hospital, university hospital, and other Non-MOPH hospital*
[b] *Provincial health office, Health technical centre, nursing/public health college*

[18] *The VIA providers have to be trained intensively for two weeks using a competency-based module. The module requires a qualified nurse as the trainee since this service includes not only a visual inspection of cervix with acetic acid (VIA) itself but also a pelvic examination and further cryosurgery treatment. In Thailand, it is uncommon to have registered nurses working full time in the sub-district health centres.*

(1.2) Providers and the screening coverage per district

The district-level data (N=51) in the case-study provinces: Nakhon Phnom, Roi-Et, and Chiang Mai on the women screened by Pap smears and VIA was linked to the female population size and number of hospital beds and screening service providers. The population coverage of cervical cancer screening was found to be not homogeneous across the districts. This variation reflects a critical role of DHS as the 'de facto' functional unit of performing screening activities under the national cervical cancer prevention and control program. In addition, a breakdown of the national aggregates to district-level data helps shed light on a small-area variation in the screening performance and the determination of magnitude of the link (if any) between the structure and performance of the cervical cancer screening program.

Tables 5.3-5.7 present for each district the number of target female population based on the official civil registry database[19] and the number of cases where screening services were provided, based on the Pap Registry and CPIStm databases, respectively. The screening coverage was calculated and the resulting screened cases per 100 women was presented along with the size (number of beds) and number of health care providers of the MOPH hospital that is the main health provider in each district (i.e., the district hospital in the district outside the provincial city and the provincial hospital in the Muang district or the provincial city).

TABLE 5.3 Pap smear coverage by districts, Nakhon Phnom

	Hospital size (beds)	Number of providers	2005			2006		
			Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)
Muang (Provincial city)	341	2	4,246	714	16.8	4,304	889	20.7
Thatphanom	90	4	2,836	918	32.4	2,981	631	21.2
Banphaeng	60	2	865	73	8.4	906	214	23.6
Nakae	60	3	2,730	915	33.5	2,956	260	8.8
Srisongkhram	60	2	2,355	316	13.4	2,387	223	9.3
Renunakhon	30	4	1,589	279	17.6	1,630	47	2.9
Plapak	30	3	1,581	195	12.3	1,802	173	9.6
Tha-uthen	30	3	1,837	352	19.2	1,806	43	2.4
Nawa	30	7	1,484	647	43.6	1,356	430	31.7
Phonsawan	30	2	1,639	613	37.4	1,639	951	58.0
Nathom	30	4	778	152	19.5	836	173	20.7
All districts		36	21,940	5174	23.7	22,603	4,034	17.8

[19] *From an in-depth interview of screening providers at health facilities and health managers at PHO's NCD department, defining the target population is a continually debatable issue. While PHO usually bases the denominator of the screening coverage on the official civil registration system, the health care providers would like to use the census or survey data to reflect the number of women who are actually living in the catchment areas and eligible for the screening service.*

TABLE 5.4 Pap smear coverage by districts, Roi-Et

	Hospital size (beds)	Number of providers	2005			2006		
			Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)
Muang (Provincial city)	541	6	6,493	871	13.4	6,397	450	7.0
Selaphum	60	4	5,218	1,439	27.6	5,494	446	8.1
Suwannaphum	60	1	4,194	196	4.7	4,295	162	3.8
Phonthong	60	5	3,844	782	20.3	3,860	282	7.3
Kasetwisai	30	2	3,136	551	17.6	3,195	64	2.0
Pathumrat	30	6	1,861	379	20.4	1,863	290	15.6
Chaturaphakphiman	30	4	3,244	2,928	90.3	3,368	1,993	59.2
Thawatburi	30	4	2,356	248	10.5	2,482	417	16.8
Phanomphrai	30	7	3,869	716	18.5	3,949	973	24.6
Phochai	30	3	1,722	121	7.0	1,748	93	5.3
Nongphok	30	3	2,023	358	17.7	2,154	279	13.0
Mueangsuang	30	3	541	20	3.7	582	107	18.4
Phonsai	30	4	860	399	46.4	781	154	19.7
Atsamat	30	3	2,647	632	23.9	2,830	95	3.4
Moeiwadi	30	3	917	38	4.1	891	35	3.9
Sisomdet	30	2	1,517	248	16.3	1,568	236	15.1
Changhan	30	3	2,108	246	11.7	2,150	460	21.4
All districts		63	46,550	10,172	21.9	47,607	6,536	13.7

TABLE 5.5 Pap smear coverage by districts, Chiang Mai

	Hospital size (beds)	Number of providers	2005			2006		
			Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)
Muang (Provincial city)	519		4,002	258	6.4	3,806	185	4.9
Maerim		15	3,008	600	19.9	3,134	204	6.5
Chomthong	120	7	2,244	386	17.2	2,281	882	38.7
Sanpatong	120	6	3,040	792	26.1	3,243	755	23.3
Fang	90	4	3,498	17	0.5	3,539	357	10.1
Chiangdao	60	6	1,865	156	8.4	1,995	145	7.3
Maechaem	30	3	2,035	568	27.9	2,014	334	16.6
Doisaket	30	7	2,910	410	14.1	3,146	615	19.5
Maetaeng	30	3	2,210	11	0.5	2,272	109	4.8
Samoeng	30	5	669	78	11.7	654	184	28.1
Mae-ai	30	6	2,231	100	4.5	2,130	231	10.8
Phrao	30	5	2,123	567	26.7	2,216	65	2.9
Sankamphaeng	30	3	2,236	722	32.3	2,406	876	36.4
Sansai	30	2	3,192	271	8.5	3,579	62	1.7
Hangdong	30	3	2,850	20	0.7	3,192	142	4.4
Hod	30	6	1,298	14	1.1	1,435	274	19.1
Doitao	30	7	914	357	39.1	950	23	2.4
Omkoi	30	3	1,352	56	4.1	1,485	15	1.0
Saraphi	30	3	3,248	323	9.9	3,492	695	19.9
Wianghaeng	30	3	412	149	36.2	513	57	11.1
Chaiprakan	30	4	780	326	41.8	867	412	47.5
Maewang	30	6	1,043	199	19.1	1,107	294	26.6
Mae-on	30	6	920	177	19.2	1,048	389	37.1
Doilor	30	4	1,302	556	42.7	1,419	498	35.1
All districts		117	49,382	7,113	14.4	51,923	7,803	15.0

During the period 2005-2006, the Pap smear coverage for the whole province of Nakhon Phnom (23.7-17.8%) was approximately one-fifth of the population (Table 5.3), which is similar to that in Roi-Et (21.9-13.7%) (Table 5.4) but higher than in Chiang Mai (14.4-15.0%) (Table 5.5). In Muang district, where the provincial administration is centreed and the provincial hospital is located, the population coverage was relatively lower than in the rest of the districts within the same province. The total number of screened cases in Muang district was even lower than in certain smaller districts of the province.

While there is a noticeable variation in the Pap smear screening coverage across the district levels, the differences between 2005 and 2006 within the same districts of the three study provinces is quite small. The coefficients of correlation (r) for the number of screened women and for the population coverage between 2005 and 2006 are 0.738 and 0.581, respectively. This is statistically significant ($P<0.001$). However, a change in the Pap smear coverage in the year 2006 from the year 2005 occurred in some of the districts. Since the number of target population within the same district tends to be stable, it is the number of screened cases that drives such a temporal change. Some districts, however, performed consistently above the provincial average in both years, for example, Nawa and Phonsawan in Nakhon Phnom; Chaturaphakphiman[20] in Roi-Et; and Sanpatong, Sankamphaeng, Chaiprakan, and Doilor in Chiang Mai.

Interestingly, the cross-district variation in VIA coverage for Roi-Et province (Table 5.6) is a little smaller than that found in Pap smear coverage over the same period. For VIA in Roi-Et, the coefficient of variation (CV) in 2005-2006 across the districts is 0.6-0.8; whereas for Pap smear the CV is 1.0-0.9. In Chiang Mai, however, the VIA coverage variation (CV=1.6-1.1) is larger than the Pap smear variation (CV=0.8-0.8) over the same years (Table 5.7). This is likely due to the fact that in Roi-Et, the VIA program has been implemented for 5-6 years already, whereas in Chiang Mai the first couple years of the VIA program was confined to only a small number of districts, especially those with relatively large hospitals (Chomthong and Sanpatong, for example). Some districts located in remote (Doitao) or mountainous (Doisaket, Samoeng, Omkoi) areas had very low coverage. In some districts (Mae-ai), the hospitals may choose to limit their service only to the target population living in their catchment areas.

[20] *Interestingly, this district (Chaturaphakphiman) had a very low coverage of VIA and recently scaled down the VIA screening service.*

TABLE 5.6 VIA coverage by districts, Roi-Et

	Hospital size (beds)	Number of providers	2002			2003			2004			2005			2006		
			Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)
Muang (Provincial city)	541	6	16,866	5	0.03	17,508	1,336	7.6	17,442	1,465	8.4	17,639	1,237	7.0	17,761	965	5.4
Selaphum	60	3	15,124	1,102	7.3	16,292	3,337	20.5	15,224	1,279	8.4	15,513	2,983	19.2	15,416	593	3.8
Suwannaphum	60	4	11,618	2,159	18.6	11,938	3,916	32.8	11,804	709	6.0	12,029	1,728	14.4	12,229	548	4.5
Phonthong	60	4	11,093	1,912	17.2	11,514	1,256	10.9	11,397	1,495	13.1	11,554	2,101	18.2	11,609	556	4.8
Kasetwisai	30	2	9,025	1	0.01	9,356	653	7.0	9,290	2,157	23.2	9,426	1,949	20.7	9,443	204	2.2
Pathumrat	30	4	5,141	506	9.8	5,261	854	16.2	5,202	927	17.8	5,288	932	17.6	5,378	426	7.9
Chaturaphakphiman	30	3	8,975	124	1.4	9,278	806	8.7	9,170	211	2.3	9,108	176	1.9	9,071	75	0.8
Thawatburi	30	4	6,812	451	6.6	7,067	1,761	24.9	6,778	1,221	18.0	6,937	704	10.1	6,948	675	9.7
Phanomphrai	30	6	10,933	666	6.1	11,193	2,405	21.5	10,883	1,435	13.2	10,920	2,789	25.5	10,939	2,126	19.4
Phochai	30	3	4,982	1,158	23.2	5,139	1,723	33.5	5,020	1,142	22.7	5,162	725	14.0	5,219	1,038	19.9
Nongphok	30	3	6,142	648	10.6	6,471	492	7.6	6,368	928	14.6	6,630	653	9.8	6,625	810	12.2
Mueangsuang	30	3	1,732	334	19.3	1,801	477	26.5	1,614	503	31.2	1,669	85	5.1	1,659	137	8.3
Phonsai	30	4	2,216	769	34.7	2,293	435	19.0	2,257	291	12.9	2,303	976	42.4	2,410	20	0.8
Atsamat	30	3	7,627	2,747	36.0	8,100	2,873	35.5	8,025	266	3.3	8,258	1,296	15.7	8,259	25	0.3
Moeiwadi	30	2	2,480	317	12.8	2,594	217	8.4	2,556	234	9.2	2,542	229	9.0	2,529	52	2.1
Sisomdet	30	2	4,217	1,205	28.6	4,415	249	5.6	4,349	444	10.2	4,294	692	16.1	4,269	293	6.9
Changhan	30	3	5,694	487	8.6	5,721	969	16.9	5,673	698	12.3	5,634	456	8.1	5,546	483	8.7
All districts		59	130,677	14,591	11.2	135,941	23,759	17.5	133,052	15,405	11.6	134,906	19,711	14.6	135,310	9,026	6.7

TABLE 5.7 VIA coverage by districts, Chiang Mai

	Hospital size (beds)	Number of providers	2005			2006		
			Target pop.	New cases	Coverage (%)	Target pop.	New cases	Coverage (%)
Muang[a] (Provincial city)	519		10,102	18	0.2	9,182	12	0.1
Maerim[a]		3	7,521	565	7.5	7,255	378	5.2
Chomthong	120	3	5,650	2,257	39.9	5,593	1,525	27.3
Sanpatong	120	4	6,608	1,110	16.8	5,927	1,752	29.6
Fang	90	4	8,404	292	3.5	7,872	810	10.3
Chiangdao	60	6	5,169	1,462	28.3	5,346	516	9.7
Maechaem	30	3	5,457	1,129	20.7	5,734	940	16.4
Doisaket	30	2	6,868	1	0.01	6,556	127	1.9
Maetaeng	30	3	5,604	214	3.8	5,060	2	0.04
Samoeng	30	2	1,843	-	-	1,831	-	-
Mae-ai	30	3	5,304	66	1.2	5,244	158	3.0
Phrao	30	2	5,208	2	0.04	4,671	84	1.8
Sankamphaeng	30	2	5,434	47	0.9	4,886	880	18.0
Sansai	30	2	8,340	304	3.6	7,933	49	0.6
Hangdong	30	3	7,461	8	0.1	7,157	234	3.3
Hod	30	2	3,683	133	3.6	3,627	1,249	34.4
Doitao	30	4	2,556	2	0.1	2,378	66	2.8
Omkoi	30	2	3,583	-	-	4,293	144	3.4
Saraphi	30	3	7,868	60	0.8	7,189	666	9.3
Wianghaeng	30	3	1,277	3	0.2	1,423	65	4.6
Chaiprakan	30	4	2,154	52	2.4	2,218	1,035	46.7
Maewang	30	2	2,647	1,224	46.2	2,560	665	26.0
Mae-on	30	2	2,589	-	-	2,342	112	4.8
Doilor	30	4	3,123	1,092	35.0	2,825	570	20.2
All districts		68	124,453	10,041	8.1	119,102	12,039	10.1

[a] The MOPH provincial hospital in Chiang Mai is Nakornping Hospital which is located in Maerim district (adjacent to Muang district). Chiang Mai provincial health office designates the catchment area for target population living outside the district centre to district health office.

The temporal correlation for VIA screening performance in the study provinces (Roi-Et and Chiang Mai) by number of screened women and by coverage is lower than that for Pap smears. The correlation coefficient (r) between 2005 and 2006 is 0.492 (P=0.001) for VIA screened women and 0.299 (P=0.057) for VIA coverage. This correlation became negative despite statistical non-significance (P>0.05) in certain pairs of years: 2002 vs. 2004 and 2002 vs. 2006 for the number of cases (r=-0.204 and -0.067, respectively) and for the population coverage (r=-0.052 and -0.117, respectively). This again reflects the dynamicity of the program performance, and is probably due to the newness of the VIA strategy, especially during the first couple of years of implementation.

The size of the hospital and the number of health personnel available for cervical cancer screening per hospital are not found to be significant predictors of the coverage achievement for Pap smears. The correlation coefficients between the number of cytoscreeners and the number of the women screened by Pap smear (r=0.093 and 0.085 for 2005 and 2006, respectively) or the population coverage (r=0.092 and 0.062 for 2005 and 2006, respectively) are very low and statistically non-significant. An exception is found in certain high coverage districts, for example, Nawa in Nakhon Phnom, Chaturaphakphiman and Phonsai in Roi-Et, and Doilor in Chiang Mai.

For VIA, the health care providers (mostly the registered nurses) available in each hospital seem to play an important role in determining both the number of screened women and the population coverage. An in-depth interview with a senior nurse, who is the VIA supervisor, revealed that the technical skill required for the VIA service is more sophisticated than for Pap smears.[21] Hence, only the registered nurses rather than health workers are qualified for providing the VIA service. The correlation coefficients between the number of VIA providers and the number of the women screened by VIA (r=0.444 and 0.441; P=0.004 and 0.004 for 2005 and 2006, respectively) or the population coverage (r=0.293 and 0.150; P=0.067 and 0.357 for 2005 and 2006, respectively) are much higher than that of Pap smears.

[21] During the VIA screening, not only the uterine cervix but also other gynecological problems will be examined by the VIA providers.

(2) Health resource requirements

To determine the resources needed for the screening strategy of the cervical cancer prevention and control program, the whole service process related to Pap smears and VIA is identified step by step with the type of human and physical resources required shown in Table 5.8 and 5.9, respectively.

Compared with VIA, a complete chain of Pap smear screening requires an additional type of human resource, namely a cytotechnician or cytologist. To read a questionable case due to, for example, poorly prepared slides or an unskilled technician, a pathologist may be sought for consultation. Cytology units also require regular quality auditing.

To link the initial screening process (i.e., smearing and slide fixing) with the final test result (i.e., slide reading), Pap smears need a good logistical system for packaging, transporting, and storing the prepared slides between health centres or district hospitals and the cytology units of provincial hospitals or private laboratories. Apart from the capital investment required for laboratory set ups, (external) geographic factors and (internal) service frequencies are two major unit cost drivers of the Pap smear operation.

TABLE 5.8 Resource use per Pap smear procedure

Procedure	Human resource	Physical resource
Smearing and slide fixing	- Health worker - Nurse	Recurrent - Spatula - Glass slide - Reagent Durable - Speculum - Room and bed
Slide delivery		- Package - Transportation - Storage
Slide reading	- Cytotechnician - Cytologist	Durable - Laboratory set up - Microscope
Supervision (if questionable)	- Pathologist	
Confirmation (if epithelial abnormality)	- Colposcopist - Gynecologist	- Colposcope - LEEP/conization

As a single visit approach (SVA), VIA does not require additional types of human resources. A single provider can complete the whole screen-and-treat process given a qualified training background. The VIA provider has to have a professional degree of at

least that of a registered nurse (RN), whereas Pap smear providers can be health workers[22].

As for the physical resources, though acetic acid is a relatively cheap and common household item, the cryotherapy unit itself is quite expensive (costs approximately 80,000 Baht) and also rather delicate[23]. It needs good maintenance and careful operation. To reach the very remote areas, a mobile coolant unit with a heavy steel container becomes an issue for transportation.

TABLE 5.9 Resource use per VIA procedure

Procedure	Human resource	Physical resource
Visual inspection	- Intensively trained nurse	Recurrent - Cotton swap - Acetic acid Durable - Well light source - Speculum - Room and bed
Cryotherapy (if aceto-white positive)	- Intensively trained nurse - Gynecologist (if referred)	Recurrent - Coolants (CO_2,N_2O) Durable - Cryotherapy unit
Supervision (if newly trained)	- Nurse supervisor - Gynecologist	
Confirmation (if referred)	- Colposcopist - Gynecologist	- Colposcope - LEEP/conization

A major constraint to a scaling up of VIA is the issue related to service providers, both upstream and downstream[24]. There is a barrier to market entry for the VIA screener. This is partly because VIA requires its providers to be trained intensively. This training is based on the JHPIEGO's competency training module. Each training session is limited to 20 or 16-24 trainees and lasts for approximately two weeks or 10 full days. In addition to lectures and demonstrations by trainers, each trainee is assigned into a small group (4-5 trainees), and receives individual site practice with a human model. The trainee then provides an actual service (both VIA and cryotherapy) for at least four patients. Each

[22] Those who have completed a two year public health certificate after a high school level education, and work mostly in the sub-district level health centres.

[23] An in-depth interview with VIA nurses revealed that certain hospital directors were reluctant to acquire the cryotherapy unit for this reason.

[24] The downstream issue has been discussed in WP1, i.e., potentially increasing service load to colposcopists of the referred cases with aceto-white positive results and some of them being false positive.

practice site requires at least one gynecologist and two supervisor nurses. With this training structure, 4-5 gynecologists and 8-10 supervisor nurses are required for each training module. An in-depth interview with a senior gynecologist, who is the leader of the JHPIEGO's project, revealed that each year the so-called 'competency-based training' of VIA can be conducted no more than 4-6 times nationwide. A table in WP1 reveals the relatively slow pace of the VIA scaling up program, by province, during the last 5 years. In budgetary terms[25], each training module for 20 trainees costs approximately 400,000 Baht (or USD600 per head, USD1=33 Baht). Additionally, each batch of the newly-trained nurses requires first-year supervision for six rounds which costs approximately 120,000 Baht in total (or USD180 per head).

(3) Availability of human and physical resources

Findings in this section were drawn mostly from primary data collection in the three case study provinces: Nakhon Phnom, Roi-Et, and Chiang Mai as well as a national facility survey.

Table 5.10 gives an overview of health resource profiles of the three study provinces related to the cervical cancer screening program. Nakhon Phnom and Roi-Et are two provinces located in the same geographical northeastern region, but are in different health regions. Chiang Mai, the second largest province in Thailand, is located in the northern region.

The three study provinces vary in size, in terms of the female population. They also vary in terms of both the availability of health care facilities and health care providers. At present, Nakhon Phnom implements only the Pap smear program[26], whereas Roi-Et and Chiang Mai have both Pap smear and VIA screening programs implemented throughout all of their districts. The percentage of the population at risk (i.e., women aged 30-60 years) in Roi-Et is about twice that of Nakhon Phnom. Chiang Mai is the largest province in terms of target population size and the number of districts and health facilities.

[25] *Data from Chiang Mai PHO in the fiscal years 2005-2006.*
[26] *Nakhon Phnom has piloted the VIA screening program since 2003 in one district (Nathom). Because of the unsuccessful implementation, the district (by the district hospital) decided to terminate the program in 2005.*

TABLE 5.10 Health resource profiles for cervical cancer screening –Study provinces

	Nakhon Phnom	Roi-Et	Chiang Mai
Demographics			
Female population 30-60 years (2006)	148,506	296,923	369,677
• Number of districts	11+1	17+3	22+2
• Number of sub-districts	152	230	268
Service pattern			
Pap smear clinics			
• General, not specific	1 PH, 3 DH	1 DH	1 PH
• 1 day/week	2 DH	9 DH	19 DH
• 2 day/week	5 DH	3 DH	3 DH
• > 2 day/week	--	1 PH, 3 DH	--
VIA implemented?	1 pilot district (2003-2005)	Yes, since 2002 (SAFE project in 2001)	Yes, since 2005
Health care facility			
• Health centres	152	230	268
• District hospitals • (no. of hospitals x beds)	10 (6x30 + 3x60 + 1x90)	16 (13x30 + 3x60)	22 (18x30 + 1x60 + 1x90 + 2x120)
• Provincial hospitals • (beds)	1 (341)	1 (541)	1 (519)
• Other facilities	-	-	1 University hospital
Cytology laboratories			
• Public hospitals	1	2	3
• Private laboratories	2	2	4
Referred hospitals	6	1	2
Human resources			
VIA screeners	-	59	68
Cytology screeners			
• In health centre	149	230	268
• In district hospital	34	57	102
• In provincial hospital	2	3	15
Cytologists and cytotechnicians			
• In provincial hospital	2	3	2
• In Health Region	15	17	31
Colposcopists	-	4	5
Obstetricians/ Gynecologists			
• In district hospital	-	2 (in 2 DH)	6 (in 3 DH)
• In provincial hospital	3	6	10

DH = District hospitals, PH = Provincial hospitals

The following sub-sections focus on two types of health resources necessary for completing the screening process. Both types of resource are deemed as being major limitations to the scaling up of the program. They are cytology laboratories and colposcopies.

(3.1) Resources needed for the follow-up of initial Pap smear screening: Cytology laboratories

A major strategic concern in the proposed scaling up of the Pap smear screening program involves the issues around the availability and readiness of human resources in following up the cases after the initial screening. At the present time, there are only 303 cytologists/cytotechnicians nationwide, working mostly in tertiary care level hospitals. There is a lot of variation in the distribution of the cytologists/cytotechnicians across the different geographic regions. A large number of the cytologists/cytotechnicians (33%) are working in health care facilities located in the central region. Of the remaining cytologists/cytotechnicians, 27% are in the northeast, 22% in the north and 18% in the south. Compared with the cytologist/cytotechnician distribution, the Pap smear target in the northeast accounted for 36% of the national figure. In the central and northern regions the figures stood at 26-27%, with a figure of 10% in the southern region (Figure 5.1).

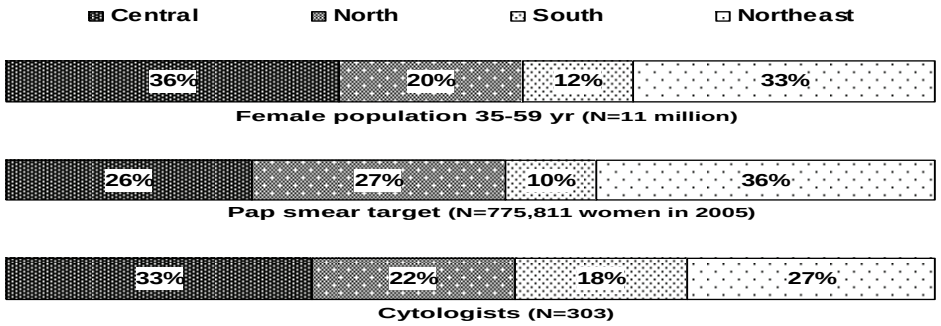


FIGURE 5.1 Distribution of cytologists/cytotechnicians, Pap smear targets, and female population by regions

Source: NCI (2005), NSO (2006)

Table 5.11 breaks down the total number of cytologists and cytotechnicians by the most detailed health regions that cover the three study provinces. Taking the total number of Pap smear slides recorded in the Pap Registry and CPIStm databases for each health region, an average cytologist/cytotechnician read approximately 1,600-1,800 slides in 2005. As such, the cytology service load in these three regions was significantly higher than the national average figure (775 slides per cytologist/cytotechnician).

TABLE 5.11 Number of existing cytologists and cytotechnicians, 2005

	Number of cytologists / cytotechnicians	Number of slides read[a]	Slides per cytologist / cytotechnician
Region 11 (Nakhon Phnom & 3 others)	15	22,158	1,824
Region 12 (Roi Et & 2 others)	17	16,517	1,581
Region 1 (Chiang Mai & 7 others)	31	47,205	1,792
Whole country	303	185,736	775

[a] *As recorded in PapRegistry and CPIStm*

Cytologists and cytotechnicians face more problems than just geographic distribution. They also face a large amount of uncertainty in their career path. Dynamicity (i.e., turn over, production and replenishment) of cytologists will be the focus of Pap smear delivery.

Private laboratories are an important alternative to the cytology units of provincial hospitals. Many sub-district health centres, district hospitals, and private hospitals and clinics choose to use these laboratories between screening and treatment. Table 5.12 presents the cytology service profiles of three major private laboratories that serve health facilities in Nakhon Phnom and Chiang Mai.

TABLE 5.12 Private cytology laboratories for Pap smear screening, 2006

	Nakhon Phnom		Chiang Mai
Name of facilities surveyed	Udon Cytotech	Chitlada	SB Labs
Location of laboratory	Udon Thani	Nakhon Phnom	Chiang Mai
Location of health facility served	Udon Thani, Nakhon Phnom and others	Nakhon Phnom	Chiang Mai and others
Number of cytotechnicians	7	3	1
Number of pathologists	0	0	4
Number of district hospitals served			
• In study provinces	7 out of 10	3 out of 10	8 out of 22
• In other provinces	9	0	11
Number of private hospitals/clinics served			
• In study provinces	0	2	34
• In other provinces	4	0	13
Number of slides read			
In total	27,463	3,023	39,229
On average (per cytologist)	3,923	1,008	7,846
• Slides from private clinics	1.9%	5.0%	49.4%
• Slide from public facilities	98.1%	95.0%	50.6%

In Nakhon Phnom, all ten district hospitals rarely request cytology services from the cytology unit of the provincial hospital. Seven hospitals send the smeared slides for further reading to a private laboratory in Udon Thani, a large province 200 km to the west of Nakhon Phnom. The rest (three district hospitals) choose another small private laboratory located in a district of Nakhon Phnom province. The service load in 2006 for the first laboratory was almost 30 thousand slides (or four thousand per cytotechnician), of which 98% were from public facilities (16 hospitals) in Udon Thani, Nakhon Phnom, and neighboring provinces. The service load for the second laboratory was only three thousand (or one thousand per cytotechnician), of which 95% were obtained from health centres and district hospitals in Nakhon Phnom.

In Chiang Mai, half of the 22 district hospitals choose to send their Pap smear slides to the provincial hospital (Nakornping Hospital) for the cytology service. Eight hospitals choose a private laboratory that has four pathologists working part-time on slide reading. The service load at this private laboratory was approximately 40 thousand slides (or eight thousand per pathologist or cytotechnician). In this laboratory, half of the slides were obtained from private hospitals and clinics (N=47) in Chiang Mai and other provinces.

It is interesting to note that the NCI has estimated the slide reading capacity of a cytologist/cytotechnician as 7,200 slides per person per year.[27] As such, the current workload found in this report is still below the potential of full productivity.

(3.2) Resources for a confirmation of positive screening: Colposcopy

For the referral of cases with abnormal Pap test results and VIA-positive findings, a colposcopy for a confirmed diagnosis is the next important step in the screen-and-treat tandem. Whether this is a major resource constraint issue in the scaling up strategy for the cervical cancer screening program in Thailand, especially in the provincial areas, will be identified next.

A national survey of all 96 provincial-level MOPH hospitals (except those located in Bangkok) was conducted in mid-2007 for this report. Table 5.13 presents the availability of colposcopic services by regional location for the 83 hospitals that responded to the survey (the response rate was 86.5% out of a total of 96 hospitals).

[27] *Or 30 slides per day, based on 20 working days per month and 12 months per year*

TABLE 5.13 Availability of colposcope by region and sizes of MOPH-provincial hospitals -by number of hospitals

	Total hospitals	Survey response		Colposcope	
		Non-response	Response	Available	Not available
All	96	13 (13.5%)	83	69 (83.1%)	14 (16.9%)
• Central[a]	36	5 (13.8%)	31	24 (77.4%)	7 (22.6%)
• North	21	3 (14.3%)	18	16 (88.9%)	2 (11.1%)
• Northeast	20	2 (10.0%)	18	14 (77.8%)	4 (22.2%)
• South	19	3 (15.8%)	16	15 (93.8%)	1 (6.2%)
– < 300 beds	22	3 (13.6%)	19	14 (73.7%)	5 (26.3%)
– 301-500 beds	44	9 (20.5%)	35	26 (74.3%)	9 (25.7%)
– > 500 beds	30	1 (3.3%)	29	29 (100.0%)	0

[a] *Exclude Bangkok*

At present, 83.1% of the provincial hospitals that responded to the survey have colposcope services available to confirm diagnoses. Noticeably, 14 known provincial hospitals (of which 7 are in the central region) do not have the capacity to provide this necessary diagnostic service. By hospital size, all 29 hospitals with over 500 beds have the colposcopy service available, whereas only 74% of the smaller hospitals (either under or over 300 beds, each with comparable proportions) have the colposcope machines.

It is notable that for some provinces, especially those located in the central region, each may have more than one provincial-level hospital[28] (25 provinces in the central region have 36 provincial-level hospitals). An interview of a senior gynecologist, who is a key figure in the professional community of colposcopists in Thailand, revealed that it is not necessary to have colposcope services available in every provincial hospital if the referral network within the same province is working well. As such, the current coverage of colposcopy will increase to 87.1% (Table 5.14). The 14 hospitals that have no colposcopes are located in nine provinces: one in the south, two in the north, and three in northeast or central regions.

[28] *Defined as an acute care facility with over 250 beds. This is to distinguish from a district-level hospital with a service capacity limited to general care practice and a size of 10-150 beds. All provincial hospitals are located in every provincial city but some may be located in a relatively large district within the same province.*

TABLE 5.14 Availability of colposcope by regions and sizes of MOPH-provincial hospitals - By number of provinces

	Total provinces	Survey response		Colposcope	
		Non-response	Response	Available	Not available
All	75	5 (6.7%)	70	61 (87.1%)	9 (12.9%)
• Central[a]	25	1 (4.0%)	24	21 (87.5%)	3 (12.5%)
• North	17	1 (5.9%)	16	14 (87.5%)	2 (12.5%)
• Northeast	19	2 (10.5%)	17	14 (82.4%)	3 (17.6%)
• South	14	1 (7.1%)	13	12 (92.3%)	1 (7.7%)

[a] *Excluding Bangkok*

Table 5.15 presents the distribution of physicians providing reproductive health services who are gynecologists and colposcopists, colposcope machines, and colposcopy services in those provincial hospitals that responded to the survey.

TABLE 5.15 Distribution of colposcopic services and providers

	Number of hospitals	Distribution
No. of Gynecologists per hospital		
• 1-2 MDs	9	16.1%
• 3-4 MDs	17	30.3%
• 5-10 MDs	23	41.1%
• > 10 MDs	7	12.5%
No. of Colposcopists per hospital		
• None	8	14.3%
• 1-2 MDs	20	35.7%
• 3-4 MDs	15	26.8%
• 5-10 MDs	11	19.6%
• > 10 MDs	2	3.6%
No. of colposcopes per hospital		
• 1 machine	50	86.2%
• 2 and more machines	8	13.8%
No. of patients per hospital per year		
• < 100 patients	22	46.8%
• 100-500 patients	20	42.6%
• >500 patients	5	10.6%
Years since service first operated		
• 1-5 years	16	32.0%
• 6-10 years	28	56.0%
• >10 years	6	12.0%
Frequency of service provided		
• 1 day/week	8	20.0%
• 2 days/week	10	25.0%
• 3 days/week	7	17.5%
• 4 days/week	2	5.0%
• 5 days/week	11	27.5%
• 7 days/week	2	5.0%

Of the hospitals that reported having reproductive health staff with a Doctor of Medicine degree (MD), more than half (53.6%) had at least 5 gynecologists. The average number of colposcopists and colposcopes per hospital is lower than that of the gynecologists, revealing the fact that not all gynecologists can perform a colposcopy as a confirming diagnosis for cervical abnormalities. They need to be specially trained in medical schools. Only 23.2% of the surveyed hospitals reported having at least 5 MDs who performed colposcopies and only 13.8% had more than one colposcope machine that could be used when one was out of service. Noticeably, as many as 8 provincial hospitals (14.3%) had no MD colposcopists at all.

Almost half (46.8%) of the surveyed hospitals had a colposcopy service load of less than 100 patients in a year on average (i.e., less than 10 patients a month). Only five hospitals provided this confirming diagnostic service to over 500 patients a year. For recentness of the service, most of the services (88.0%) have been available to the public for no longer than 10 years.

(4) Human resource requirements for scaling up

This section sheds light on the human resource requirements needed for a scaling up of the cervical cancer screening programs. Data from two case study provinces: Nakhon Phnom and Chiang Mai, was used to estimate the boundary of the actual screening service workload for each type of health personnel currently existing in the public sector. To understand the country's capability of achieving a full scale screening-confirming approach, the potential service load was calculated based on the total population (with variably assumed targets of coverage) and screening test parameters at the national level.

(4.1) Cyto-screeners

The majority of health personnel who provide initial Pap smear screening (called 'cyto-screeners' in this report) work in health centres (80.5% in Nakhon Phnom and 69.6% in Chiang Mai). A typical health centre has one health worker (usually female) responsible for cervical cancer screening. This worker is generally also responsible for other reproductive health services. In a hospital, several reproductive health personnel work as a team to provide screening services (2-7 nurses in Nakhon Phnom and 2-17 nurses in Chiang Mai).

Most of the cyto-screeners have been working with Pap smears for 1-5 years (58.4% in Nakhon Phnom and 58.3% in Chiang Mai). Nurses are the key health personnel in providing the screening service. Almost half of the cyto-screeners in Nakhon Phnom (43.8%) and Chiang Mai (48.7%) had a professional background as a registered nurse. However, only a handful of these nurses spend more than half of their overall working hours dealing with screening activities (2.2% in Nakhon Phnom and 3.7% in Chiang Mai). In practice, most cyto-screening activities were performed through a two-to-three month period during the public health campaign season.

Table 5.16 and 5.17 present the potential service load in 2006 per cyto-screener for each district in Nakhon Phnom and Chiang Mai, respectively. The target population is equal to the entire female population in the Pap smear target age group. In order to achieve 100% population coverage target, each cyto-screener would have to serve 122 women annually (in Nakhon Phnom) and 135 women (in Chiang Mai), on average. The minimum-maximum loads across districts ranged from 82 to 166 women in Nakhon Phnom and 59 to 233 in Chiang Mai. Notably, a majority of the districts (7 out of 11 in Nakhon Phnom and 14 out of 24 in Chiang Mai) had service loads less than the provincial average.

Even with an assumption of 100% Pap smear screening coverage, existing human resources, in terms of cyto-screeners, can accommodate such a target population. With a maximum load of 233 women a year (in Saraphi district, Chiang Mai), one cyto-screener can provide the service to up to 20 cases a month or one woman a day on average. The issue is that there is unlikely to be a uniform distribution of the cervical cancer screening service. As such, each cyto-screener might have to do the Pap smear for approximately 80-120 women during the 2-3 month peak season. An in-depth interview with health workers in health centres revealed that the organization and management of the screening campaign could be accomplished through a rotating pool of health personnel from the DHS networks.

TABLE 5.16 Potential service load per cyto-screener in Nakhon Phnom, 2006

District	Target population	Cyto-screeners	Service loads
Muang	4,304	26	166
Thatphanom	2,981	19	157
Banphaeng	906	11	82
Nakae	2,956	26	114
Srisongkhram	2,387	20	119
Renunakhon	1,630	15	109
Plapak	1,802	12	150
Tha-uthen	1,806	20	90
Nawa	1,356	16	85
Phonsawan	1,639	13	126
Nathom	836	7	119
All districts	22,603	185	122

TABLE 5.17 Potential service load per cyto-screener in Chiang Mai, 2006

District	Target population	Cyto-screeners	Service loads
Muang	3,806	25	152
Maerim	3,134	15	209
Chomthong	2,281	20	114
Sanpatong	3,243	23	141
Fang	3,539	19	186
Chiangdao	1,995	17	117
Maechaem	2,014	17	118
Doisaket	3,146	21	150
Maetaeng	2,272	17	134
Samoeng	654	11	59
Mae-ai	2,130	17	125
Phrao	2,216	21	106
Sankamphaeng	2,406	14	172
Sansai	3,579	17	211
Hangdong	3,192	16	200
Hod	1,435	17	84
Doitao	950	15	63
Omkoi	1,485	15	99
Saraphi	3,492	15	233
Wianghaeng	513	6	86
Chaiprakan	867	12	72
Maewang	1,107	13	85
Mae-on	1,048	12	87
Doilor	1,419	10	142
All districts	51,923	385	135

(4.2) Cytologists/cytotechnicians

As mentioned previously, a major hurdle to completing the Pap smear screening process lies in the cytology laboratories. Private laboratories play an important role in conducting cytology for Pap smears (see Section 3.1). In the public sector, only 2 cytologists and cytotechnicians were working full time in each provincial hospital in Nakhon Phnom and Chiang Mai. There are no cytology units in the district hospitals in Nakhon Phnom. In contrast, Chiang Mai has 6 cytologists/cytotechnicians working full time in three relatively large district hospitals.

Table 5.18 presents the potential service load for the cytologists/cytotechnicians currently existing in each region (except Bangkok) if every woman in the target age cohorts (i.e., 35, 40, 45, 50, 55, and 60 years) had to be screened by Pap smear once a year. To achieve the 100% target, each cytologist/cytotechnician is required to read approximately 7.7 thousands slides, on average. This targeted load is comparable with the service productivity experienced by the study private laboratory in Chiang Mai (7,846 slides in 2006, see WP1). This is a little over the expectation from the NCI, who state that one cytologist can read approximately 30 slides in one day (or 7.2 thousands per 240 working days a year).

Compared with the national average work load of 775 slides in the current public health system (see Table 5.11), most cytology units in public hospitals will have to improve their productivity by almost ten times. The northeastern region will face the most difficulty in scaling up their cytology service to meet 100% of the target population coverage due to the typical problem in human resource misdistribution (see Figure 1) and the fact that public hospitals in the northeast have already shouldered a relatively higher load of cytology services (1.6-1.8 thousand per cytologist/cyto-technician in Regions 11 and 12, see Table 5.11).

TABLE 5.18 Potential service load of slide reading in laboratory units, 2006

Region	Target population	Cytologists/ Cytotechnicians	Service loads
Central	650,914 (28.0%)	100 (33.0%)	6,510
North	507,283 (21.8%)	66 (21.8%)	7,687
Northeast	850,781 (36.6%)	81 (26.7%)	10,504
South	313,209 (13.5%)	56 (18.5%)	5,594
All regions	2,322,187	303 (100.0%)	7,664

(4.3) Colposcopists

Table 5.19 shows the total female population who are the target of the Pap smear program and the number of colposcopes and colposcopists available in the public sector. Similar to the geographic distribution of cytologists/cytotechnicians, most colposcopists are working in hospitals located in the central region. Only 25 colposcopists work in 19 provinces of the northeast.

TABLE 5.19 Number of total female population at target ages, colposcopes, and colposcopists

Region	Target Population [a]	Colposcopes [b]	Colposcopists [b]
Central	650,914	41	64
North	507,283	22	37
Northeast	850,781	23	25
South	313,209	18	24
All regions	2,322,187	104	150

Source: [a] Department of Provincial Administration, Ministry of Interior, 2006
[b] Department of Medical Services, Ministry of Public Health, 2004

Three scenarios were set upon the varying population coverage of Pap smear: 10% (the coverage in 2005); a 50% target (adopted by most provinces); and 80% (as the ideal target). Services by a colposcopists are classified into two types of abnormalities: All epithelial abnormalities detected from Pap smears, defined as ASC-US or above, and high grade epithelial lesions, defined as HSIL/CIN-II or above.

Based on the national average of detecting epithelial abnormalities (1.9%) in the Pap Registry (2005-2006) and the rate of detecting high grade epithelial lesions (28.2%), given the epithelial abnormalities in Sanpatong Hospital, the total cases and potential service loads per colposcopist are presented in Tables 5.20 and 5.21, respectively.

TABLE 5.20 Number of cases with epithelial abnormalities per colposcopist

Region	Total cases [a]			Service loads per colposcopist		
	10% coverage	50% coverage	80% coverage	10% coverage	50% coverage	80% coverage
Central	1,237	6,184	9,894	19	97	155
North	964	4,819	7,711	26	130	208
Northeast	1,616	8,082	12,932	65	323	517
South	595	2,975	4,761	25	124	198
All regions	4,412	22,061	35,297	29	147	235

[a] ASC-US or above based on the national average from PapRegistry 2005-06 = 1.9% of the screened women

TABLE 5.21 Number of cases with high grade epithelial lesions per colposcopist

Region	Total cases [a]			Service loads per colposcopist		
	10% coverage	50% coverage	80% coverage	10% coverage	50% coverage	80% coverage
Central	349	1,744	2,790	5	27	44
North	272	1,359	2,174	7	37	59
Northeast	456	2,279	3,647	18	91	146
South	168	839	1,343	7	35	56
All regions	1,244	6,221	9,954	8	41	66

[a] *HSIL/CIN-II or above based on retrospective data in Sanpatong Hospital, Chiang Mai = 28.2% of the epithelial abnormalities*

With the current scenario, the annual workload for confirming all abnormal lesions was only 29 cases per colposcopist. As expected, colposcopists in the hospitals located in the northeastern region shared the greatest workload (65 cases). If only high grade epithelial lesions were referred to the colposcopists, the national workloads would be only 8 cases per colposcopist per year.

The potential annual workload per colposcopist would increase to 147-235 cases of women with any epithelial abnormalities if the Pap smear screening covered 50-80% of the entire age-targeted female population, respectively. For selective high grade lesions, the national average colposcopy workload would be reduced to 41 and 66 cases per colposcopist per year.

(4.4) VIA providers

The potential VIA service load at the district level in Roi-Et is presented in Table 5.22. The calculation was based on the female population at VIA-target ages (i.e., 30-44 years except 35 and 40 years) and the number of VIA providers existing in each hospital in 2006. As explained previously, VIA providers are restricted to those registered nurses who have passed a two-week intensive training course. Nearly all of them are working in public hospitals.

If all VIA-target women were to be screened, the case loads on each VIA provider would be much higher than that on the cyto-screeners. Each nurse has to provide the VIA service for 2,293 women on average each year (or about 10 cases a day). However, there is a wide variation in the potential VIA loads across different districts. The VIA load could

reach approximately 5 thousand in the districts that have a large population or lower numbers of VIA providers, such as Selaphum or Kasetwisai. In a relatively small district, such as Mueangsuang and Phonsai, the service load might be as little as approximately five hundred per provider. This wide variation reflects the fact that the VIA program is a relatively new innovation. The VIA program's introduction and maintenance depends largely on the provincial CMOs and hospital directors. Outreach to sub-districts outside the catchment areas of district hospitals may not be a priority of the VIA providers, most of whom are confined these district hospitals.

TABLE 5.22 Potential service load per VIA provider in Roi-Et, 2006

District	Target population	VIA providers	Service loads
Muang (Provincial city)	17,761	6	2,960
Selaphum	15,416	3	5,139
Suwannaphum	12,229	4	3,057
Phonthong	11,609	4	2,902
Kasetwisai	9,443	2	4,722
Pathumrat	5,378	4	1,345
Chaturaphakphiman	9,071	3	3,024
Thawatburi	6,948	4	1,737
Phanomphrai	10,939	6	1,823
Phochai	5,219	3	1,740
Nongphok	6,625	3	2,208
Mueangsuang	1,659	3	553
Phonsai	2,410	4	603
Atsamat	8,259	3	2,753
Moeiwadi	2,529	2	1,265
Sisomdet	4,269	2	2,135
Changhan	5,546	3	1,849
All districts	135,310	59	2,293

5.4 Conclusion

Cervical cancer screening by Pap smears and VIA has different focal points in terms of health care providers. The Pap smear service was performed mostly (66.0%) in health centres at the sub-district level. Nearly all cases (97.4%) received the VIA service in the district health system (DHS), whereby the health centres and district hospitals share a similar fraction (47.6% vs. 49.8%, respectively). The majority of Pap smears being performed by health centres are congruent with the hierarchy of the public health system, where preventative services are concentrated on the front line of healthcare treatment, at the sub-district level. This is in large part due to the fact that the skill required for Pap smears is compatible with health workers, whereas VIA requires the higher skill of a registered nurse, and is thus confined to the district hospital level.

For Pap smears, major concerns include the issues surrounding the readiness of cytology laboratories. At the present, there are 303 cytotechnicians nationwide, working mostly in tertiary care level hospitals. A large number of the cytotechnicians (33%) are working in health care facilities located in the central region, whereas 27% were in the northeast, 22% in the north and 18% in the south. By health regions that cover the three study provinces, a cytotechnician read approximately 1,600-1,800 slides in 2005. As such, the cytology service load in these three regions is higher than the national average of 775 slides per person.

Private laboratories are an important alternative to the cytology units of provincial hospitals that many sub-district health centres, district hospitals, and private hospitals and clinics choose for the step in-between the screening and treatment. In Nakhon Phnom, all ten district hospitals rarely request cytology services from the cytology unit of the provincial hospital. Seven hospitals send the smeared slides for further reading to a private laboratory in Udon Thani, a large province 200 km to the west of Nakhon Phnom. The rest (three district hospitals) choose another small private laboratory located in a district of Nakhon Phnom province. The service load in 2006 for the first laboratory was almost 30 thousand slides (or four thousand per cytotechnician), of which 98% were from public facilities (16 hospitals) in Udon Thani, Nakhon Phnom, and other neighboring provinces. The service load for the second laboratory was only three thousand (or one

thousand per cytotechnician), of which 95% were obtained from health centres and district hospitals in Nakhon Phnom.

In Chiang Mai, half of the 22 district hospitals choose to send their Pap smear slides to the provincial hospital (Nakornping Hospital) for the cytology service. Eight hospitals choose a private laboratory that has four pathologists working part-time on slide reading. The service load was approximately 40 thousand slides (or eight thousands per pathologist or cytotechnician). In this laboratory, half of the slides were obtained from private hospitals and clinics (N=47) in Chiang Mai and other provinces.

For the referral of cases with abnormal Pap test results and VIA-positive finding, colposcopy for a confirmed diagnosis is the next important step in the screen-and-treat tandem. A national survey of all 96 provincial hospitals under the MOPH (except those in Bangkok) was conducted in mid-2007 for this report. Tables 5.13, 5.14, and 5.15 present the availability and distribution of colposcopic services and providers for those provincial hospitals that responded to the survey (response rate 86.5%).

In 2007, 83.1% of the surveyed provincial hospitals have colposcopic services available (88.0% having had the service for less than 10 years): 100% of over 500-bed hospitals vs. 74% of smaller hospitals. While 53.6% have at least 5 gynecologists each, 23.2% have at least 5 colposcopists and 14.3% do not have any colposcopists. Almost half (47.8%) have a colposcopic service load of less than 100 patients in a year and only four hospitals provide this confirming diagnosis service to over 500 patients a year.

This work package found all types of health personnel currently existing in the public sector are sufficient for the scaling up of cervical cancer screening programs. The main issue concerns geographic distribution, whereby health facilities in the northeast suffer the most. Existing cyto-screeners who are health workers and nurses in health centres and hospitals can accommodate the target population even though the screening coverage was set to over 50%. In contrast, a major limitation to scaling up the VIA program is caused by barriers to the market entry of trained nurses. The productivity required to expand follow up services (due to a scaling up of the screening coverage) was found to not be beyond the capacity threshold of the existing cytologists/cytotechnicians and colposcopists.

References

1. Ferlay J. Globocan 2002: Cancer Incidence, Mortality and Prevalence Worldwide. Lyon: IARC Press; 2004.
2. Bundhamcharoen K, Teerawattananon Y, Vos T, Begg S. Burden of Disease and Injuries in Thailand, Priority Setting for Policy. Nonthaburi: Bureau of Health Policy and Planning, Ministry of Public Health; 2002.
3. Khuhaprema T, Srivatanakul P, Sriplung H, Wiangnon S, Sumitsawan Y, Attasara P. Cancer in Thailand Vol.IV, 1998-2000. Bangkok; 2007.
4. Munoz N, Bosch FX, de Sanjose S, Herrero R, Castellsague X, Shah KV, et al. Epidemiologic classification of human papillomavirus types associated with cervical cancer. N Engl J Med. 2003 Feb 6;348(6):518-27.
5. Pengsaa P, Sriamporn S, Kritpetcharat O, Kamsa-Ard S, Suwanrungruang K, Noda S, et al. A comparison of cytology with Pap smears taken by a gynecologist and with a self-sampling device. Asian Pac J Cancer Prev. 2003 Apr-Jun;4(2):99-102.
6. Bradley J, Barone M, Mahe C, Lewis R, Luciani S. Delivering cervical cancer prevention services in low-resource settings International Journal of Gynecology and Obstetrics. 2005;89:S21-S9.
7. Franco EL, Rohan TE, Villa LL. Epidemiologic evidence and human papillomavirus infection as a necessary cause of cervical cancer. J Natl Cancer Inst. 1999 Mar 17;91(6):506-11.
8. Tsu VD, Pollack AE. Preventing cervical cancer in low-resource settings: how far have we come and what does the future hold? Int J Gynaecol Obstet. 2005 May;89 Suppl 2:S55-9.
9. Mandelblatt JS, Lawrence WF, Gaffikin L, Limpahayom KK, Lumbiganon P, Warakamin S, et al. Costs and benefits of different strategies to screen for cervical cancer in less-developed countries. J Natl Cancer Inst. 2002 Oct 2;94(19):1469-83.
10. Gaffikin L, Blumenthal PD, Emerson M, Limpaphayom K. Safety, acceptability, and feasibility of a single-visit approach to cervical-cancer prevention in rural Thailand: a demonstration project. Lancet. 2003 Mar 8;361(9360):814-20.
11. RTCOG and the JHPIEGO Corporation Cervical Cancer Prevention Group. Safety, acceptability, and feasibility of a single-visit approach to cervical-cancer prevention in rural Thailand: a demonstration project. Lancet. 2003;361:814-20.
12. zur Hausen H. Cervical carcinoma and human papillomavirus: on the road to preventing a major human cancer. Journal of National Cancer Institute. 2001;93:252-3.
13. Priest A. Cervical cancer vaccine may come soon to Canada. Canadian Medical Association Journal. 2006;175(3):235.

14. The Lancet. Rolling out HPV vaccines worldwide. Lancet. 2006;367:2034.

15. Everett W. A vaccination against complacency. 2006 13 June [cited 2006 12 August] ; Available from: http://www.boston.com/yourlife/health/diseases/articles/2006/06/13/a_vaccination_against_complacency/

16. World Health Organization. Cervical cancer screening programmes: managerial guidelines. Geneva; 1992.

17. International Agency for Research on Cancer. Cervix Cancer Screening. IARC Handbooks of Cancer Prevention. Lyon: IARC Press; 2005. p. 241.

18. Srivatanakul P. Cervical cancer screening: Pap smear. In: Srivatanakul P KT, Deerasamee S, editor. Appropriate strategic plan in cervical cancer control and prevention of Thailand. Bangkok: Thai National Cancer Institute; 2000. p. 19-22.

19. Maneerat J. Clinical Significance of Positive Visual Inspection with Acetic Acid (VIA) Result at Nakornping Hospital. Srinagarind Med J. 2007;22:59-66.

20. World Health Organization. Cervical cancer screening in developing countries. WHO consultation; 2002; France, Inis; 2002. p. 26-8.

21. Sankaranarayanan R NB, Dinshaw KA, Jayant K, Budukh A, Mahé C,. Early results from a randomised controlled trial of visual, cytology, and HPV screening for cervical cancer in rural India. Int J Cancer. 2004(in press).

22. Tomyabatra K. Evaluation of Visual Inspection with Acetic Acid (VIA), Lugol's Iodine (VILI) and Pap Smear as Cervical Cancer Screening Tools: Randomized Controlled Trial with Related Subject Design. Department of Medical Services Conference. Ministry of Public Health, Thailand; 2007.

23. Sriplung H. Chapter IV: Projection of cancer problems. In: Khuhaprema T, Srivatanakul P, Sriplung H, Wiangnon S, Sumitsawan Y, Attasara P, editors. Cancer in Thailand Vol IV, 1998-2000. Bangkok: Bangkok Medical Publisher; 2007. p. 81-4.

24. Sriplung H, Wiangnon S, Sontipong S, Sumitsawan Y, Martin N. Cancer incidence trends in Thailand, 1989-2000. Asian Pac J Cancer Prev. 2006 Apr-Jun;7(2):239-44.

25. Arbyn M, Sasieni P, Meijer CJ, Clavel C, Koliopoulos G, Dillner J. Chapter 9: Clinical applications of HPV testing: A summary of meta-analyses. Vaccine. 2006 Aug 21;24 Suppl 3:S78-89.

26. The Committee of Gynecologic Oncology. Clinical practice guidelines for cervical cancer screening. Bangkok: The Royal Thai College of Obstetricians and Gynecologists; 2006.

27. Myers ER, McCrory DC, Nanda K, Bastian L, Matchar DB. Mathematical model for the natural history of human papillomavirus infection and cervical carcinogenesis. Am J Epidemiol. 2000 Jun 15;151(12):1158-71.

28. Sukvirach S, Smith JS, Tunsakul S, Munoz N, Kesararat V, Opasatian O, et al. Population-based human papillomavirus prevalence in Lampang and Songkla, Thailand. J Infect Dis. 2003 Apr 15;187(8):1246-56.

29. International Health Policy Program, Health Intervention and Technology Assessment Program. The progress report: Research for Development of an Optimal Policy Strategy for Prevention and Control of Cervical Cancer in Thailand. Bangkok: Population and Reproductive Health Capacity Building Program, The World Bank; 2007 20 August.

30. Rambout L, Hopkins L, Hutton B, Fergusson D. Prophylactic vaccination against human papillomavirus infection and disease in women: a systematic review of randomized controlled trials. Cmaj. 2007 Aug 28;177(5):469-79.

31. Goldie SJ, Gaffikin L, Goldhaber-Fiebert JD, Gordillo-Tobar A, Levin C, Mahe C, et al. Cost-effectiveness of cervical-cancer screening in five developing countries. N Engl J Med. 2005 Nov 17;353(20):2158-68.

32. Briggs A, Sculpher M, Claxton K. Decision Medelling for Health Economic Evaluation. Oxford: Oxford University Press; 2006.

33. Briggs AH. Handling uncertainty in cost-effectiveness models. Pharmacoeconomics. 2000;17:479-500.

34. Daniels MJ, Zhao YD. Modelling the random effects covariance matrix in longitudinal data. Stat Med. 2003 May 30;22(10):1631-47.

35. The Commission on Macroeconomics and Health. Macroeconomics and health: investing in health for economic development. Geneva: World Health Organization; 2001.

36. Wibulpolprasert S. The need for guidelines and the use of economic evidence in decision -making in Thailand: lessons learnt from the development of the National List of Essential drugs. J Med Assoc Thai. 2008;91(suppl.2):s1-s3.

37. Goldie SJ, Kim JJ, Myers E. Chapter 19: Cost-effectiveness of cervical cancer screening. Vaccine. 2006 Aug 21;24 Suppl 3:S164-70.

38. Kulasingam SL, Benard S, Barnabas RV, Largeron N, Myers ER. Adding a quadrivalent human papillomavirus vaccine to the UK cervical cancer screening programme: A cost-effectiveness analysis. Cost Eff Resour Alloc. 2008;6:4.

39. Devlin N, Parkin D. Does NICE have a cost-effectiveness threshold and what other factors influence its decisions? A binary choice analysis. Health Econ. 2004 May;13(5):437-52.

40. Parkin DM, Bray F. Chapter 2: The burden of HPV-related cancers. Vaccine. 2006 Aug 21;24 Suppl 3:S11-25.

41. Kingdon JW. Agendas Alternatives and Public Policy. Boston: Little Brown; 1984.

42. Cookson R. Evidence-based policy making in health care: what it is and what it isn't. J Health Serv Res Policy. 2005 Apr;10(2):118-21.

43. Walt G. Health Policy: An Introduction to Process and Power. London: Zed Books; 1994.

44. Williams I, Bryan S. Understanding the limited impact of economic evaluation in health care resource allocation: a conceptual framework. Health Policy. 2007 Jan;80(1):135-43.

45. Lancet editorial. Should HPV vaccines be mandatory for all adolescents? Lancet. 2006;368:1212.

46. Colgrove J. The ethics and politics of compulsory HPV vaccination. N Engl J Med. 2006 Dec 7;355(23):2389-91.

47. Raffle AE. Human papillomavirus vaccine policy. Lancet. 2007 Feb 3;369(9559):367-8.

48. Marasinghe J, Amarasinghe A. Prophylactic vaccine against cervical cancer and importance of maintaining methods. 2006 8 August [cited 2006 15 August]; Available from: http://www.cmaj.ca/cgi/eletters/175/3/235

49. Baumgartner, Frank R, Bryan DJ. Agenda Dynamics and Policy Subsystems. Journal of Politics. 1991;53(4):1044-74.

50. Immergut, Ellen M. Institutional Constraints on Policy. In: M. Molan, M. Rein, R.E. Goodin, editors. The Oxford Handbook of Public Policy. Oxford: Oxford University Press; 2006.

51. Wilsford, David. Path dependency, or why history makes it difficult but not impossible to reform health care systems in a big way. Journal of Public Policy. 1994;14(3):251-83.

52. Monsonego J, Bosch FX, Coursaget P, Cox JT, Franco E, Frazer I, et al. Cervical cancer control, priority and new directions. International Journal of Cancer. 2003;108:329-33.

53. Sankaranarayanan R, Esmy PO, Rajkumar R, Muwonge R, Swaminathan R, Shanthakumari S. Effect of visual screening on cervical cancer incidence and mortality in Tamil Nadu, India: a cluster-randomised trial. Lancet. 2007;370:398-406.

54. Family Health International. HPV Vaccines New Tools in the Prevention of Cervical Cancer and Other HPV Disease in Asia and the Pacific 2 November 2006; Bangkok: Symposium proceedings.

55. Suba EJ, Murphy SK, Donnelly AD, Furia LM, Huynh ML, Raab SS. Systems analysis of real-world obstacles to successful cervical cancer prevention in developing countries. Am J Public Health. 2006 Mar;96(3):480-7.

Appendix

APPENDIX 1 List of participants in the consultation on suitable strategies to control cervical cancer in Thailand, 25th December 2007, Miracle Grand Hotel, Bangkok

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17. Ms Tipayawan Lorrattanachaiyong	National Science and Technology Development Agency
18. Ms Thidatip Wongsurawat	National Science and Technology Development Agency
19. Ms Pattamaporn Prachumrat	National Science and Technology Development Agency
20. Ms Suparin Jirasookprasert	National Science and Technology Development Agency
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