การวิเคราะห์ต้นทุนการคัดกรองมะเร็งปากมดลูก

จังหวัดร้อยเอ็ด ประเทศไทย

นายวัชระ เอี่ยมรัศมีกุล

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
สาขาวิชาการพัฒนาระบบสาธารณสุข
วิทยาลัยวิทยาศาสตร์สาธารณสุข
จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2552

COST IDENTIFICATION ANALYSIS OF CERVICAL CANCER SCREENING IN
ROI ET PROVINCE, THAILAND

Mr. WACHARA EAMRATSAMEEKOOL

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Public Health Program in Health Systems Development

College of Public Health Sciences

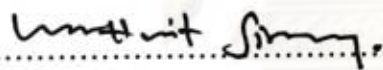Chulalongkorn University

Academic Year 2009

Thesis Title   COST IDENTIFICATION ANALYSIS OF CERVICAL
                   CANCER SCREENING IN ROI ET PROVINCE, THAILAND
By   MR. WACHARA EAMRATSAMEEKOOL
Field of Study   HEALTH SYSTEMS DEVELOPMENT
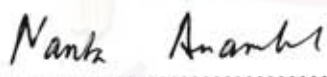Thesis Advisor   ASSOCIATE PROFESSOR SATHIRAKORN PONGPANICH, Ph.D.

Accepted by the College of Public Health Sciences, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.... Dean of the College of Public Health Sciences

(Professor Surasak Taneepanichskul, M.D.)

THESIS COMMITTEE

.... Chairman

(Wattasit Siriwong, Ph.D.)

.... Thesis Advisor

(Associate Professor Sathirakorn Pongpanich, Ph.D.)

.... External Examiner

(Nanta Auamkul, MD.)
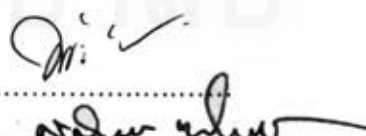
วัชระ เอี่ยมรัศมีกุล: การวิเคราะห์ต้นทุนการคัดกรองมะเร็งปากมดลูก จังหวัดร้อยเอ็ด ประเทศไทย (COST IDENTIFICATION ANALYSIS OF CERVICAL CANCER SCREENING IN ROI ET PROVINCE, THAILAND) อ. ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร.สถิรกร พงศ์พานิช, 101 หน้า.

ปัญหาความขาดแคลนเป็นอุปสรรคที่สำคัญประการหนึ่งของการป้องกันและควบคุมมะเร็งปากมดลูก การศึกษาต้นทุนการคัดกรองมะเร็งปากมดลูกของจังหวัดร้อยเอ็ดจะทำให้ทราบข้อมูลต้นทุนเพื่อพิจารณาจัดระบบบริการอย่างมีประสิทธิภาพ การศึกษาดำเนินเชิงพรรณนาย้อนหลัง โดยวิเคราะห์ต้นทุนรวม ค่าแรง ค่าวัสดุ ค่าลงทุนของการคัดกรองโดยวิธีวีไอเอและแป๊ปสเมียร์ ของโรงพยาบาลสังกัดราชการในจังหวัดร้อยเอ็ด โดยแบ่งเป็นระดับโรงพยาบาลทั่วไป โรงพยาบาลชุมชน 60 เตียงและ 30 เตียง ในปีงบประมาณ 2552 ผลการศึกษาพบว่าต้นทุนรวมของการคัดกรองมะเร็งปากมดลูกของโรงพยาบาล 7 แห่งซึ่งมีโรงพยาบาลทั่วไป 1 แห่ง โรงพยาบาลชุมชน 60 เตียง 2 แห่ง และ 30 เตียง 4 แห่ง เท่ากับ 3,046,127.00 บาท ตรวจคัดกรองได้ 15,577 ราย เฉลี่ยรายละ 195.55 บาท ต้นทุนของการคัดกรองด้วยวิธีวีไอเอเท่ากับ 119.56 บาท คิดเป็น 0.54 เท่าของวิธีแป๊ปสเมียร์ที่มีค่า 223.41 บาท ต้นทุนการคัดกรองของโรงพยาบาลทั่วไป โรงพยาบาลชุมชน 60 เตียงและ 30 เตียง เท่ากับ 158.95, 170.83 และ 241.44 บาทตามลำดับ ต้นทุนต่อหน่วยของการคัดกรองมะเร็งปากมดลูกของโรงพยาบาลสังกัดราชการในจังหวัดร้อยเอ็ดของวิธีวีไอเอมีค่าประมาณครึ่งหนึ่งของวิธีแป๊ปสเมียร์ และสูงกว่าเงินชดเชยที่สถานบริการได้รับจากงบบริการสร้างเสริมสุขภาพและป้องกันโรคที่บริหารระดับประเทศ

สาขาวิชา การพัฒนาระบบสาธารณสุข   ลายมือชื่อนิสิต...
ปีการศึกษา 2552   ลายมือชื่ออาจารย์ที่ปรึกษา...

##5179155253 MAJOR HEALTH SYSTEMS DEVELOPMENT

KEYWORDS: cost/cervical cancer/screening/identification

WACHARA EAMRATSAMEEKOOL: COST IDENTIFICATION ANALYSIS OF CERVICAL CANCER SCREENING IN ROI ET PROVINCE, THAILAND. THESIS ADVISOR: ASSOCIATE PROFESSOR SATHIRAKORN PONGPANICH, PH.D., 101 PP.

Lack of resources has long been claimed as one barrier for the failures of cervical cancer control programmes. Cost analysis of cervical cancer screening in Roi Et Province could identify data to support decisions for efficient health care system management. Retrospective data were descriptively explored to identify total or full cost, labor-, material-, and capital costs of cervical cancer screening among public hospitals within Roi Et Province as categorized as general, 60-bed and 30-bed hospitals in fiscal year 2009. The results showed full cost of total enrolled seven hospitals, which included one general, two 60-bed and four 30-bed hospitals, were 3,046,127.00 bahts with 15,577 clients. The overall unit cost was 195.55 bahts. The unit cost for SVA was 119.56 baths which was 0.54 times of the cost for Pap smear at 223.41 bahts. The unit costs of general, 60-bed and 30-bed hospitals were 158.95, 170.83 and 241.44 respectively. The unit cost of cervical cancer screening among public hospitals in Roi Et Province by SVA method was about half of Pap smear and was higher than the reimbursement provided under the National Priority Program and Central Procurement benefit.

Field of Study:	Health System Development	Student's Signature...............
Academic Year:	2009	Advisor's Signature................

ACKNOWLEDGEMENTS

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASC-H	Atypical squamous cells: cannot exclude a high-grade squamous intra-epithelial lesion
ASC-US	Atypical squamous cells of undetermined significance
CIN	Cervical intraepithelial neoplasia
CIS	Carcinoma in situ
CxBx	Cervical biopsy
DNA	Deoxyribonucleic acid
ECC	Endocervical curettage
FIGO	International Federation of Gynecology and Obstetrics
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
HSIL	High grade squamous intraepithelial lesion
LEEP	Loop electrosurgical excision procedure
LSIL	Low grade squamous intraepithelial lesion
Pap	Papanicolaou smear
SCJ	Squamo-columnar junction
SVA	Single visit approach
VIA	Visual inspection with acetic acid

CHAPTER I

INTRODUCTION

Background and rationale

Cervical cancer is an important health problem for women throughout the world. Data from the International Agency for Research on Cancer (IARC), a part of World Health Organization (WHO), show that cervical cancer is a leading cause of death from cancer among women in low-resource setting, affecting women at a time of life when they are critical to social and economic stability.[1] It is the third most common cancer in women – affecting more than 1.4 million women worldwide; and each year more than 460,000 new cases occur and about 231,000 women die of the disease.[2]

Cervical cancer occurs worldwide, but the highest incidence rates are found in Central and South America, eastern Africa, South and South-East Asia, and Melanesia. [3] Although cervical cancer is highly preventable through cytologic screening or Pap smear test, most women in poorer countries do not have access to effective screening programmes. [4] Understanding how cervical cancer develops is essential to designing effective interventions to prevent deaths from this disease.[4] Such screening, however, requires an established laboratory, highly trained cytotechnologists, and up to three visits for screening, evaluation of cytologic abnormalities, and treatment and is therefore difficult to implement and sustain in setting with limit resources.

In Thailand, cervical cancer stills the most common cancers of women.[5] The age-standardized rate for the incidence was 24.7.[6]

Data from Roi Et Cancer Registry in 2007, cervical cancer ranged the third most common type of cancer of women, followed only liver & bile duct and breast cancers.[7]

The barriers to control of cervical cancer have long been claimed for the failures of the programmes are the following: [3]

- Political barriers: lack of priority for women's sexual and reproductive health; and lack of national policies & appropriate guidelines.

- Community and individual barriers: lack of awareness of cervical cancer as a health problem; and attitudes, misconceptions and beliefs that inhibit people discussing diseases of the genital tract.

- Economic barriers (lack of resources).

- Technical and organizational barriers, caused by poorly organized health system and weak infrastructure.

In year 2000, Roi Et was the first province in Thailand to provide single visit approach (SVA) combining visual inspection of the cervix with acetic acid (VIA) and cryotherapy. [8] After founded that SVA with VIA and cryotherapy was safe, acceptable, and feasible, Roi Et has provided cervical cancer screening through two main screening methods since then. [8] The first method is single visit approach with VIA and, if abnormal and eligible, will be treated with cryotherapy in the same visit. The second method is conventional cytology testing or Pap smear. Pap smear and VIA are significantly more cost-effective than other interventions available in the country: HPV DNA test and HPV vaccine. [9]

Unit cost analysis of cervical cancer screening in Roi Et Province could identify data to support decisions for efficient health care system management.

Research questions

Primary research question

What are the total and unit costs of cervical cancer screening services in Roi Et province, Thailand.

Secondary research questions

1. What are the total and unit costs of cervical cancer screening services in Roi Et general hospital
2. What are the total and unit costs of cervical cancer screening services in enrolled community hospitals

Objectives and Scope of Study

General objective

1. To identify unit costs of cervical cancer screening services in Roi Et province, Thailand

Specific objectives

1. To identify unit costs of cervical cancer screening services in Roi Et Province
2. To identify total and unit costs of cervical cancer screening services in Roi Et General Hospital
3. To identify total and unit costs of cervical cancer screening services of enrolled community hospitals in Roi Et.

Expected Benefits and Applications

1. Decision makers in Roi Et healthcare system can use the research results to support their decisions for efficient healthcare service design.
2. Managers in Roi Et healthcare system can know total and unit costs of cervical cancer screening for managerial issues and to create more economic consciences.
3. Chief Financial Officer will be alert and allocate resources more efficiently.
4. Healthcare providers will aware and utilize supplies and consumables more economically.
5. Provide baseline financial data to be compared with total and unit costs, and cost reduction measures in the future.

Variables

There were 2 types of variables in this study:

1. Cost centers
   a. Non-revenue producing cost center – NRPCC
   b. Revenue producing cost center – RPCC
   c. Patient Service Area - PS
2. Costs
   a. Labor, material and capital costs
   b. Direct and Indirect costs
   c. Routing service and medical care costs
   d. Diagnostic cost
   e. Treatment cost
   f. Full cost
   g. Unit cost of cervical cancer screening
   h. Unit cost of SVA screening
   i. Unit cost of cytologic test screening

Conceptual Framework


```
┌─────────────────────────────────────────────────┐
│        Total cost of Roi Et cervical cancer       │
│             prevention and control                │
└─────────────────────────────────────────────────┘
        │                                   │
  ┌───────────┐                      ┌────────────────┐
  │ SVA tests │                      │ Cytology tests │
  └───────────┘                      └────────────────┘
    │       │                          │          │
┌──────────┐ ┌────────────┐    ┌──────────┐ ┌────────────┐
│LC+MC+CC  │ │Indirect    │    │LC+MC+CC  │ │Indirect    │
│          │ │cost        │    │          │ │cost        │
└──────────┘ └────────────┘    └──────────┘ └────────────┘
```

Routine Screening costs	Cytology test prices

Change to cost

Diagnostic test cost	Diagnostic test cost

Treatment cost

/No. of patients receiving
VIA & Cryotherapy

/No. of patients
receiving Pap tests

SVA Unit cost	Medical Care cost	Cytology Unit cost

Full Cost

/No. of all patients

Unit Cost of Cervical
Cancer Screening

NB: SVA = single visit approach through visual inspection using acetic acid and cryotherapy

CHAPTER II
REVIEW OF LITERATURES

The scope of this chapter includes:

1. Review of cervical cancer control
2. Review of cost identification analysis

Cervical cancer control

This section includes:

1. Cervical cancer situation
2. Natural history and etiology of cervical cancer
3. Preventing cervical cancer
   a. Primary prevention
   b. Secondary prevention
4. Treatment of precancerous cervical lesions
5. Barriers to providing cervical cancer prevention services
6. Comprehensive cervical cancer control

Cervical cancer situation

Cervical cancer worldwide

Cervical cancer is an important health problem for women throughout the world. It is the third most common cancer in women – affecting more than 1.4 million women worldwide. Each year, more than 460,000 new cases occur and about 231,000 women die of the disease. [2] It is a leading cause of death from cancer among women in low-resource setting, affecting women at a time of life when they are critical to social and economic stability.[1]

Cervical cancer is highly preventable through cytologic screening programs that facilitate the detection and treatment of precancerous lesions. Understanding how cervical cancer develops is essential to designing effective interventions to prevent deaths from this disease.[4] Such screening, however, requires an established laboratory, highly trained cytotechnologists, and up to three visits for screening,

evaluation of cytologic abnormalities, and treatment and is therefore difficult to implement and sustain in setting with limit resources.

Alternative methods, such as DNA testing for human papillomavirus (HPV) and simple visual screening, may prove more practical when incorporated into new strategies that are less dependent on existing laboratory infrastructure and require fewer visits.
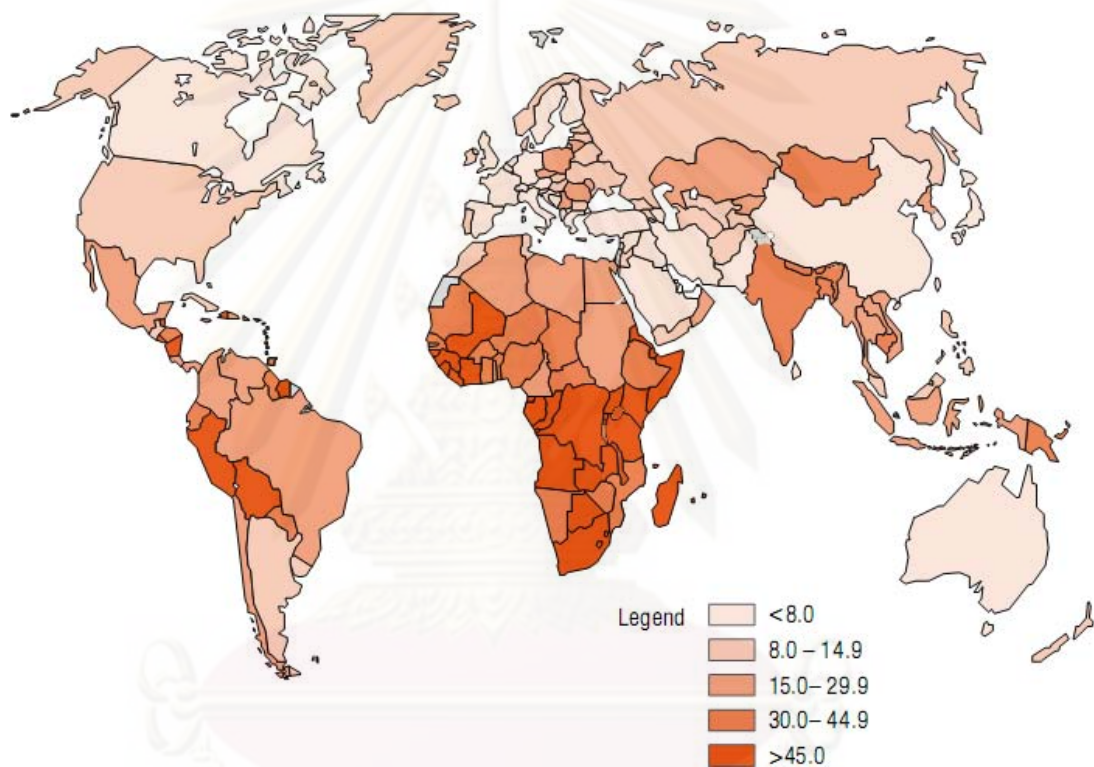
Figure 1: Worldwide incidence rate of cervical cancer per 100,000 females
(all ages), age-standardised to the WHO standard population (2005) [3]

Natural history and etiology of cervical cancer

Cancer is a term used for the malignant, autonomous and uncontrolled growth of cells and tissues. Such growth forms tumors, which may invade surrounding and distant parts of the body, destroying normal tissues and competing for nutrients and oxygen. Metastases occur when small groups of cells become detached from the original tumor, are carried to distant sites via the blood and lymph vessels, and start new tumors similar to the original one.

The development of cervical cancer

The primary cause of squamous cervical cancer is persistent or chronic infection with one or more of the so-called high-risk or oncogenic types of human papillomavirus (HPV). The worldwide HPV prevalence in cervical carcinomas is 99.7 percent. [10] The most common cancer-causing types are 16 and 18, which are found in 70% of all cervical cancers reported. Other oncogenic types (e.g. 31, 33, 45, and 58) are found less commonly and may have different prevalence in different geographical areas. Low-risk HPV types 6 and 11 are not associated with cancer, but cause genital warts. The key determinants of HPV infection for both men and women are related to sexual behavior, and include young age at sexual initiation, a high number of sexual partners, and having partners with multiple partners. High-risk HPV infection is most common in young women, with peak prevalence as high as 25–30 percent in women under 25 years of age. In most sites, prevalence decreases sharply with age.

While infection with a high-risk HPV is the underlying cause of cervical cancer, most women infected with high-risk HPV do not develop cancer. Most cervical HPV infections, regardless of type, are short-lived, with only a small number persisting and even fewer progressing to precancerous lesions or invasive cancer. The conditions or cofactors that lead HPV infection to persist and progress to cancer are not well understood, but the following probably play a role.

- HPV-related cofactors:
  – Viral type;
  – Simultaneous infection with several oncogenic types;
  – High amount of virus (high virus load).
- Host-related cofactors
  – Immune status: people with immunodeficiency (such as that caused by HIV infection) have more persistent HPV infections and a more rapid progression to precancer and cancer;
  – Parity: the risk of cervical cancer increases with higher parity.
- Exogenous cofactors:
  – Tobacco smoking;

‒ Coinfection with HIV or other sexually transmitted agents such as herpes simplex virus 2 (HSV-2), Chlamydia trachomatis and Neisseria gonorrhoeae;

‒ Long-term (> 5 years) use of oral contraceptives.

During early adolescence and first pregnancy, when squamous metaplasia is occurring, infection with HPV may induce changes in the newly transformed cells, with viral particles being incorporated into the DNA of the cells. If the virus persists, it may cause precancerous and, later, cancerous changes by interfering with the normal control of cell growth. Estimates of the time it takes for cancer to develop from HPV infection vary. Sixty per cent or more of cases of mild dysplasia resolve spontaneously and only about 10% progress to moderate or severe dysplasia within 2–4 years; in some cases, moderate or severe dysplasia may occur without an earlier detectable mild dysplasia stage. Less than 50% of cases of severe dysplasia progress to invasive carcinoma, with much lower rates seen in younger women. The usual 10–20-year natural history of progression from mild dysplasia to carcinoma makes cervical cancer a relatively easily preventable disease and provides the rationale for screening.

Precancer classification systems

There are many systems in use in different parts of the world for classifying and naming precancerous conditions of the cervix, based on cytology and histology (Table 1). Some are more useful than others because they incorporate knowledge of the disease's natural history acquired over the past few decades. The classification system of cervical intraepithelial neoplasia (CIN) evolved in 1968, to take into account the different natural histories seen with different degrees of dysplasia. It is still used in many countries for cytological reports, although strictly speaking it should only be used for histological reports (results of microscopic examination of tissue samples). The Bethesda system was developed in the 1990s at the United States National Cancer Institute. In this system, which should be used only for cytological reports, CIN 2 and 3 are combined into one group, termed high-grade squamous intraepithelial lesions (HSIL).

Cytologically (i.e. on microscopic examination of a smear), it is difficult, if not impossible, to distinguish CIN 2 and 3. In the 2001 Bethesda classification, atypical cells are divided into ASC-US (atypical squamous cells of undetermined significance) and ASC-H (atypical squamous cells: cannot exclude a high-grade squamous epithelial lesion). This classification is recommended by WHO for cytological reports.

Table 1: Cervical precancer: different terminologies used for cytological and histological reporting [3]

Cytological classification (used for screening)		Histological classification (used for diagnosis)	
Pap	**Bethesda system**	**CIN**	**WHO descriptive classifications**
Class I	Normal	Normal	Normal
Class II	ASC-US ASC-H	Atypia	Atypia
Class III	LSIL	CIN 1 including flat condyloma	Koilocytosis
Class III	HSIL	CIN 2	Moderate dysplasia
Class III	HSIL	CIN 3	Severe dysplasia
Class IV	HSIL	CIN 3	Carcinoma in situ
Class V	Invasive carcinoma	Invasive carcinoma	Invasive carcinoma

Natural history of invasive cervical cancer

Invasive cervical cancer is defined by the invasion of abnormal cells into the thick fibrous connective tissue underlying the basement membrane. It starts with a microinvasive stage, which is not visible with the naked eye on speculum examination and has to be diagnosed histologically, using a tissue sample from a cone biopsy or hysterectomy. It then evolves into larger lesions, which may extend to the vagina, pelvic walls, bladder, rectum and distant organs. If left untreated, cervical cancer progresses in a predictable manner and will almost always lead to death. The

International Federation of Gynecology and Obstetrics (FIGO) system is often used to describe the extent of cancer invasion and to select treatment options (Table 2).

There are four, usually sequential, routes through which invasive cancer progresses. The disease is generally confined to the pelvis for a long period, where it is accessible to treatment.

1. Within the cervix. Spread from a tiny focus of microinvasive cancer, eventually involving the entire cervix which can enlarge to 8 cm or more in diameter. The cancer can be ulcerating, exophytic (growing outwards) or infiltrating (invading inwards).

2. To adjacent structures. Direct spread in all directions is possible: downwards to the vagina, upwards into the uterus, sideways into the parametrium (the tissues supporting the uterus in the pelvis) and the ureters, backwards to the rectum, and forwards to the bladder.

3. Lymphatic. Spread to pelvic lymph nodes occurs in 15% of cases when the cancer is still confined to the cervix, and increases as the cancer spreads. Lymph node metastases are at first confined to the pelvis and are later found in the chain of nodes along the aorta, eventually reaching the supra-clavicular fossa (the space above the collar bone). If the cancer has advanced into the lower third of the vagina, the groin nodes may become involved and will be palpably enlarged.

4. Distant metastases through the bloodstream and lymph channels. Cervical cancer cells may spread through the blood stream and lymphatic system to develop distant metastases in the liver, bone, lung and brain.

Table 2: Clinical staging of cervical cancer (FIGO, revised 1994)

Stage	Characteristics
0	Carcinoma in situ (CIS), cervical intraepithelial lesion (CIN) 3
I	Carcinoma is strictly confined to cervix (extension to corpus should be disregarded)
IA	Invasion is limited to measured stromal invasion with a maximum depth of 5 mm and no wider than 7mm
IA1	Measured invasion of stroma no greater than 3 mm in depth and no wider than 7 mm
IA2	Measured invasion of stroma greater than 3 mm and no greater than 5 mm in depth and no wider than 7mm
IB	Clinical lesions confined to the cervix or preclinical lesions greater than IA
IB1	Clinical lesions no greater than 4 cm in size
IB2	Clinical lesions greater than 4 cm in size
II	Carcinoma extends beyond cervix but has not extended to pelvic wall; it involves vagina, but not as far as the lower third
IIA	No obvious parametrial involvement
IIB	Obvious parametrial involvement
III	Carcinoma has extended to the pelvic wall; on rectal examination there is no cancer-free space between tumor and pelvic wall; tumor involves lower third of vagina; all cases with hydronephrosis or nonfunctioning kidney should be included, unless they are known to be due to another cause
IIIA	No extension to pelvic wall, but involvement of lower third of vagina
IIIB	Extension to pelvic wall, or hydronephrosis or nonfunctioning kidney due to tumor
IV	Carcinoma has extended beyond true pelvis or has clinically involved mucosa of bladder or rectum
IVA	Spread of growth to adjacent pelvic organs
IVB	Spread to distant organs

FIGO = International Federation of Obstetricians and Gynecologists.

Preventing cervical cancer

Primary prevention

Preventing HPV infection will prevent cervical cancer. This primary prevention approach, however, presents greater challenges than for most other STIs. Although condoms significantly reduce the risk of infection of HIV, there is no conclusive evidence that condoms reduce the risk of HPV infection. Studies have suggested, however, that condoms may provide some protection against HPV-associated diseases, including cervical neoplasia.[11]

The most effective way to prevent cervical cancer would be to develop a vaccine against HPV. The benefits of such a vaccine would be particularly significant in developing countries, where women's healthcare services are minimal or severely limited. A vaccine, however, would protect a person against only some types of HPV. There may be subtypes within these virus types that would not be prevented by the vaccine. In addition, the types of HPV associated with cervical disease vary by geographical area. Therefore, a vaccine against HPV would need to contain a mixture of several virus types.[12,13]

Despite these problem, at least two vaccines are available that can protect women from cancer-linked papaillomaviruses (HPV types 16 and 18): bivalent (Cervarix®) and Quadrivalent (Gardasil®) vaccines. Both are considered prophylactic vaccines and preferably given prior to natural exposure to HPV types 16 and 18. It will most likely be several years, however, before either vaccine will be affordable in developing countries. There have also been attempts to produce a therapeutic vaccine, which would be boost the immune system of someone who is already infected and cause the cancer to regress or even disappear. This vaccine is targeted to inactivate the E6 and E7 proteins, those viral proteins that block the action of the cell growth regulating proteins (Rb and p53).[14]

Until a protective vaccine is widely available, primary prevention must focus on reducing the behaviors and risks that increase a person's risk of becoming infected. Risk reduction counseling related to risk factors should be incorporated into all levels of the healthcare system, especially those dealing with young people, and should inform adolescents that practices designed to minimize the risk of STI or HIV exposure (e.g., the use of male or female condoms) may not be as effective for HPV

prevention. In addition, vigorous efforts to discourage adolescents, especially young girls, from starting smoking and initiating sexual activity should be widely and continually disseminated.

Secondary prevention

Women who are already infected with HPV should be screened to determine whether they have early, easily treatable precancerous lesions (i.e., screening). If lesions are found, they should be treated before they progress to cancer. Although the Pap smear is the most well-established method of screening women for precancerous lesions, other approaches to screening women at risk for cervical cancer have been investigated. These include visual screening, HPV tests and automated cytology screening.

Screening

For screening programs to have an impact on the incidence of cervical cancer, they need to screen as many women as possible. Ideally, the programs would screen 80 percent of the population at risk. Then, those women who are identified as having precancerous lesions need to have those lesions treated before they progress to cancer. When coverage is high, it is not necessary to screen women annually to have an impacted on disease incidence. For example, if all women ages 35-64 who have had one negative Pap smear were to be screened every 5 years (and all those with dysplasia treated), the estimated incidence of cervical cancer could be reduced by about 84 percent (Table 3). Screening these women even every 10 years would reduce the incidence by an estimated 64%.

Table 3: Reduction in cumulative cervical cancer rate with different frequencies of screening. [15]

Frequency of screening in years	Reduction (%) in cumulative rate
1	93.5
2	92.5
3	90.8
5	83.6
10	64.1

Rates of cervical cancer are higher in developing countries in part because those countries lack effective screening programs. Because the majority of cervical cancer cases occur among women in developing countries, screening methods need to be both effective at detecting precancerous changes and feasible in settings with limited resources. Pap smear-based programs have been difficult to establish and maintain in many developing countries because they involve many complex and costly steps. Pap smear or cytology-based screening may seem relatively simple, but it involves taking an adequate smear, having the necessary equipment and supplies, processing and analyzing the specimen, and communicating the information back to the woman so appropriate next steps can be agreed upon. If any of these steps are unreliable or logistically burdensome, the entire prevention program can fail and, with it, the potential for any public health benefit.[16]

Many, if not all, of these steps can be problematic in low-resource settings. For example, in a number of countries, Pap smears are offered only in urban areas by a small private sector facility or at referral facilities. And, even in these settings, trained cytotechnicians and cytopathologists are scarce, and turnaround times for processing and analyzing specimens can be long. Because women do not receive their results promptly, many do not return to the clinic for their results and become lost to follow up.

Recent data indicate that visual inspection of the cervix using acetic acid (VIA) is at least as effective Pap smears in detecting disease and may be associated with fewer logistic and technical constraints. In 1994, a study was conducted in South Africa in which VIA and Pap smears were performed in a mobile unit that was equipped to process smears on site. in this study, either immediately after or within a few days of screening, a gynecologist performed colposcopy to confirm disease. The positive predictive value of VIA was found to be similar to that of Pap smears, and the conclusion was that ─naked-eye visualization of the cervix after application of diluted acetic acid… warrants consideration as an alternative to cytologic screening.

In 1999, a study of more than 10,000 women in Zimbabwe addressed the question of whether VIA can effectively distinguished diseased from non-diseased cervices. In Phase 2 of this study, in which direct test quality estimated were

calculated, the reported sensitivity of VIA (77%) was higher than that of the Pap smear, whereas the specificity (64%) was lower (Table 4).[17]

Table 4: Test qualities of VIA in primary healthcare setting [17]

Test	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
VIA	77	64	19	96
Pap smear	44	91	33	94

An important finding from the Zimbabwe study was that nurse-midwives quickly learned to perform VIA in a primary healthcare setting and could correctly identify women with no disease, those suitable for immediate treatment and those requiring referral for advance disease. They key to their performance was training. During a week-long, competency-based training course, participants used a specially designed VIA cervical atlas and practiced VIA on pelvic models before working with patients. During the first few months of the project, the nurse-midwives also received supplemental training in the work setting.

Since these initial studies were conducted and their results published, a large group of subsequent studies has been conducted, many of these building on the information and design innovations that were present in the studies mentioned above. It was suggested that VIA is comparable to the Pap test as a cervical cancer screening tool. A large study ─confirmed the utility of direct visual inspection of the cervix after the application of 5% acetic acid (DVI) as a primary screening test." Similarly, the results of a study revealed a high sensitivity and negative predictive value for CIN I and CIN II using the acetic acid test. There were many subsequent studies which also concluded ─screening for cervical precancerous and cancerous lesions using visual inspection aided by acetic acid may be a suitable low-cost and a feasible alternative modality for control of cervical cancer in a resource poor setting." Further, as a result of all of these studies, a variety of professional organizations – including the American College of Obstetricians and Gynecologists, the Canadian Society of Obstetricians and Gynecologists and the International Federation of Gynecology and

Obstetrics (FIGO) – have all endorsed VIA as a viable option for screening in low-resource settings.[18]

Treatment of precancerous cervical lesions

In order for cervical cancer prevention programmes to be truly effective and of public health value, testing should be linked to appropriate treatment for any precancerous lesions detected.

What lesions need to be treated?

There is clear consensus that high-grade (CIN II – III) lesions should be treated because they are more likely than low-grade lesions (CIN I) to progress to cancer. Published studies indicate that most low-grade lesions will regress spontaneously and thus do not require treatment. When close follow up or histological confirmation is not feasible or possible, treatment of acetowhite lesions (which could be low-grade or high-grade lesions or a false positive) may be advisable, particularly if the treatment is not highly invasive or associated with serious side effects, complications or long-term sequellae.

Factors affecting choice of treatment

Because precancerous lesions of the cervix occur most frequently in women who are still in their childbearing years – 30s and 40s – it is important to recognize and consider the method's effect on fertility as well as its safety in pregnancy. Other factors to be considered include the following:

- Method effectiveness
- Safety and potential side effects
- Who is allowed (or legally able) to provide treatment, and what training they need to become qualified to provide it
- The size, extent, severity and site of the lesion
- Acceptability (to women) of treatment offered
- Equipment and supplies required
- Cost of affordability of method

Barriers to providing cervical cancer prevention services

There are many main barriers to providing CIN treatment in developing countries with percentage of numbers of responses: [19]

1. Lack of a comprehensive screening program (66%).
2. Cost and unavailable of equipment (57%).
3. Inability to follow up women (54%).
4. Lack of trained personnel (48%).
5. Inability to identify women with early, treatable disease (34%).
6. Women's resistance to treatment (15%).
7. Other barriers (19%). This category included: cost of travel to hospital; treatment affordability to patients; lack of patient/public education; lack of political will; insufficient equipment, supplies and facilities for the large number of women needed treatment; high false-negative rate of Pap smears; crowed conditions; and long waiting time for diagnosis.

Lack of a comprehensive screening program [19]

Survey results indicated that in all regions, screening largely occurs opportunistically rather than as part of an integrated program. Where cytology (Pap smear) screening is already in place, respondents expressed concern about its quality, and specifically, about high rates of false-negative results. Clearly, establishing widespread, reliable screening is essential to reducing cervical cancer morbidity and mortality. Simple, appropriate screening approaches for low-resource settings that can be paired with outpatient treatment methods also should be identified.

Cost and unavailable of equipment [19]

Since the survey found that clinicians still rely heavily on cone biopsy and hysterectomy, even to treat low-grade lesions, the reasons were explored for why nearly 60% of respondents indicated that cost of equipment was a key barrier to treatment. Survey results revealed that equipment prices varied widely among countries and presumably depended on local availability of equipment and supplies. Still, investing in lower-cost outpatient methods to treat pre-invasive conditions is

likely to lead to considerable savings because the equipment lasts for many years and the incidence of advanced cases should decrease, thus reducing the demand for more expensive therapy. Finally, survival rates will be much greater, resulting in a lower cost per Discounted Health Life Year (DHLY) gained. DHLY is the number of years between the age at which death would have occurred from cervical cancer and the individual's expected age at death, with years gained discounted at 3% each year. Obtaining supplies for some treatment methods also is difficult.

Inability to follow up women [19]

Referral and follow up systems are essential to developing an effective cervical cancer screening and treatment program. A test and treat approach could reduce the number of clinic visits required for evaluation and treatment, which can take many weeks (and is also perceived as a barrier to care). Estimate of the percentage of women who actually return for required post-treatment follow up varied considerably. Follow up rates can be increased, however, if outreach programs are established specially to encourage women to return for follow up care.

Lack of trained personnel [19]

According to the survey, at present, gynecologists rather than other clinicians usually provide treatment in all regions.

Because many countries have a shortage of gynecologists, as well as physicians in general, reliance on them to perform treatment of precancerous lesions probably has hindered efforts to expand cervical cancer screening and treatment beyond urban areas. If mid-level practitioners, such as nurse-midwives, could be trained to perform screening and perhaps simple outpatient treatment such as cryotherapy, coverage could be expanded in many settings. The feasibility of training depends on local policies regarding healthcare delivery, and should be evaluated within the local context. Still, this approach warrants further exploration wherever feasible.

Women's resistance to treatment [19]

Only a small proportion of respondents (about 15%) cited women's resistance as an important barrier. Perceived resistance by women, however, may be related to lack of education and available information for women about cervical cancer, which also was mentioned as a barrier by some respondents.

Available of basic supplies and equipment

Availability of supplies, equipment and trained staff varies among regions. For examples, survey findings suggested that the majority of facilities represented by the respondents are equipped with examining tables, specula, lights and electricity; however, facilities in African countries represented in the survey were not as well-equipped with these items as those in other regions. Most facilities have access to a pathology laboratory. A majority are equipped with local anesthesia and consumable supplies, but some experienced shortages.

Although facilities represented in the survey seem to have basic equipment to provide some type of treatment, respondents still indicated that for numbers of women requiring treatment, insufficient supplies, facilities and equipment remained a barrier to service delivery. In particular, respondents cited crowed conditions and long waiting time for services and laboratory results as being important deterrents of providing treatment services.

Data from this survey suggest that in all regions, but particularly in Africa, low-cost, outpatient procedures such as cryotherapy and LEEP are not being used sufficiently. Rather, clinicians still rely heavily on cone biopsy and hysterectomy, even to treat low-grade lesions. This suggests that education of providers to help change their perceptions of the various methods, and ultimately their methods of choice, is crucial. Heavy reliance on inpatient methods also is likely due to limited access to alternative methods and lack of resources to support early detection and treatment of pre-invasive conditions. in addition, inability to follow up women was cited as another important barrier; this highlights the need to develop an effective, single-visit cervical cancer screening and treatment program.

Regionally, it appears that countries in Asia, Latin America and the Caribbean may have greater access to cryotherapy and LEEP than African countries, as well as greater capacity to incorporate these methods into their programs. This suggests that strategies for introducing outpatient treatment will probably differ among these regions, and that introduction effort in Africa, in particular, will need to be carefully considered in the context of limited resources. In all regions, however, introducing outpatient methods and clear guidelines for their use could improve overall quality of care and extend treatment services beyond central facilities, thereby reaching more women who need them.

COST IDENTIFICATION ANALYSIS

This section includes:

1. Cost identification analysis
   a. Identification of cost
   b. Cost valuation
   c. Cost analysis
2. Health service system and unit cost
   a. Concept of public health cost
      i. Definition of cost
      ii. Hospital cost
      iii. Unit cost
      iv. Perspective or point of view
   b. Cost classification
      i. Cost classification by input
      ii. Cost determination
      iii. Classification for purpose of production analysis and financial report
         1. Direct costs and indirect costs
         2. Product costs and period expense
   c. Cost classification for cost control
      i. Traceable costs and non traceable costs
      ii. Controllable costs and non controllable costs

iii. Fixed costs and variable costs

d. Costing concept for planning

e. Costing concept for alternative decision

i. Differential cost

ii. Sunk costs

iii. Opportunity cost

f. Steps in Hospital cost analysis

i. Cost center identification and grouping

ii. Direct cost determination

iii. Allocation criteria determination

iv. Full cost determination

v. Unit cost determination

COST IDENTIFICATION ANALYSIS

IDENTIFICATION OF COSTS [20]

DEFINING THE NULL WITH RESPECT TO COSTS

In applying generalized cost-effectiveness analysis (GCEA), groups of related interventions are analysed with respect to the null set or the counterfactual of those interventions not existing. In theory, all costs relating to the interventions that are being analysed with respect to the null set would be zero. However, part of the overhead costs of ensuring that interventions take place relate to the availability of trained staff, and some level of central administration such as central stores, auditing, budgeting, etc. While it might be argued that the investment in basic training of health personnel is reflected in their salaries, this is not true in many settings where government controls public sector wages and the private sector is not well established for many types of health personnel. Moreover, it is not practical to try to allocate the costs of a department of audit, for example, across all health interventions. For that reason, we propose that it should be assumed that these costs exist and will continue at the same level regardless of the different mix of interventions that are delivered. GCEA would focus on resources that could realistically be reallocated over the time horizon of the analysis. Two major types of ongoing costs are identified. The first

involves some of the costs of central administration, such as the overall planning and management of the health system that are unrelated to the development and implementation of particular interventions aimed at improving health. Some activities of a ministry of health, for example, would exist and have a certain staffing profile independent of any particular set of interventions that may be done in the country for the available resources. The second type of ongoing costs relates to the current level of education of health professionals. If the skills required to deliver an intervention are not available (or not yet available to the full extent necessary) in the country under study, training costs to develop those skills should be included as part of the intervention costs. However, if those skills are already acquired, and no further training is required, the cost of the previously acquired training can be assumed to exist. Accordingly, some types of administrative costs and those related to the formal education of health professionals have not been included in the costs of interventions for GCEA. These define the ―starting point‖ for the analysis, and would vary across settings, which is one reason for undertaking the WHO-CHOICE analysis at a sub-regional, rather than a global level.

COSTS OF PROVIDING HEALTH INTERVENTIONS

The costs of providing health interventions—such as an outpatient visit, an inpatient stay or a population-based programme—are the resources used in making the intervention available. The resources include labour, capital such as building space and equipment, consumables such as medical supplies and medications and overhead costs such as electricity, water and maintenance. By using these resources to improve health, they cannot be used to produce other goods and services, thereby incurring a welfare loss.

Resources to fund health interventions can be financed in various ways, including taxation, insurance, and direct out-of-pocket payments by households. Out-of-pocket expenses with near perfect markets can be valued in dollar terms because the expenditure undertaken by consumers will reflect the value they place on the purchased service, taking into account their budgetary constraints. Markets, however, are not even approximately perfect for most areas related to health and do not equilibrate payments with the perceived value of the service obtained. This is

particularly true for tax payments and insurance contributions. In addition, as people consume more of a certain product, the value of each unit of additional consumption falls (known as diminishing marginal utility, illustrated by a concave utility function). This means that the welfare loss of a dollar contributed by a poor person is greater than that of a dollar contributed by the rich. Because of this, the resources used to provide health interventions should be evaluated in terms of the welfare loss associated with how the funds are raised, and not in simple monetary terms. It could be argued that once the pool of funds for health has been raised, expenditure on each intervention is not subsequently linked to payment mechanisms. If this is true, the rank ordering of costs and cost-effectiveness would not be affected by different weights for each dollar contributed by the poor and rich within a particular country. This is not strictly true for situations where significant co-payments exist and where patients incur out-of-pocket payments, where the welfare loss should theoretically be estimated. This type of analysis is not typically undertaken because of the difficulties involved in estimating the welfare loss of each dollar to each contributor. We also follow the traditional approach of measuring the costs of providing health interventions in money terms while recognizing the limitations.

Classification of costs

One of the first steps of any practical costing exercise is to identify the production process of the programme or intervention. There are several ways of classifying costs. For example, they can be classified by input category (e.g. salaries, medical supplies, and capital), intervention activity (e.g. administration, planning, and supervision) or organizational level (e.g. national, district, hospital). The most important point to consider when choosing a classification scheme is to make sure that all the relevant costs are included and that the classification categories do not overlap. In most interventions, different types of activities are involved at the programme level as distinct from the point of delivery, during both start-up and post start-up periods. Programme costs are defined here as those associated with the development and administration of an intervention, outside the point of delivery. They may be incurred at any level—e.g. national, district or provincial. Examples are planning, training, media and information activities, development of information,

education and communication (IEC) materials, monitoring, some types of supervision, and social mobilization.

It is important therefore that they are included in any CEA and WHO-CHOICE reports programme and patient costs separately. Patient costs are defined as any costs incurred at the point of delivery. They are usually associated with the delivery of curative care, but can also include certain types of health education and preventive activities. The former would include health education provided to women attending maternal and child clinics, for example, while the latter would include childhood immunization.

COST VALUATION [21]

ECONOMIC PRICES

In providing recommendations for valuation in cost-effectiveness analysis, in particular for resource-poor countries, it is important to keep in mind the need to develop approaches that can be applied widely in many settings, that do not have stringent data needs, and that can be applied by non-specialists who do not necessarily have an in-depth understanding of economic principles. However, it is important to decide first which methods are methodologically correct before asking if they can be applied in practice. It is generally agreed that the economic definition of costs should be used in cost valuation, not the accounting (or financial) definition. This is based on the concept of ―opportunity cost", i.e. here defined as the value forgone by not using the same resource in the best alternative activity. It is important to distinguish between prices on the one hand (usually determined by a market, but which also can be determined from other sources), and economic value on the other. It is well known that observed prices or charges do not necessarily reflect the economic value as shown briefly in the following examples.

• In company or government accounts, buildings and equipment are depreciated over time, so that after a few years they have an accounting value of zero. However, even after this period these items still have a cost from the economic point of view. For example, there is an opportunity cost of using the buildings for tuberculosis control rather than for a factory or an office building, or using resources to make an X-ray machine rather than a machine that could be used to produce computers. Therefore, a value of capital items needs to be established even after they

have a book value of zero. In many developing countries, the ministry of health receives many inputs free of charge or at reduced price, such as donated drugs, radio or television time for health education and communication or volunteer labour. Some of these resources still have an opportunity cost in terms of foregone non-health welfare because they have alternative uses—the television time, for example, could be used to advertise consumer goods. A value needs to be established that can be given to donated or reduced-cost items even when the ministry of health does not pay for them.

Where the donated goods are specific to the health intervention—for example, pharmaceuticals or volunteer labour dedicated to a particular disease or person who is ill—the question becomes whether the intervention could always be provided using donated goods. If this is the case, the opportunity cost in terms of foregone non-health welfare in the country under consideration is zero. If not, the inputs should be valued at the cost that would be incurred if they needed to be obtained in the market place.

• In many resource markets, there may be distortions that cause the current market prices to diverge from opportunity costs. On the one hand, the observed price can be higher than the opportunity cost, due to monopoly power or taxes/import tariffs, while on the other hand the going price can be lower than the opportunity cost, due to subsidies or ―dumping" of products in the market at below cost. Again, a value needs to be established that more closely reflects the opportunity cost than the observed prices or charges.

TRANSFER PAYMENTS

Some interventions may result in financial flows within society from the government to individual patients. Examples are unemployment or sickness benefits. Such transfer payments are a financial cost to the paying government (or to taxpayers in general), a financial gain to the patient, but do not use or create resources. These money streams signify a change in command over resources, not a change in the aggregate value of resources available to society. Transfer payments are, therefore, generally excluded from a CEA. However, as argued above, social welfare is influenced by who makes and receives these payments. In theory, these welfare changes should be taken into account but this type of analysis has not typically been

done so we do not recommend their inclusion. On the other hand, any related administrative costs do use real resources and should be included.

THE UNIT OF ACCOUNT

In nearly all economies, domestic market price levels are higher than world market price levels, which may be caused by exchange controls, import quotas, and other trade restrictions. This creates a need to bring all resource inputs to a common basis so that they can be aggregated into an estimate of the costs of a health intervention. To do this it is necessary to define a unit of account, that is, to choose a numeraire or price level— domestic or world market price level—and to choose a currency— national or foreign currency—in which to express all resource inputs. The unit of account affects the valuation of traded and non-traded goods, and needs to be chosen first.

The numeraire

Because the analysis is typically undertaken from the perspective of an individual country, it is often argued that the world price level is the most appropriate starting point for analysis. The Organisation for Economic Co-operation and Development guidelines for project appraisal provide the rationale for using world prices as ―they represent the actual terms on which a country can trade". The cost to a country of importing goods is the foreign exchange given up to purchase them, so internationally traded goods are valued at their traded or ―border" prices, termed here ―international prices". Non-traded goods are, however, subject to local market distortions and the use of observed market prices might not reflect true opportunity costs. For this reason it would not be appropriate to add traded goods valued in international prices to non-traded goods valued at local market prices. The solution generally used in cost-benefit analysis in other sectors is to revalue non-traded goods in terms of international prices, taking into account distortions that exist in the domestic goods markets. To convert domestic prices to international prices requires application of a ―conversion factor", which is the proportion by which domestic prices exceed international prices because of market distortions. To do this for many goods and services is a considerable amount of work, and instead the standard conversion factor can be used, which is defined as the weighted average of all the conversion

factors in the economy (for all goods). The standard conversion factor (SCF) can be estimated as the ratio of the value of traded goods and services at the international price level to the value of traded goods and services at the domestic price level, or can be approximated by the weighted average import tariff. [22,23]

For example, if the average tariff were 25%, the SCF would be 0.8. Adjustments for market distortions are rarely enforced in CEA— particularly the use of conversion factors to ensure that traded and non- traded goods are expressed in terms of the same numeraire. In addition, shadow pricing of non-traded goods is unusual, except perhaps for the exclusion of some transfer payments, possibly because many studies have originated in the USA where market distortions are arguably lower than in other settings. Several years ago, in an evaluation of immunization programmes in developing countries, it had been shown that the use of appropriate shadow pricing can make a difference to the conclusions about whether or not an intervention is cost-effective, but little further work has been done since then. WHO-CHOICE is currently exploring this question to determine if it is possible to identify the circumstances in which it is critical to use these methods. For the moment, CHOICE uses the traditional approach. The way traded and non-traded goods have been treated is described below.

TRADED GOODS

Traded goods (e.g. equipment, supplies and pharmaceuticals) are the commodities that are, or could be, available on the international market, and could be available to all countries at an international market price. Most countries are too small to effect the international price—either for goods they import or export. So the opportunity cost for imported goods can be considered the foreign exchange that leaves the country in order to pay for the inputs—e.g. they should be valued at the international price. Similarly, the value of an input to an intervention that is produced locally but could be exported is the value that could have been obtained for it on the international market. Traded goods are, therefore, valued at the international market price, adjusted to include cost, insurance and freight (CIF) for imported goods and free on board (FOB) for exported goods. The CIF price should exclude import duties and subsidies (transfer payments), and include the selling price of the producing

country, freight, insurance and unloading charges. If the goods are imported, the costs of local transport and distribution (termed ―domestic margin‖) should be added to the landed price to approximate the local opportunity cost because local transport and distribution does use resources which cannot then be used elsewhere. The FOB price of exports should include the production cost as well as the costs to get the product to the harbor of the exporting country, and includes local marketing and transport costs and local port charges. The prices of some internationally traded goods might still include market imperfections to an extent (e.g. patented drugs are protected by definition). If an intervention in a particular country uses a patent drug, the question is whether a generic substitute exists and has similar effectiveness. If a generic substitute exists and has the same effectiveness, then its price should be used. The logic is that decision-makers need to know the cost-effectiveness of an intervention if the appropriate inputs were used. In some settings it might also be useful to show how the cost- effectiveness would alter with the use of the brand name substitute. If no generic product exists, or is unlikely to in the lifetime of the project, or the health programme does not have access to it, then the price of the patented product should be used. If a generic is predicted to become available later in the life of a project, then the expected generic price should be used after this time.

NON-TRADED GOODS

In general, personnel, utilities, buildings and domestic transport are treated as non-traded goods. Some considerations about the valuation of these items are highlighted below.

Labour costs

Labour market prices might not reflect true opportunity costs. To determine the economic value of labour employed in health interventions, these prices must be adjusted for distortions in the labour market, and so-called shadow wage rates (SWR) then could be estimated. Labour has traditionally been broken into two basic categories: scarce labour and labour which is not scarce locally. A third and fourth category, voluntary labour and patients' and care-givers' time, are also discussed. The distinction between ―scarce‖ and ―non-scarce‖ labour will vary by setting. In some

countries, it is not uncommon for doctors and nurses to be unemployed—e.g. it could not be argued that their skills are scarce. In other countries there are consistent shortages of medical personnel and government controls salaries. Similarly, in countries where agriculture is an important activity, low-skilled labour can be in short supply during certain periods of the year, such as harvest time, and readily available at other times. Therefore, the analyst should make their own judgments, and justify their choices.

Scarce labour Scarce labour is typically labour that involves skilled workers for which there is little or zero unemployment. For this type of labour, it is recommended to take prevailing market wages and fringes plus the monetary value of housing and other allowances to give an approximation of the opportunity cost. This may well underestimate the true opportunity cost of skilled health workers in countries where the private sector does not function and governments control salaries. The opportunity cost of labour is the gross salary plus fringe benefits. This represents the total resources that society pays to employ someone. Fringe benefits include the employer's contributions to social security, other pension plans, health and life insurance, and perks such as use of a car, free use of accommodation or financial contributions to private accommodation. An important question is what to do about the valuation of expatriate labour employed in a country on salaries that are much higher than those paid to people with similar skills locally. The general answer to this question for GCEA is that it depends on whether the intervention needs this type of labour or whether the expatriate labour could be replaced with local labour with the same qualifications, skills and efficiency. If for some reason the intervention absolutely needs the expatriate labour, it should be considered as a traded good and valued accordingly. However, if the intervention would be normally undertaken with local labour, and the goal is to evaluate whether an intervention undertaken efficiently is worth doing, then local labour costs should be used.

Non-scarce labour In many countries unskilled labour is not scarce— there are many more people who apply for positions in the modern sector than posts available. The cost to the economy of using unskilled labour in a health intervention is the value of the net output lost elsewhere. Where labour is drawn from rural areas and would have been employed in agricultural production, the opportunity cost is often

taken to equal the value of lost production. An indirect way of estimating this is to use the rural wage rate, adjusting for seasonal fluctuations in demand. At some times of the year this might be close to zero. Where labour is drawn from the informal sector in urban areas, the economic price of labour in the urban areas can be approximated by estimates of annual incomes in the urban informal sector. The urban formal sector wage rate is likely to be an overestimate, especially where minimum wage laws apply.

Voluntary labour Voluntary labour is, by definition, free to an intervention. It should be treated similarly to expatriate labour. If it can be assumed that the intervention will always be able to call on this volunteer labour, it would be valued at zero cost. If not, the cost of employing others to undertake this task should be used— effectively this means that it would normally be valued at the wage rate of health personnel who would normally be employed to do the same tasks.

Buildings

One of the differences between the accounting and the economic methods of cost valuation is the treatment of capital. For example, capital items such as buildings that have been written off in the accounts and no longer incur a depreciation cost would still have a cost from the economic point of view. There are two possibilities for the valuation of a building or space used by the intervention. The first is to use the annualized value of the building. This is done using the replacement costs of the building, i.e. the cost of constructing a similar building today, and the annualization factor that incorporates the useful life of the building (depreciation) and the opportunity costs (interest rate) of the funds tied up in this asset. The second option is to use the rental value of a similar space in the same location, which could provide the same function, e.g. a private clinic or hospital. The rental value incorporates both the depreciation and the opportunity costs of the asset. However, this method is only appropriate if competitive rental markets exist which is certainly not the case in the rural areas of many of the poorest countries of the world. As a result, WHO recommends and uses the former method.

TRANSFERABILITY OF COSTS ACROSS TIME

Sometimes it will not be possible to obtain unit prices from the year of the study and it will be necessary to extrapolate from earlier years. Because general price levels change over time, it is necessary to adjust costs from other time periods to the base year used in the analysis (e.g. 2000 US dollars)—that is, they need to be valued in constant or real terms (net of inflation). Money values that are unadjusted for inflation are referred to as *nominal* or current prices.

COST ANALYSIS [21]

CHOICE OF DISCOUNT RATE

WHO-CHOICE recommends estimating the costs of projects over a 10-year period. The costs incurred in each of these years cannot simply be summed without any adjustment. Individuals and society prefer to pay costs in the future rather than now, so from today's perspective, a cost of $100 payable after 10 years is not seen to be as high as a cost of $100 payable today. The present value of $100 payable in 10 years is, therefore, less than $100. Discounting is the process of converting future costs to their present value, to reflect the fact that, in general, individuals and society have a positive rate of time preference for consumption now over consumption in the future. For comparability across studies, it is important that analysis is performed using a common discount rate. For that purpose, WHO-CHOICE uses a discount rate of 3% for the base case, as suggested in a number of guidelines. A discount rate of 6% is also explored using sensitivity analysis. If country analysts wish to use country-specific rate of return of long-term government bonds as the social discount rate for costs, they may do this using sensitivity analysis.

START-UP COSTS

The start-up period is defined as the period between deciding to implement an intervention and starting to deliver it to the first beneficiary. The start-up period can vary from several months to several years. Resources used in the different start-up activities include personnel, supplies, overhead and capital items. Start-up costs, whether recurrent or capital, should be annualized over the lifetime of the start-up

activities. This is done in two steps: first the annualized value of capital items and the total costs of recurrent items are summed over the whole start-up period; second this value is annualized over the lifetime of the programme. The choice of the period over which start-up costs should be annualized is arbitrary and should be done on a case by case basis. In interventions where health technologies are not expected to change over a short time period, we recommend the use of a 10-year period as the basis of annualization of start-up costs. This is again arbitrary but will help improve the comparability of the results.

CAPACITY UTILIZATION

It is not uncommon, especially in developing countries, for capital (e.g. hospitals, health centres, laboratory equipment) and labour to be used at less than full capacity. GCEA requires estimates of the total costs of providing an intervention against the counterfactual of the intervention not existing. Overhead costs that are required to provide the intervention are included, some of which can be shared by other programmes. The total costs estimated against this counterfactual can vary substantially according to the level of capacity utilization. For example, the costs of treating TB patients in hospitals might appear to be high if a study were undertaken in a hospital where occupancy rates were low and the capital costs of the building are allocated across few patient stays. If these results are compared with the costs of providing care for children under five years of age derived from health centres that are always crowded, differences in costs would reflect differences in capacity utilization rather than the costs of each intervention run relatively efficiently. Given our interest in making recommendations on what types of interventions would be appropriate if policy-makers could reallocate resources, it is important that regional cost-effectiveness league tables control for capacity utilization and report the cost-effectiveness of interventions that are done efficiently. It is not useful for policy-makers to know the cost-effectiveness of interventions undertaken in a technically inefficient manner. This means making sure that the target efficiency is attainable in the region. WHO is currently using 80% capacity utilization as the norm for its sectoral analysis, consistent with recommendations made in previous CEA guidelines. [24, 25] Analysts wishing to adjust the WHO-CHOICE estimates to their countries can

modify this assumption as appropriate. An important implication is that analysts undertaking individual cost-effectiveness studies should report the capacity utilization that forms the basis of the estimates. Otherwise it will not be clear to policy-makers or analysts in other settings if the results simply reflect excess capacity or the fact that an intervention is not cost-effective compared to others, even if it were done in an efficient manner.

Cost of scaling up interventions

An important question that is facing many governments is the cost of scaling up interventions to achieve target coverage levels. As coverage expands into remote areas, the marginal costs of providing an intervention to each additional person usually increase. The cost of scaling up interventions, including economies and diseconomies of scale, should be taken into account. For this reason, WHO-CHOICE presents cost-effectiveness estimates of different interventions e.g. at coverage levels of 50%, 80% and 95%. This involved the development of price multipliers to provide a conversion factor for prices at different levels of coverage, and unit costs of outpatient visits to health facilities at different coverage levels.

SUMMARY OF RECOMMENDATIONS

1. Ideally, analysts should follow the ingredients approach and collect and report information on the quantities and prices of the resources used in addition to total expenditures.

2. The cost of providing health interventions should be included in the analysis as should the resources used up in seeking or obtaining an intervention (e.g. transport costs). It is recommended that productivity gains and losses due to an intervention, including time costs of seeking or obtaining care, should be excluded from the CEA. Where they are believed to be particularly important, they should be measured (rigorously) in physical units (e.g. time gains or losses) and reported separately.

3. Transfer payments should not be included in CEA. However, any related administrative costs should be included.

4. Costs of central administration and the education of health professionals can be regarded as existing or ongoing costs and should not be included in the analysis. This does not include training costs for a specific intervention, which should be included.

5. Shadow pricing should be used to determine the economic costs of goods that have no market price or if market prices are believed to have major distortions.

6. Prices of traded and non-traded goods should, in theory, be expressed in terms of a common numeraire, and we recommend using the world (international) price level to allow for comparability of results.

7. The annual costs of capital investments can be approximated by their rental price where a rental market exists and works relatively well. But because this is often not the case, the preferred approach is to annualize them taking into account purchase value, resale value, interest rate and working life.

8. Costs should be discounted at an annual rate of 3% in the base analysis. The sensitivity of the results to using a 6% rate should also be explored.

9. Analysts should report the capacity utilization that drives their cost-effectiveness estimates. WHO-CHOICE consistently uses 80% capacity utilization to obtain estimates of the cost-effectiveness of interventions if they are undertaken relatively efficiently.

10. Prices should be adjusted to a common year using the GDP deflator where possible. If this is not available, the Consumer Price Index can be used.

Health Service System and Unit Cost [26, 27,28,29]

Health system refers to the entire associated system that causes an effect to the entire national population's health, which include overall health – related factors. Examples of health – related factors include environment, economic, social, physical, biological, and the health service system. Health service system refers to a system that functions in taking care of health. A proper health service system is crucial to ensure a normal function of the health system. A good health service system has three basic characteristics which consisting of equality, quality and efficiency. [30] During the past decade, change had taken place in a variety of areas, for instance, economic, political,

political, technological, communication and information. They cause a critical effect to the national health system. Moreover, these changes can create a great demand of health service system and the complexity in health service provided. A rapid growth of economy results in the change of health service payment form towards the National Health Insurance and Social Security Welfare Scheme. This change will force the government to change the concept and the structure of health service system that seems to be inefficient and not meet the social needs. This brings about the bureaucracy reform policy. The phenomenon leads a major change in the health service system which known as ―Health System Reform." [31] The principle of health system reform is to seek for the best economic solution to solve Thai citizen health problems as well as find the new patient service pattern. Moreover, it also aims to control the cost in the health service system with an expectation to see an improvement in Thai health system from what it is today. Currently, there are only some groups of population have the health insurance coverage whereas the others do not. Further, there is still an excessive waiting time and overcrowded when going to get the health service at the public hospital. The service charge of the private hospitals is too expensive and the drug expense seems a big burden for the citizen due to the sharp increase in price. The service quality in many hospitals is questionable. The current health system utilizes the large amount of resource for providing the medical treatment to the patients. Providing the medical treatment is regarded as the wrong solution as the root of problem is still not solved completely. The new health systems will give citizens the equal access to the health service system regardless of their social and economic status. There is a desire for a new health system that effectively serves patients at their most convenience. They are well treated as if they were members of the family. A new system needed is to utilize and manage its resources more effectively and efficiently. Health system needs to focus on health promotion and prevention and give more alternatives to the patients as well.

According to the health expenditure in 1998, it stated that the total healthcare expenditure from both private sector and government budget was at 179,689.15 million bahts approximately which 70.55 percent was the personal healthcare expense. When taking the personal healthcare expenditure into consideration in particular, it comprises in – patient health care 30.22 percent and out – patient

healthcare 40.33 percent. [32] It also identified the main problem in public health system that more than 20 percent of Thai citizen did not have right to basic healthcare services equally. This can result in the inequality of access to quality health service and cause this group of people to bear the net healthcare expenditure of household income more than the other groups. The inefficiency and low service quality in healthcare service system and the redundancy in health resource management were also identified as the important problems, which can lead a push for a reform in public health system. Providing the universal healthcare insurance coverage will protect Thai citizen from healthcare expenditure burden when getting ill. Besides, it will encourage the entire health system to have the mechanism to assure the health service quality and consumer protection.

To operate the universal health coverage program, the hospital will get the insufficient budget for every registered patient. As a result, it is essential that the hospital administrator need to know the unit cost of patient service in their hospitals and be able to provide the health service under the resource constraints.

Concept of Public Health Cost

Definition of Cost

There are a number of definitions of cost can be summarized as follow:

From the accounting standpoint, cost refers to cost in the monetary term, which can be seen and actually paid out. From the economist perspective, cost refers to the resource used in both monetary and non-monetary form, including the negative consequence which is not the expense but intangible. This intangible cost will be valued and included as well.

Cost refers to the value of resources used to produce something. [33] Cost also refers to the expense in the monetary form and non-monetary form used in order to produce the product and service. There are three different perspectives in cost analysis which consisting of provider perspective, consumer perspective and social perspective.

Cost refers to amount of money or expense that the producer or service provider must pay in order to obtain the necessary raw material or service to use in producing goods or service.

Cost refers to the value of resources used final products or outputs or service. The cost will not be equal to the service charge, as the service in the public sector will be subsidized by the government. Therefore, the service is always lower than the cost in the public organizations. On the contrary, providing service in the private sector is aimed to make the profit. This result the service charge is always more expensive than its cost. Cost can be classified in to produce the final products or outputs or service. The cost will not be equal to the service charge, as the service in the public sector will be subsidized by the government. Therefore, the service is always lower than the cost in the public organizations. On the contrary, providing service in the private sector is aimed to make the profit. This result the service charge is always more expensive than its cost. Cost can be classified into two types, that is, financial cost and economic cost. Cost in economic standpoint consists of three distinguish characteristics. First is the ―usage of real resource" such as usage of land, labor or asset. These resources have ―alternative use" in economic system. When being used in one activity, another benefit will be lost (benefit foregone). Therefore, the economic cost often refers to what known as ―opportunity cost" in using the resource.

Cost refers to the loss of resources which can be the value of benefit or monetary value in order to achieve the objective (value of resource used in production process).

Cost refers to cash or something equivalent paid out to obtain the goods or service, which bring about the benefit to the organization at the present or in the future. When the benefit has occurred, the accounting will regard cost as an expense.

To summarize, cost refers to the investment made in order to obtain the final product, asset or any service. In accounting viewpoint, the cost that can be measured in the monetary unit will be taken into account whereas in economic viewpoint, opportunity cost, negative consequence and implicit cost are included into cost of the investment.

Hospital Cost

Hospital cost refers to the expense of the hospital in managing or operating the patient service. Examples of vital hospital costs are out-patient and in-patient cost. These costs can be identified as the standard unit cost and determined by the type of patient service. It is called as unit cost of out-patient per case or per visit and unit cost of in-patient per patient day. Moreover, the hospital cost also refers to the full cost of every department which involving in patient service area. Generally, hospital consists of several departments, which their functions associated to the work of all other departments Therefore hospital cost finding is different from the business organization cost finding.

Although hospital operation is divide into different departments, every department works together cooperatively according to their functions. In order to provide correct service to patient, no single department works independently. As a result, there is a cost allocation amongst department reciprocally and the full cost will be gradually summed up in direct patient service area. When dividing the full cost by the number of patients or number of visits, the unit cost can be determined eventually.

Unit Cost

Unit cost refers to the comparison between the resource used and result or output. Unit cost can be a tool to measure the efficiency of resource management, budget allocation, service charge determination or the decision to maintain or cancel some services.

Unit cost or average cost is the calculation of the health institutions' possible expense that will be incurred in operating the health service for on patient or per visit or per patient day.

Average cost is the value, which illustrating the overall of the production cost or a service cost on the average. The value can be calculated from the full cost divided by the final output, for example, the average cost of out-patient service is the full cost of the out-patient service divided by the number of all out-patients. A similar calculation can be also done for the average cost of in-patient service per case or per

patient day. Hence, the average cost will represent the value that can equally be compared regardless of the size of the production. [34]

Unit cost analysis will be carried out in the period of time. Normally, it will be done on the yearly basis, during the end of fiscal year. However, to gain the better control of the resource, it can be conducted more often than once a year.

$$\text{Unit cost} = \frac{\text{Full Cost of Patient Service}}{\text{Number of Patient Service Unit}}$$

In order to find the unit cost of the Patient Service Area (PS), the in-patient unit cost and out-patient unit cost will be calculated differently. The number of visit and number of patient day represent the number of service unit that are used to calculate the unit cost of the out-patient and in-patient service respectively.

$$\text{Unit cost of out-patient service} = \frac{\text{Full Cost of out-patient Service}}{\text{Number of out-patient visit}}$$

and

$$\text{Unit cost of in-patient service} = \frac{\text{Full cost of in-patient service}}{\text{Number of in-patients or patient days}}$$

Perspective or point of view

The perspective of cost estimation can be classified into three groups as following:

1. Cost in the provider's perspective, it refers to all expenses incurred when providing health service to the patients, which consist of labor cost, material cost and capital cost. This cost is not equal to the service fee charged to the patients.

2. Cost in the patient's perspective, it refers to all expenses incurred when going to get the treatment from the hospital. It will include the expenses caused by the sickness, for example, loss of income when taking sick leave.

3. Cost in the society's perspective, it refers to the sum of all expenses incurred. For instance, sick leave, environmental pollution, or a harmful epidemic.

Cost Classification

Cost classification or cost grouping and identification can be done in several ways depending upon the classification criteria. It can be divided into four different groups.

1. Cost classification by cost absorbing criteria. This can be divided into two groups, which consisting of cost generated inside the organization called ―Internal cost" and cost generated outside the organization called ―External cost."

2. Cost classification by activity criteria. This can be divided into two groups, which consisting of direct cost and indirect cost.

3. Cost classification by the disbursement criteria. It can be divided into two groups which comprising tangible or explicit cost, the cost which paid out and can be seen and intangible or implicit cost, the cost which not paid out and cannot be seen.

4. Cost classification by medical criteria, which is divided into two groups. Cost associated with medical issues called ―Medical Cost" and other that is not associated called ―Non-Medical Cost."

In addition, this cost classification depends on the objective of the usage. Some cost can be useful for one analysis but useless for the other. Cost factors can be classified by several criteria. However, a good classification needs to be consistent to the situation or the objective of use so that no overlap of cost will occur. Cost can be classified into six different types.

1. Cost classification by Input: It is simplest classification. The same type of input will be classified into the same group. Input criteria can be divided into two major groups.

    1.1 Capital Cost is cost invested to obtain the resource which its total life is more than one year. This includes building and heavy equipment (including training cost that affect the hospital cost in the long run, generally it occurs once in a long while can be considered as human capital development).

1.2 Operating costs, Recurrent costs or Running costs are costs invested in order to obtain the resource which usually worn down. This includes labor cost for the personnel, maintenance cost, utility cost and short-term training cost.

2. **Cost determination**: cost classification for the purpose of public health project analysis can be classified by the following characteristics.

2.1 Determined by activities: it can be Training, Orientation, Management, Administration, Following up and Appraisal, Support and transportation.

2.2 Determined by the level of use: it can be national, regional, provincial, or district level.

2.3 Determined by the source: it can refer to Ministry of Public Health, Other Ministry, International Organization or Local Government. However, thing to be considered here is that not try to classify a lot of sources at the same time. Since it might be difficult to justify which category the cost center belong to and finally they might be overlapped.

3. **Classification for purpose of Production analysis and Financial report**

3.1 Direct Costs and Indirect Costs

Direct cost refers to the material cost and labor cost that is directly associated with the production or service. It can be clearly identified which product or service it belongs to. Direct cost will vanish only when the production or service is written – off.

Indirect cost refers to cost that cannot be identified which product or service it belongs to specifically since they are associated with various production processes and services. For example, utility cost, depreciation cost, office rent or equipment cost. In management perspective there is a consideration whether indirect cost should be included into the product or service price. In case there is no religion between indirect cost and product or service, such as, how the utility expense should be included in the service charge. In other word, how to calculate the cost of product or service need to find the suitable method to distribute indirect cost to the product and service appropriately.

3.2 Product costs and Period expense

Product cost is cost which relating to the output or final products. It can define to be the cost of goods. It comprises the labor cost, material cost and overhead cost.

Actually, this cost is the inventory in the asset part of the balance sheet. When goods get sold, this cost becomes the cost of goods sold in Profit and Loss statement or Income statement. Therefore, the product cost will be considered as asset when the goods or products remain unsold but will be considered as expense when they are sold out.

Period expense is the expense which cannot be defined whether it belongs to any product or services. It will be reported as the expense in the reporting period, for example, the promotion expense, the administration expense.

4. Cost Classification for Cost Control

To control cost, it needs to understand the concept of responsibility center. This center refers to any departments in the organization that can measure its performance, has a responsible person who can interfere the department's operation so that the cost will be in the acceptable level. The fundamental principle is that the cost will be controlled by human. Therefore, to control the cost, it needs to define the responsibility center and responsible person to compute the cost data of each department and compare the incurred cost to the estimated cost in order to find the cause of deviation and take any possible action. Cost classification for cost control can be summarized as follow:

4.1 Traceable costs and Non traceable costs: For traceable cost, it can be divined clearly that which responsibility center it relates to. On the contrary, non-traceable cost is the cost, which cannot be defined the responsibility center. Therefore, it needs to be allocated to the other cost centers at the activity level in the responsibility center, for instance, quantity of product, space, and the number of workers. The responsibility center normally can control this kind of cost. This cost determination will help distinguish the clear role in cost control. The administrator of the responsibility center will control only the traceable cost. The role of non-traceable cost controlling will be responsible by the other cost centers.

4.2 Controllable costs and Non controllable costs. Although the cost can by traceable which responsibility center it belongs to, in some cases, the cost cannot be controlled by the head of that responsibility center. For example, the maintenance expense of the equipment in one department is not under control of that department head, but the cost is under control of the maintenance department head. Another example is the depreciation cost of equipment and building, they are not under the control of the responsible center head. Determining cost into the controllable cost and non-controllable cost is to help the administrator focusing on the controllable cost, which deviates from the budget plan.

4.3 Fixed Costs and Variable Costs

In cost controlling and price setting the management should understand the behavior of cost or the change of cost in any activity level, for example, quantity of product or service. Fixed Cost is the cost, which the value will not change when the activity level or the quantity of output service change, unlike the other indirect cost. However, it does not mean there will be no occurs. The change will not occur automatically when the level of activity changes only. The change in fixed cost will be possibly caused by the administrator's decision, for example, salary increase. Furthermore, it can be occurred in the long term in case the administrator decides to invest in increasing the building or equipment as the health service increase dramatically.

Variable Cost is the cost that varies to the level of activity, for example, the pharmaceutical product cost.

Determining the cost into fixed cost and variable cost needs to define the specific time frame and scope. In the long run, the fixed cost can be changed to the variable cost. For example, selling out the unused equipment, reducing the employment due to the decreasing workload.

5. Costing Concept for planning

Planning is the objective setting for the future operation. In economic terms, the vital objective of operation is income, expense and profit. Estimating the figure of income, expense or profit can help the administrator to compare what is expected and the actual. The process in estimating and analyzing the income, expense and profit is

called budgeting. Budget plan can cover the budget for each responsibility center, Income and Expense statement estimation and Balance Sheet estimation.

In expense estimation, the estimated cost or standard cost will be taken into account, which basing on the actual cost analysis during the previous period systematically. The labor cost, material cost and overhead costs will be analyzed in order to get the unit cost. When it is calculated together with the estimated quantity of output or service, this will help estimate the total expense accordingly.

6. Costing Concept for Alternative Decision

Decision-making is not the routine job so it needs the cost concept as following.

6.1 Differential cost: In case there are some similar costs amongst the considered alternatives, the administrator can easily focus on comparing the different cost. This helps reduce workload in the calculation process.

6.2 Sunk costs: It is the cost which incurred from the decision in the past which there will be no change happened due to the current or future decision. Therefore, sunk cost remains unchanged in any alternatives ant not necessary to be considered, for example, purchased equipment is considered as the sunk cost. Although there is a closure of department or cancellation of some service and that equipment was not in use any longer, the depreciation cost is still exist.

6.3 Opportunity cost: When deciding to invest resource in one alternative, there will be the opportunity cost occurs or it means the possible revenue occurs if we invest the money or resource in the better or best alternative. This concept is the economic concept. The opportunity cost occurred is not cash. It is not recorded in the accounting system. However, it is the cost that administrators need to consider comparing the alternatives appropriately.

The expenditure to produce the health service can be interpreted as the cost in different point of views. As a result, the cost classification and grouping is essential as well as the reliability and correctness of the cost calculation in goods and service production. If the unrelated cost has been included to cost calculation, the calculated cost will be higher than actual. One expense must be calculated only once, not redundantly. Moreover, it is very vital to ensure that all the relevant expenses or costs have been included in the calculation completely and concisely.

In conclusion, the cost classification depends on its application. Therefore, this study will classify cost into two main groups which consisting of the total direct cost and indirect cost since the service the service operations in each department are related and associated to each others. The cost will by distributed and received amongst the cost centers reciprocally and the entire cost will be allocated to the patient service area eventually. By using the accounting cost analysis to compile the allocated indirect cost from the other supporting departments and the total direct cost, each department will get its fall cost accordingly.

Steps in Hospital Cost Analysis

The hospital cost analysis is based on the statistical expenditure data and operating time from the all departments within the hospital cost finding. Therefore, it is crucial to have accurate information that associating to actual situation in each hospital cost finding procedure can be divided down into five following steps.

1. Cost center Identification & Grouping
2. Direct Cost determination
3. Allocation Criteria determination
4. Full Cost determination
5. Unit Cost Calculation

The full detail of hospital cost analysis procedure will be described as below.

1. Cost Center Identification & Grouping

Hospital cost center identification and grouping are divided into four different groups.

- Non – Revenue Producing Cost Center: NRPCC or Non-charging Directly to Patients refers to any departments that their main responsibilities relating to the administrative work and providing support to other departments. Their service will not be charged directly to patients. These departments cannot produce any revenue to the hospital. Examples of department include General Administration, Academic, Finance and Accounting, Telephone, Security Guard, Laundry, Public Relation and social work and etc.

- Revenue Producing cost center: RPCC or Charging to patients for their services refers to any departments that provide health service to patients which can produce the revenues to the hospital. These departments include Radiology, Laboratory, Operation Theater, Pharmacy and etc.

- Patient Service Area: PS refers to the direct patient service department, Which includes out-patient and in-patient department.

- Non – Patient Service Area: NPS refers to any departments that provide the service relating to Health Promotion and Disease Prevention

During the cost distribution process, the name given to the department that distributed all its cost to other department is Transient Cost Center: TCCs. These cost centers refer to Non Revenue Produce Cost Center (NRPCC) and Revenue Produce Cost Center (RPCC). The department that absorbing all the allocated cost is Absorbing Cost Center: ACCs. These refer to the departments that provide health service to patient which consist of Patient Service Area (PS) and Non - Patient Service Area (NPS).

Cost Center Identification Criteria and Method

Cost center identification is one crucial process since it sets and determines the boundary of data collection and the final result. The characteristic of cost center identification criteria is outlined as below.

1. Cost centers that have a specific and clear role or function in the operation of the hospital. However, they may or may not need to have a distinct structure. The distinct structure of cost center refers to its separate office location, having own staffs working particularly for its department. A distinct structure will help simplify the cost data analysis. In case the cost centers do not have a distinct structure, but a clear result of output, they will include the unit which provide service to patient after the normal operating hour, provide to service to social security patient or medical student program.

2. Cost center shall have a distinct data of its resource consumption and its cost level is relatively high. Examples of resource consumption data include number of personnel and material consumption record and etc. Generally, the more cost center can be identified, the more accurate the cost calculation will be. However,

with more cost center identified, it simply means more workload in data collection. As a result, in order to simplify the calculation, department with similar function and those with relative low operating cost are grouped together, for example, grouping all administrative departments into a single cost center (General Administration)

3. Cost center shall have a tangible and measurable result. The result will be used in the unit cost calculation for the absorbing cost center or in cost distribution (transient cost center which providing support to the absorbing cost center).

4. It is required by the hospital administrator to know the unit cost of that particular department and the data collection is not too complicated.

5. For the purpose of this study, various cost centers are classified into four different group is each group is designated with letter A , B, C, D and E as follows:

- A represents Non Revenue Producing Cost Center (NRPCC),
- B represents Revenue Producing Cost Center (RPCC),
- C and D represents patient Service Area (PS)
- C represents Out-Patient Service (PL – OPD)
- D represents In-Patient Service (PS – IPD)
- E represents Non-Patient Service Area (NPS)

2. Direct Cost Determination

Direct cost determination aims to identify the value of all resource that cost center used up. It divides the resource nit small units so that it will be easier to analyze its relation to the final product or output. Cost data of each cost center are gathered in logical steps depending on the characteristic of each cost center. The study will start with indentifying the elements of production, how much each element is used and calculating the cost. This will allow us to calculate the cost of each element in the production process.

Total direct cost of each cost center is found by summing their labor cost, material cost and capital cost.

Total Direct Cost $\quad=\quad$ Labor Cost + Material Cost + Capital Cost

$\qquad$ (TDC) $\qquad=\qquad$ LC $\quad+\quad$ MC $\quad+\quad$ CC

1. **Labor cost** means the cost that paid to the staffs in exchange of their work. This includes wage, salary, overtime and other expenditure in performing their duty.

Additionally, it includes the other allowance that paid out in term of money such as child tuition fee, medical fee, housing allowance. In accounting viewpoint, it is quite complicate to determine the labor cost as an indirect cost or direct cost. Overtime is generally regarded as indirect cost of overhead cost. However, in the cost analysis of medical care service, overtime can be specified directly to one patient service area, for example, Accident and Emergency patient or patient who get operation after normal operating hours, in-patient in each ward. The next thing to be considered is whether to separate cost analysis during the normal operating hours or after normal operating hours. For examples, labor cost of physician should

Some organization treated all kinds of the allowance as the indirect cost. In this case, all allowance is gathered to the central unit or administration unit. While some organizations will consider which department the allowance belongs to. If the allowance belongs to the person whose work directly associated with operation process or service provision, the allowance will be considered as the indirect cost. In this case, allowance and fringe benefit will be added directly to the other labor cost of that cost center.

In economic viewpoint, the fringe benefit can be in the other form, which is not the monetary form, such as, cars and houses that provide for staff. However, this can be converted into monetary form by using the housing and car rental rate. In addition, some people will further consider the future staff benefit, such as, retirement mutual fund

2. **Material Cost** refers to all kinds of material supplies that each cost center requisite from the disbursement unit during the study period. The primary disbursement units include material Supply and Pharmacy. The material cost also refers to the maintenance cost and utility cost. Estimating the material cost can be done by using material requisition record if the record is particularly accurate. If the requisition record does not exist, the unit cost of material needs to be calculated by finding the price of the materials and their quantity.

3. **Capital Cost** refers to annual depreciation costs of equipment and building, including the training expense that affect the hospital cost in the long run. This kind of cost generally occurs once in a long while. In accounting viewpoint,

depreciation cost will be calculated by using Straight-line method. This means the depreciation cost will be equally averaged out by their total life. Otherwise it can be calculated by taking the initial cost subtracted by the salvage value (the price when the equipment reach its total life) and divided by the total life of building or equipment. Total life of building and equipment generally equals to 20 years while total life of vehicle equals to 3 to 5 years. The medical equipment's total life equals to 5 to 15 years depending upon the type of equipment.

$$Depreciation \ \ Cost = \frac{Initial \ \ Cost - Salvage \ \ Value}{Total \ \ Life \ \ (Year)}$$

Generally, one building will be utilized by various departments in a period of time. Therefore, after getting the depreciation cost of each building, the cost must be divided by the number of departments, which utilize that building in accordance with its usage proportion. In case the area of the building is occupied by more than one department, the proportion of their time spent need to be included in the calculation accordingly.

3. Allocation Criteria Determination

Cost allocation Criteria

For the transient cost center, there must be cost allocation criteria to determine which data used to distribute their cost to other cost centers. The criteria can be divided into four following groups.

- Personnel Criterion: it relates to the hospital personnel, for example, the number of full time personnel or equivalent in the hospital, in Nurse Department of Physician.
- Cost Criterion: it relates to the expense in each cost center, for example, wage, salary, material cost and etc.
- Patient Criterion: it relates to the patient, for example, the number of patient day and number of visit.
- Service Criterion: it relates to general service of the hospital, for example, weight of the cloth used or occupied area and etc.

Indirect Cost Allocation

The principle of the cost allocation is that direct cost of the non revenue producing cost center (NRPCC) and revenue producing cost center (RPCC) which are transient cost center (TCC) will be distributed to other cost center as an indirect cost according to their function and relation of service and support provided to each other. The full cost will then be distributed to patient service area (PS) which known as an absorbing cost center (ACC) plus the indirect cost allocated from transient cost center (TCC: NRPCC and RPCC) as illustrated below.
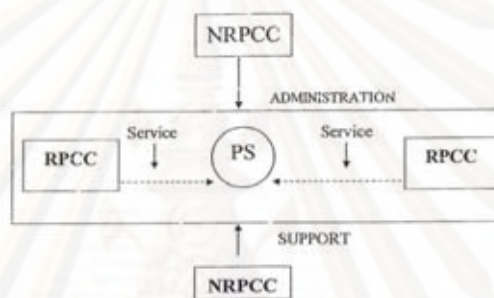
Cost allocation means the cost distribution of supporting department to the direct patient service area (PS). Cost allocation is performed for the following reasons:

- To ensure that all costs are allocated entirely to Patient Service Area (PS) so that unit cost can be calculated with no cost left.

- To reflect the relation and association between each cost center, which leads to the most accuracy in performance efficiency evaluation.

The result of cost allocation will transform the cost of transient cost center to be the indirect cost of the absorbing cost center entirely. There will be no cost remained at the transient cost center.

Generally, there are four basic cost allocation methods commonly used in cost analysis which include:

- Direct Distribution Method

- Step-Down Method

- Double Distribution Method

- Simultaneous Equation Method

In term of simplicity in calculation, the direct distribution method is the simplest. On the contrary, if we take the accuracy into consideration, this method is least. As

known, the cost from one cost center will not be allocated to another cost center simply and directly as there are several cost centers providing support and services amongst each other according to their related functions. In the meanwhile, one cost center allocates its cost to the other cost center; they will absorb the cost from the other cost center reciprocally. It is called the reciprocal service allocation problem. There are two ways to solve such problem, which include:

- Ignore such relation amongst cost centers when allocating the cost. When allocating the cost to the other cost centers, there will be o cost absorbed from other cost centers. This results in the low reliability of indirect cost calculation.

- Take that relation into consideration when allocating the cost. This means that when one cost center allocating the cost to another cost center, it can also absorb the cost from the other cost center and continue allocating the received cost to the other center reciprocally.

4. Full Cost Determination

The full cost is the sum of the direct cost of patient service area and the indirect cost which allocated from the revenue producing cost center (RPCC) and the non-revenue producing cost center (NRPCC).
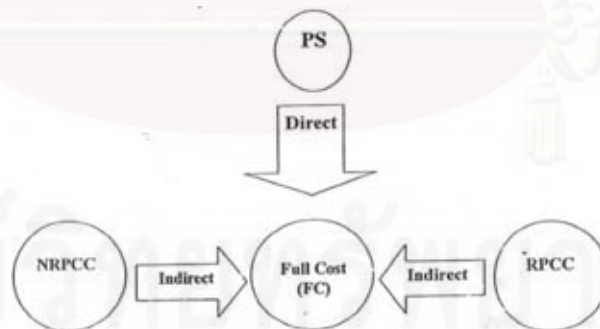
Figure 2: Full Cost Determination

After the entire cost of transient cost center (TCC$_S$) are eventually allocated to the absorbing cost centers (ACC $_S$), the full cost of patient service area will be as follow:

Full Cost (PS) = Direct Cost (DC) + Indirect Cost (IDC)

$$= DC\ (PS) + IDC\ (NRPCC) + IDC\ (RPCC)$$

= Total Direct Cost from Patient Service Area (PS) + Indirect Cost from Non-Revenue Producing Cost Center (NRPCC) + Indirect Cost of Revenue Producing Cost Center (RPCC)

Full cost of the patient service area will consist of 3 parts as following:

Direct cost of patient service area	= DC (PS)
Indirect cost allocated from non-revenue producing cost center	= IDC (NRPCC)
Indirect cost allocated from revenue producing cost center	= IDC (RPCC)

When considering the full cost of Patient Service Area in the public or state hospital, the full cost will include the building cost, personnel cost, office supplies cost, medical equipment cost and so on. This kind of cost will incur immediately when health service provided to the patients. However, it is the cost which not being charged directly to the patient. The patient will therefore not feel that they are charged (The cost incur but not charged directly to the patients). This cost can be also called the overhead cost. Normally, the overhead cost will be charged by the general private hospitals that are not subsidized by the government.

In case of the revenue producing cost centers, the cost charged to the patient is the direct cost. The medical care cost is the cost incurred when the patients are investigated, diagnosed or treated which depends on the seriousness of ailment, type of diseases and method of medical treatment.
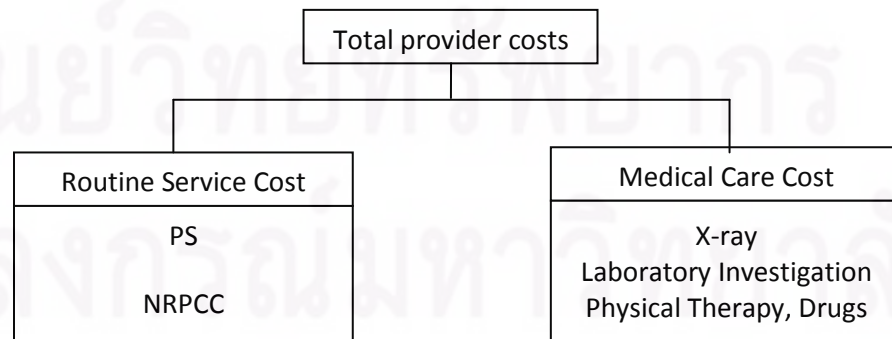
Figure 3: Total provider Costs

5. Unit cost Calculation

Unit cost is the comparison of the quantity of resource used and the final product or output. Unit cost is a tool to measure the efficiency of resource management, budget allocation, service fee defining, and the consideration to keep or cut-off the health service.

Generally, unit cost analysis will be conducted in the period of time. It can be annually basis at the end of fiscal year. The wholly one-year cost analysis has a good point as the data record is more complete, not fluctuated due to the seasonal change. However, if there are any obstacles or limitation, the cost analysis can be conducted in the shorter period of time or less than one year.

$$Unit\ cost\ of\ patient\ service\ =\ \frac{Full\ cost\ of\ patient\ service\ area}{Number\ of\ patient\ service\ unit}$$

To calculate the unit cost of patient service area (PS) more accurately, the patient service area will be divided into out-patient and in-patient services cost center by using the number of out-patient visits and the number of in-patient or patient day as a unit of service.

$$Unit\ Cost\ of\ out-patient\ service\ =\ \frac{Full\ Cost\ of\ out-patient\ service}{Number\ of\ out-patient\ visits}$$

And

$$Unit\ Cost\ of\ in-patient\ service\ =\ \frac{Full\ Cost\ of\ in-patient\ service}{Number\ of\ in-patient\ or\ patient\ day.}$$

$$Unit\ Cost\ (OPD)\ =\ \frac{Full\ Cost\ (PS)}{Number\ of\ Visits}$$

$$Unit\ Cost\ (IPD)\ =\ \frac{Full\ Cost\ (PS)}{Number\ of\ Patient\ Days}$$

Figure 4: Unit Cost Calculation

CHAPTER III

METHODOLOGY

Research design

Retrospective descriptive study

Study area

Roi Et Province, Thailand

Study period

During September to November 2009

Population and Samples

The target population is the hospitals in Roi Et province.

The population to be sampled is public hospitals in Roi Et province.

The samples are public hospitals within Roi Et province in fiscal years 2009.

Research Instruments

1. Questionnaires for quantitative data collection
   a. Labor cost collecting forms
   b. Material cost collecting forms
   c. Capital cost collecting forms
   d. Cost allocation diagram
2. Applications for data collection and analysis: Microsoft Excel 2007.

Questionnaire development

Questionnaire was created, pre-tested and try out during the second week of September 2009. Data collected were analysed and checked for any improvement of content of the form of questionnaires and applications used.

Data collection

1. Preparation phase: duration 2 weeks

   a. Research team preparation meeting, document development, review of literatures and planning for study operation.

   b. Research assistants completed a one-day training workshop on data collection.

   c. Budget plan development and preparation.

   d. Informed the sampled hospitals about the study and schedule for hospital visits.

   e. Cost center identification of cervical cancer screening and treatment for precancerous lesions. These were grouped into three categories:

      i. Non-revenue producing cost center: NRPCC, begin with code number 1 (From 101 to 199).

      ii. Revenue producing cost center: RPCC, begin with code number 2 (From 201 to 299).

      iii. Patient service: PS, begin with code number 3 (From 301 to 399).

      iv. Sub-groups were categorized by related professionals, such as N for nursing department, M for physician department, S for other supporting departments.

      v. Allocation criteria as shown in chapter 1.

      vi. Questionnaire printing and numbered.

      vii. Study team meeting and finalize schedules and time table.

      viii. Present to provincial monthly meeting (within September 2009) to all hospital directors and district health officers for the operation of the study.

2. Implementation phase. Duration 2 month.

   a. This retrospective study set 2 weeks for the collection of data from 1 general hospital, 16 community hospitals.

   b. These hospitals were grouped into 3 categories: General hospital (1 hospital), 60-bed hospitals (4 hospitals) and 30-bed hospitals (12 hospitals).

c. One general hospital, two 60-bed, and four 30-bed hospitals were randomly sampled and used as study units.

d. Consents were issued by hospital directors.

e. For those who refused to give consent, researcher will call and provide more additional information that may be needed. If the authority still refused to cooperate, remaining list will be re-sampled for new hospital.

f. Interviewee included hospital directors, financial officials, clerk staff, and laboratory staff.

g. Interview was completed by trained research assistants.

h. Interview topics were according to interview guideline.

i. Interview duration took about 60 minutes.

j. Material costs were collected from receipts and official financial documents of corresponding hospitals.

k. Capital costs were collected from hospital financial reports.

l. Data verification by quality data processing, both by data collector and by computerized system such as standard data recording form, data collector or research assistant training, using computerized system. In case of any doubt, research assistants will re-confirm with corresponding hospital officials.

Type of data	Form	Source of data
Labor costs		
1. Salaries	LC1	Hospital salary sheets
2. Overtime compensations	LC2	
3. Performance payment	LC3	
4. Training expenses	LC4	
Material costs		
1. Medicals	MC1	
2. Supplies	MC2	
3. Consumables	MC3	
Capital costs		
1. Instruments	CC1	
2. Stationery	CC2	
3. Buildings	CC3	

Data analysis

There were two steps of data analysis.

1. Data processing.
    a. Data were processed by personal computer with Microsoft Excel 2007.
2. Data analysis.
    a. Cost data were allocated and analysed according to conceptual framework model as shown in chapter 1.
    b. Descriptive statistics, such as percentage or mean, were employed.

Inclusion criteria

1. Hospitals with action plans for cervical cancer screening for the year 2009.
2. Hospitals with allocation of budget for cervical cancer screening services.

Exclusion criteria

1. Hospitals without action plan for cervical cancer screening for the year 2009.
2. Hospitals without allocation of budget for cervical cancer screening services.

Limitations

1. Women who received more than one tests were counted by the first screening visit.
2. This study did not explore private clinics.
3. This study explored the hospitals as the main contractors for healthcare services, so micro-costing at sub-district and community levels will not be included.
4. The cost of treatment related to radiotherapy and surgery were not explored.

Operational Definitions

1. Target women are those aged 30 – 45 years during the year being screened. These women are pre-menopausal and their SCJ could be identified by trained nurse providers.

2. Routine service costs are those not specific for individuals, include:
   a. Labor cost
   b. Material cost
   c. Capital cost
   d. Indirect cost

3. Precancerous lesions of cervix include mild, moderate and severe dysplasia; cervical intraepithelial neoplasia (CIN) of all grades; and carcinoma in situ (CIS) of cervix.

4. Single visit approach (SVA) means testing target women with visual inspection using acetic acid (VIA) and, if abnormal and eligible, treats with cryotherapy in the same visit.

5. Cytologic test or Pap smear means examine the specimen by cytological technicians or pathologists by cytological method.

6. Diagnostic cost includes cost of colposcopic examination, cervical biopsies, and endocervical curettage. It includes the cost of pathology report.

7. **Treatment cost** in this study is the treatment of *precancerous* cervical lesions. This includes cost of loop electro-excision procedure (LEEP), conization of cervix, and hysterectomy. It also includes cost of pathology report for the corresponding procedures.

8. Explore to the completion of treatment, if any, of precancerous lesion of cervix.

9. Officials' salaries, wages and compensations are Roi Et Healthcare services expenses.

10. Charge prices are used as laboratory costs.

11. Consumables and supplies are reliable as they come from respondent units.

12. Replacement values are used as capital cost.

13. Roi Et Cancer Registry provided hospital based data for the province.

CHAPTER IV

RESULTS

The results were presented as follow:

1. General findings
2. Cost identification analysis

General findings

There were seven hospitals enrolled. There was one general hospital with 549 beds, 6 gynecologists, 6 SVA providers and 3 cytotechnician. Two 60-bed hospitals had 5-6 doctors with one cytotechnician each. They had 3-4 SVA providers and only one hospital had gynecologist. Four 30-bed hospitals had 3-5 (average 3.75) doctors with 2-5 (average 3.25) SVA providers. One of these hospitals had gynecologist but all had no cytotechnician. Table 5 presented details of these hospitals.

Table 5 General findings among seven hospitals

Hospital	Number of beds	MD	Gynecologists	SVA-related staff	Cyto-technician
1	549	60	6	6	3
2	60	6	1	3	1
3	60	5	0	4	1
4	30	5	1	5	0
5	30	4	0	2	0
6	30	3	0	3	0
7	30	3	0	3	0

All but one hospital provided both SVA and Pap smear testing. One 30-bed hospital based their cervical cancer screening solely on Pap smear.

Interviews with service providers revealed that normally SVA service was provided by two main strategies – the hospital-based and the mobile clinic services. The hospital-based service was provided at a clinic about out-patient department or at

the primary health care unit within the hospital. The mobile clinic service was provided by SVA trained nurses rotating by van to health centers around the district, normally in monthly basis. Providers were all hospital staff.

Steps in Pap smear testing include the followings:

1) At the primary care or health center level, healthcare provider collected cervical specimen, put it on glass slide, immerse into glass container with 95% alcohol for at least 30 minutes and then let dry, then send to central laboratory capable of processing and interpretation.

2) At the central laboratory, cytotechnician process the slide, interpret, and report the findings.

3) There were five cytotechnicians actively practicing in this study, three were at the general hospital and two at 60-bed hospitals.

The performances of seven hospitals in year 2009 are presented in Table 6. These figures include only those targeted women under district's catchment area. The rationale for this comes from underlying health care system. Each hospital acts as a contracting unit for primary care (CUP) under the universal coverage scheme and is responsible for providing promotion and prevention services. At the study time, the recommendation for cervical cancer screening stated that women aged 30-45 years should be first provided by SVA, then by Pap smear every five years until age 60.

Table 6 Performances of cervical cancer screening among seven hospitals within year 2009

	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
Population	154,721	117,048	107,449	74,616	74,587	64,988	81,256	674,665
Women 30-45 years	22,288	16,348	16,136	10,613	10,720	9,237	11,887	97,229
Women 46-60 years	14,636	10,198	8,313	6,668	6,149	4,839	7,509	58,312
SVA uptake	670	1,038	1,292	808	681	626	0	5,115
Pap uptake	3,216	1,447	1,806	815	618	868	1,692	10,462
Total uptake	*3,886*	*2,485*	*3,098*	*1,623*	*1,299*	*1,494*	*1,692*	*15,577*
Cryotherapy from SVA	33	13	6	17	56	7	0	132
Cryotherapy from Pap	0	0	0	0	0	0	0	0
Total Cryotherapy	**33**	**13**	**6**	**17**	**56**	**7**	**0**	**132**
Colposcopy from SVA	17	0	0	15	0	0	0	32
Colposcopy from Pap	19	0	0	2	0	0	0	21
Total Colposcopy	**36**	**0**	**0**	**17**	**0**	**0**	**0**	**53**
Biopsy from SVA	12	0	11	12	1	0	0	36
Biopsy from Pap	18	0	0	2	0	0	0	20
Total Biopsy	**30**	**0**	**11**	**14**	**1**	**0**	**0**	**56**
ECC from SVA	12	0	0	12	0	0	0	24
ECC from Pap	18	0	0	2	0	0	0	20
Total ECC	**30**	**0**	**0**	**14**	**0**	**0**	**0**	**44**
LEEP from SVA	10	0	0	6	0	0	0	16
LEEP from Pap	14	0	0	1	0	0	0	15
Total LEEP	**24**	**0**	**0**	**7**	**0**	**0**	**0**	**31**

Cost identification analysis

In order to identify cost of cervical cancer screening, price list for cervical procedures at Roi Et Hospital year 2009 was used as reference standard (Table 7) and for calculation according to the conceptual framework on page 5.

Table 7 Price list for cervical procedures (Thai Baht)

Cryotherapy	150
Colposcopy	250
Endocervical curettage (ECC)	500
Colposcopy-directed cervical biopsy	500
Loop electro-excision procedure (LEEP)	2,500

(Source: Standard price list for out-patient procedures; Roi Et Hospital, 2009)

Labor cost identification

Cost identification began with labor cost analysis as shown in Table 8. This information came mainly from financial report for fiscal year 2009. Because all but one hospital provide cervical cancer screenings through nurse providers who were capable for both SVA and Pap smear screening in the same time, labor cost were divided equally for SVA and Cytology. Some hospitals provided additional budget for Pap smear service directly to primary health centers and cause increased labor cost in corresponding hospitals. Labor cost of cytology method came from two stages, first from collection of the specimen and second from the interpretation fees. The second source of labor cost emerged only from those hospital without cytotechnician (hospitals 4-7). Interpretation fee was 50 bahts per slide. The labor cost among these hospitals was calculated from this basis.

The average labor cost was 75,285.00 (range 51,450 – 88,644) bahts for SVA services among six hospitals and 167,704.00 (range 82,350 – 342,240) bahts for Pap smear among all seven hospitals.

Table 8: Labor cost for cervical cancer screening (Thai Baht)

Item	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
Labor cost - SVA	84,672.00	88,644.00	88,644.00	63,600.00	51,450.00	74,700.00	NA	451,710.00
Labor cost - Cytology collection	138,564.00	249,760.00	138,564.00	63,600.00	51,450.00	74,700.00	257,640.00	974,278.00
Labor cost - cytology interpretation	0.00	0.00	0.00	40,750.00	30,900.00	43,400.00	84,600.00	199,650.00
Labor cost - Cytology	138,564.00	249,760.00	138,564.00	104,350.00	82,350.00	118,100.00	342,240.00	1,173,928.00

Material cost identification

Material cost for SVA service came from acetic acid, cotton wools and swabs, recording form, and gasoline. The cost ranges from 2,880 to 18,880 with average 5,956.67 bahts (Tables 9, 10). For Pap smear screening, material cost came from 95% Alcohol, glass slides, tissue papers, wrapping sheets, disposable spatulas, recording form, postal fee, and gasoline. Material cost for Pap smear service ranges from 36,390 to 230,260 with average 129,706.57 bahts. Because there was huge variation of material cost among the enrolled hospitals, a sample hospital was used for material cost calculation of both SVA and Pap smear services as showed in Table 10.

Table 9: Material cost for cervical cancer screening (Thai Baht)

Item	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
Material cost - SVA	4,300.00	2,880.00	2,880.00	18,880.00	2,800.00	4,000.00	NA	35,740.00
Material cost – Cytology	230,260.00	131,060.00	131,060.00	36,390.00	171,500.00	109,800.00	97,876.00	907,946.00

Table 10: Material cost for SVA and Pap smear services from hospital 4 as a sample

Item	Unit	Unit price	Sub-total
SVA service			
• **5% Acetic acid**	24	28	672
• **Cotton wools**	4	52	208
• **Cotton swabs**	2000	2	4000
• **Recording form**	2000	1	2000
• **Gasoline**	24	500	12000
SVA Material cost (Bahts)			*18,880*
Pap smear service			
• **95% Alcohol**	2	710	1420
• **Glass slide**	2000	2	4000
• **Tissue papers**	60	12	720
• **Wrapping papers**	10	25	250
• **Spatulas**	2000	5	10000
• **Recording form**	2000	1	2000
• **Postal fees**	2000	3	6000
• **Gasoline**	24	500	12000
Pap smear Material cost (Bahts)			*36,390*

Capital cost calculation

Capital cost for SVA and Pap smear service came mainly from the depreciation of equipment calculated by refer to costing manual and was presented in Tables 11 and 12. The capital cost of SVA was 14,351.00 bahts. Three hospitals with cytology facilities had higher cytology capital cost (41,597.00 bahts) than the other four (26,339 bahts) due to inclusion of microscope and staining equipment.

Table 11: Capital cost for SVA and Pap smear services (Thai Baht)

SVA	Number	Unit price	Cost	Estimated useful life	Salvage value	Depreciation
Speculum	50	1700	85000	15	10	5,666.00
Lithotomy table	2	17000	34000	20	100	1,695.00
Light source	2	35000	70000	10	100	6,990.00
Capital cost for SVA						**14,351.00**
Pap smear	Number	Unit price	Cost	Estimated useful life	Salvage value	Depreciation
Speculum	50	1700	85000	15	10	5,666.00
Lithotomy table	2	17000	34000	20	100	1,695.00
Light source	2	35000	70000	5	100	13,980.00
Glass container	10	2500	25000	5	10	4,998.00
Microscope	1	85000	85000	15	100	5,660.00
Staining equipment	2	24000	48000	5	10	9,598.00
Capital cost for Pap smear						**41,597.00**

Table 12: Capital cost of cervical cancer screening

Item	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
Capital cost – SVA	14,351.00	14,351.00	14,351.00	14,351.00	14,351.00	14,351.00	NA	86,106.00
Capital cost – Cytology	41,597.00	41,597.00	41,597.00	26,339.00	26,339.00	26,339.00	26,339.00	230,147.00

Table 13 displays cost structure of cervical cancer screening for SVA and Pap smear among these hospitals.

Table 13: Cost structure for cervical cancer screening for SVA and Pap smear (Bahts)

	Labor cost	Material cost	Capital cost	Total direct cost
SVA	451,710.00	35,740.00	86,106.00	573,556.00
	78.76%	*6.23%*	*15.01%*	*100%*
Pap smear	1,173,928.00	907,946.00	230,147.00	2,312,021.00
	50.77%	*39.27%*	*9.95%*	*100%*

Diagnosis or confirmatory test included three main procedures: colposcopy examination, endocervical curettage (ECC), and cervical biopsy. Combined with price list in Table 7, diagnosis cost calculation was made and presented in Table 14.

Treatment cost of pre-cancerous lesions following cervical cancer screening composed of two procedures: cryotherapy and loop electrosurgical excision procedure or LEEP. This was the treatment for pre-cancerous cervical lesion along the screening process. Price list as appeared in Table 7 was used to calculate for treatment cost and displayed in Table 15.

Table 14: Diagnosis cost calculation for cervical cancer screening (Bahts)

	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
No. Colpo/SVA	17	0	0	15	0	0	0	32
Cost Colpo/SVA	*4,250*	*0*	*0*	*3,750*	*0*	*0*	*0*	*8,000*
No. Colpo/Pap	19	0	0	2	0	0	0	21
Cost Colpo/Pap	*4750*	*0*	*0*	*500*	*0*	*0*	*0*	*5250*
Total Colpo.	36	0	0	17	0	0	0	53
Cost of Colpo.	*9,000.00*	*0.00*	*0.00*	*4,250.00*	*0.00*	*0.00*	*0.00*	*13,250.00*
No. ECC/SVA	12	0	0	12	0	0	0	24
Cost ECC/SVA	*6,000.00*	*0.00*	*0.00*	*6,000.00*	*0.00*	*0.00*	*0.00*	*12,000.00*
No. ECC/Pap	18	0	0	2	0	0	0	20
Cost ECC/Pap	*9,000.00*	*0.00*	*0.00*	*1,000.00*	*0.00*	*0.00*	*0.00*	*10,000.00*
Total ECC	30	0	0	14	0	0	0	44
Cost of ECC	*15,000.00*	*0.00*	*0.00*	*7,000.00*	*0.00*	*0.00*	*0.00*	*22,000.00*
No. CxBx/SVA	12	0	11	12	1	0	0	36
Cost CxBx/SVA	*6,000.00*	*0.00*	*5,500.00*	*6,000.00*	*500.00*	*0.00*	*0.00*	*18,000.00*
No. CxBx/Pap	18	0	0	2	0	0	0	20
Cost CxBx/Pap	*9,000.00*	*0.00*	*0.00*	*1,000.00*	*0.00*	*0.00*	*0.00*	*10,000.00*
Total CxBx	30	0	11	14	1	0	0	56
Cost CxBx	*15,000.00*	*0.00*	*5,500.00*	*7,000.00*	*500.00*	*0.00*	*0.00*	*28,000.00*
Diag. cost/SVA	16,250.00	0.00	5,500.00	15,750.00	500.00	0.00	0.00	38,000.00
Diag. cost/Pap	22,750.00	0.00	0.00	2,500.00	0.00	0.00	0.00	25,250.00
Diagnosis cost	**39,000.00**	**0.00**	**5,500.00**	**18,250.00**	**500.00**	**0.00**	**0.00**	**63,250.00**

* ECC = endocervical curettage; CxBx = cervical biopsy.

Table 15: Treatment cost of pre-cancerous lesions following cervical cancer
screening in seven hospitals at Roi Et (Bahts)

	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
No. Cryo/SVA	33	13	6	17	56	7	0	132
Cost Cryo/SVA	4,950.00	1,950.00	900.00	2,550.00	8,400.00	1,050.00	0.00	19,800.00
No. Cryo/Pap	0	0	0	0	0	0	0	0
Cost Cryo/Pap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Cryotherapy	33	13	6	17	56	7	0	132
Cost of Cryotherapy	4,950.00	1,950.00	900.00	2,550.00	8,400.00	1,050.00	0.00	19,800.00
No. LEEP/SVA	10	0	0	6	0	0	0	16
Cost of LEEP/SVA	25,000.00	0.00	0.00	15,000.00	0.00	0.00	0.00	40,000.00
No. LEEP/Pap	14	0	0	1	0	0	0	15
Cost of LEEP/Pap	35,000.00	0.00	0.00	2,500.00	0.00	0.00	0.00	37,500.00
Total LEEP	24	0	0	7	0	0	0	31
Cost of LEEP	60,000.00	0.00	0.00	17,500.00	0.00	0.00	0.00	77,500.00
Treatment cost	**64,950.00**	**1,950.00**	**900.00**	**20,050.00**	**8,400.00**	**1,050.00**	**0.00**	**97,300.00**

After all the cost centers are allocated, then cost identification analysis of
cervical cancer screening reveals the details presented below. The unit cost is 119.56
bahts for SVA and 223.41 bahts for Pap smear testing. The cost of SVA test is 0.54
times of Pap smear method. When combined with treatment cost, the unit cost of
cervical cancer screening in Roi Et for year 2009 is 195.55 bahts (Table 16). The unit
cost of cervical cancer screening is 158.95 bahts for Roi Et general hospital and
207.72 bahts for community hospitals, 170.83 bahts for 60-bed and 241.44 bahts for
30-bed hospitals.

Table 16: Cost identification analysis of cervical cancer screening in Roi Et, year
2009

Item	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7	Total
Labor cost - SVA	84,672.00	88,644.00	88,644.00	63,600.00	51,450.00	74,700.00	NA	451,710.00
Labor cost - Cytology collection	138,564.00	249,760.00	138,564.00	63,600.00	51,450.00	74,700.00	257,640.00	974,278.00
Labor cost - cytology interpretation	0.00	0.00	0.00	40,750.00	30,900.00	43,400.00	84,600.00	199,650.00
Labor cost - Cytology	138,564.00	249,760.00	138,564.00	104,350.00	82,350.00	118,100.00	342,240.00	1,173,928.00
Material cost - SVA	4,300.00	2,880.00	2,880.00	18,880.00	2,800.00	4,000.00	NA	35,740.00
Material cost - Cytology	230,260.00	131,060.00	131,060.00	36,390.00	171,500.00	109,800.00	97,876.00	907,946.00
Capital cost - SVA	14,351.00	14,351.00	14,351.00	14,351.00	14,351.00	14,351.00	NA	86,106.00
Capital cost - Cytology	41,597.00	41,597.00	41,597.00	26,339.00	26,339.00	26,339.00	26,339.00	230,147.00
Indirect cost - SVA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect cost - Cytology	NA	NA	NA	NA	NA	NA	NA	NA
Routine screening cost for SVA	103,323.00	105,875.00	105,875.00	96,831.00	68,601.00	93,051.00	NA	573,556.00
Cytology test prices	410,421.00	422,417.00	311,221.00	167,079.00	280,189.00	254,239.00	466,455.00	2,312,021.00
Diagnostic cost - SVA	16,250.00	0.00	5,500.00	15,750.00	500.00	0.00	NA	38,000.00
Diagnostic cost - Cytology	22,750.00	0.00	0.00	2,500.00	0.00	0.00	0.00	25,250.00
SVA cost	119,573.00	105,875.00	111,375.00	112,581.00	69,101.00	93,051.00	0.00	611,556.00
Cytology cost	433,171.00	422,417.00	311,221.00	169,579.00	280,189.00	254,239.00	466,455.00	2,337,271.00
Number of patients - SVA	*670*	*1,038*	*1,292*	*808*	*681*	*626*	*0*	*5,115*
Number of patients - Cytology	*3,216*	*1,447*	*1,806*	*815*	*618*	*868*	*1,692*	*10,462*
Number of all patients	*3,886*	*2,485*	*3,098*	*1,623*	*1,299*	*1,494*	*1,692*	*15,577*
SVA Unit cost	178.47	102.00	86.20	139.33	101.47	148.64	0.00	119.56
Cytology Unit cost	134.69	291.93	172.33	208.07	453.38	292.90	275.68	223.41
Treatment cost	64,950.00	1,950.00	900.00	20,050.00	8,400.00	1,050.00	0.00	97,300.00
Full cost	617,694.00	530,242.00	423,496.00	302,210.00	357,690.00	348,340.00	466,455.00	3,046,127.00
Unit cost of cervical cancer screening (Bahts)	158.95	213.38	136.70	186.20	275.36	233.16	275.68	**195.55**

CHAPTER V

DISCUSSION, SUMMARY AND CONCLUSIONS

Discussion

Total or full cost of cervical cancer screening within seven hospitals in Roi Et is 3,046,127.00 bahts and unit cost is 195.55 bahts. At Roi Et General Hospital total or full cost is 617,694.00 bahts and unit cost is 158.95 bahts while at community hospitals total or full cost is 2,428,433.00 bahts and unit cost is 207.72 bahts. The unit cost at 60-bed and 30-bed hospitals are 170.83 bahts and 241.44 bahts respectively. Unit costs increase as hospital sizes decrease (158.95, 170.83, and 241.44 bahts for general-, 60-bed, and 30-bed hospitals respectively) (Figure 5). The main reason is the numbers of patients screened by larger hospital are greater than by smaller ones.

The unit costs for SVA and Cytology service are 119.56 and 223.41 bahts. The SVA unit cost found in this study (119.56 bahts) outnumbers the cost reported in other publication at US$0.92 or 36.80 bahts. [35] The main different is that in this study the service expenses include all costs of the contracting unit spending for cervical cancer screening programme on monthly basis. The cost of providing such screening programme is rather fixed due to the organization of district health care system – those costs that are associated with coordinating and evaluating a cervical cancer screening program.[36] The organization of screening services is important because strategies that involve the use of visual inspection or HPV DNA testing and that require only one or two clinical visits offer cost-effective alternatives to conventional cytology-based screening in low-resource settings. [37]

Even SVA using visual inspection using acetic acid (VIA) had been noted to be the most efficient and effective strategy for detecting and treating cervical cancer precursors in low-resource settings, [38] there is still many barriers to control of cervical cancer. One of these barriers which have long been claimed for the failure of the programmes is economic barriers (lack of resources). [3] The most clinically effective and cost-effective strategies in less-developed countries were those that

enhanced the linkage between screening and treatment, through either a reduced number of visits or improved follow-up, and that relied on less laboratory infrastructure than did conventional cytologic methods. [37] A prerequisite for a successful programme is a valid screening test, too. [39] In Thailand one of the efforts to break these barriers is to put the cervical cancer screening as one of the National Priority Program and Central Procurement. [40] This is important because for screening to be effective, it should be organized according to an agreed policy. [41] Reimburses for such preventive care as cervical cancer screening depend on the basis of cost the hospital spends. The unit cost of SVA service (119.56 bahts) outnumbers the reimbursement or incentive provided by the National Health Security Office (NHSO) of Thailand at 70.00 bahts for fiscal year 2009. [40] The unit cost of Cytology service, on the other hand, is lesser than the amount compensated at 250.00 bahts (Figure 6). Practically the different reimbursement for different method may affect the selection of screening services used by the contracting units and providers. The reimbursement should be the same amount for the same target group of clients.
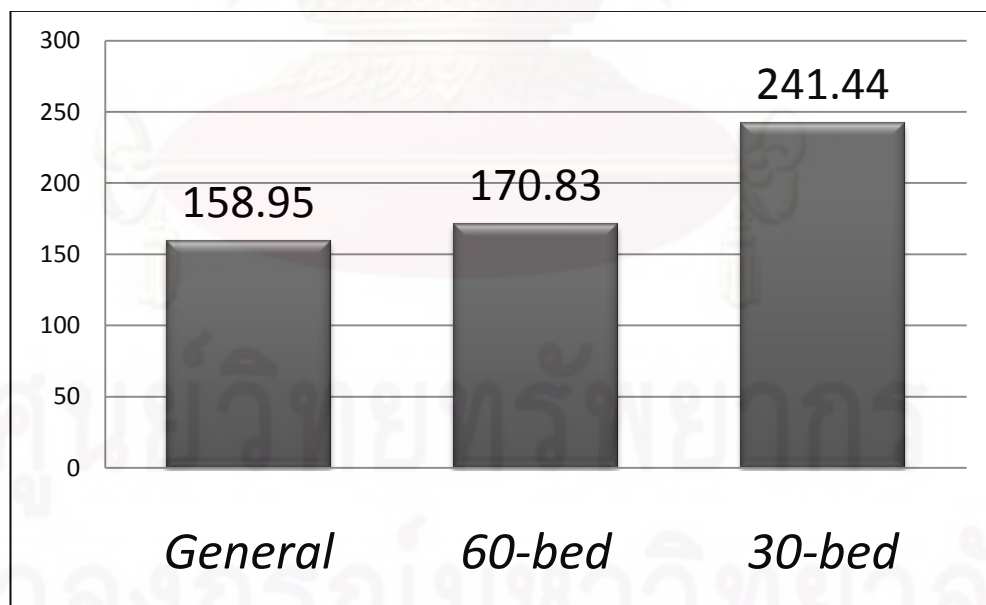
Figure 5: Unit cost against Hospital types
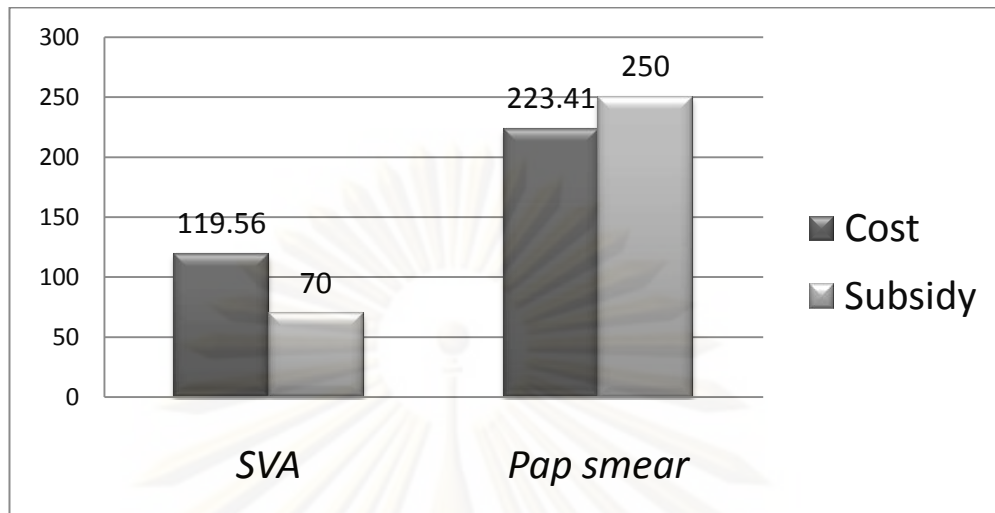
Figure 6: Comparison of Cost and Subsidy

The expense incurred with new diagnoses with unclear clinical significance is a harm of cancer screening and can be minimized by adopting a more focused scope for screening. [42] This study has two characteristics of economic analysis. [43] First it deals only with the costs without consequences. Second, it compares two methods of screening – SVA and Cytology (or Pap smear). That is why cost identification analysis of cervical cancer screening is used (Table 17). If further consequences or outputs are examined, then cost-effectiveness will be possible. Cost in health can be analyzed in various ways: direct costs to the patient; cost to the insurer or sick fund on behalf of the patient; costs to the hospital or other provider; and indirect costs of illness to the patient, her family, and society, including time off work due to illness or lowered productivity. [44]

This study had several limitations as stated in chapter I. Women who received more than one tests will be count by the first screening visit. This duplication of service will increase the programme expense. This study does not explore private clinics, so for future research should those private clinics be included. This study is not designed to explore the cost at sub-district and community levels. Micro-costing can be helpful to identify indirect cost. Also this study is not designed to explore the cost of treatment related to radiotherapy and surgery which occur mostly at regional Cancer Center outside Roi Et Province.

Table 17 Health care evaluation [43]

		Costs and Consequences examined?		
		No		Yes
		Consequences only	Cost only	
Comparison of two or more alternatives?	No	Outcome description	Cost description	Cost-outcome description
	Yes	Efficacy or effectiveness evaluation	Cost analysis	CEA CUA CBA

Summary and conclusion

The unit cost of cervical cancer screening in Roi Et is 195.55 bahts. The unit cost is 119.56 bahts for SVA and 223.41 bahts for cytology testing. Future study is needed to explore micro-costing at sub-district and community levels, and to explore the cost of treatment related to radiotherapy and surgery at regional cancer center.

Recommendations

1. Reimbursement should be the same amount for the same target group of clients (women aged 30-45 years) at 250 Bahts per case. This recommendation comes from the fact that the unit cost found in this study is underestimated.
2. Further study should be planned to explore indirect cost and cost of cancer treatment related to radiotherapy and surgery at regional cancer center.

REFERENCES

[1] Ferlay J, Bray F, Pisami P, and Parkin DM. (2004). GLOBALCAN 2002: Cancer
     incidence, mortality and prevalence worldwide. Lyon: IARC Press.

[2] Parkin DM, Sankaranarayanan R. (1999). Prevention of cervical cancer in
     developing countries. Thai Journal of Obstetrics and Gynecology.
     11(Suppl 1):3-20.

[3] World Health Organization. (2006). Comprehensive cervical cancer control: a
     guide to essential practice. Geneva: WHO.

[4] World Health Organization. (2002). Cervical cancer screening in developing
     countries – report of a WHO consultation. Geneva: WHO.

[5] National Cancer Institute of Thailand. (2004). Cancer in Thailand 1998-2000.
     Vol.4. Bangkok: National Cancer Institute.

[6] Srivatanakul P. Cervix uteri. (2007). In: Khuhaprema T, Srivatanakul P, Sriplung
     H, Wiangnon S, Sumitsawan Y, Attasara P, editors. Cancer in Thailand.
     Vol.IV, 1998-200. Bangkok: Bangkok Medical Publisher.

[7] Roi Et Cancer Registry 2007. (2008). Roi Et: Roi Et Hospital.

[8] Royal Thai College of Obstetricians and Gynaecologists (RTCOG) and the
     JHPIEGO Corporation Cervical Cancer Prevention Group. (2003). Safety,
     acceptability, and feasibility of a single-visit approach to cervical-cancer
     prevention in rural Thailand: a demonstration project. Lancet. 361:814-20.

[9] International Health Policy Program, Thailand and Health Intervention and
     Technology Assessment Program, Ministry of Public Health, Thailand.
     (2008). Research for development of an optimal policy strategy for

prevention and control of cervical cancer in Thailand. Nonthaburi: Graphico Systems.

[10] Walboomers JM et al. 1999. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. J Pathol 189(1): 12–19.

[11] National Institute of Allergy and Infectious Diseases (NIAID). (2002). Workshop Summary: Scientific Evidence on Condom Effectiveness for Sexually Transmitted Disease (STD) Prevention.: Bethesda: NIAID.

[12] Groopman J. (1999). Contagion. The New Yorker . 75(26):44-49.

[13] Stewart AC et al. (1996). Intratype variation in 12 human papillomavirus types: a worldwide perspective. Journal of Virology. 70(5):3127-36.

[14] Massimi P, Banks L. (1997). Repression of p53 transcriptional activity by the HPV E7 proteins. Virology. 227(1):255-9.

[15] International Agency for Research on Cancer (IARC) Working Group on Evaluation of Cervical Cancer Screening Programmes. (1986). Screening for Squamous cervical cancer: duration of low risk after negative results of cervical cytology and its implication for screening policies. BMJ. 293:659-64.

[16] Gaffikin L et al. (2003). Performance of visual inspection with acetic acid for cervical cancer screening: a qualitative summary of evidence to date. Obstetrical and Gynecology Survey. 58(8):543-50.

[17] University of Zimbabwe/JHPIEGO Cervical Cancer Project. (1999). Visual inspection with acetic acid for cervical cancer screening: test qualities in a primary care setting. Lancet. 353(9156):869-73.

[18] American College of Obstetricians and Gynecologists. (2004). ACOG Statement of Policy: cervical cancer prevention in low-resource settings. Obstetrics & Gynecology. 103:607-9.

[19] Bishop A et al. (1995). <u>Cervical dysplasia treatment in developing countries: a situational analysis.</u> Seattle: Program for Appropriate Technology in Health (PATH).

[20] Edejer TTT, Baltussen R, Adam T, Hutubessy R, Evans DB, and Murray CJL. <u>Making choices in health: WHO guide to cost-effectiveness analysis.</u> [Online] 2003. Available from: http://www.who.int/choice/publications/p_2003_generalised_cea.pdf [March 10, 2010]

[21] Hutton G, Baltussen RM. <u>Valuation of goods in cost-effectiveness analysis: notions of opportunity costs and transferability across time and countries.</u> [Online] 2003. Available from: http://www.who.int/choice/publications/ d_2002_valuation.pdf [March 10, 2010]

[22] Murray CJL, Lopez AD. (1996). <u>The Global Burden of Disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020.</u> 1st ed. Murray CJL, Lopez AD, eds. Cambridge, MA: Harvard University Press.

[23] Asian Development Bank. (1997). <u>Guidelines for the economic analysis of projects.</u> Manila: Asian Development Bank.

[24] Drummond MF, O'Brien BJ, Stoddart GL, and Torrance GW. (1997). <u>Methods for the economic evaluation of health care programmes.</u> 2nd ed. Oxford: Oxford University Press.

[25] Gold MR, Siegel JE, Russel LB, and Weinstein MC, eds. (1996). <u>Cost-effectiveness in health and medicine.</u> New York: Oxford University Press.

[26] Anuwat Supachutikul, Adisuan Laichuthai, Viroj Tangcharoensathien, and Sukulya Kongsawasdi. <u>Introduction to cost analysis of health facilities.</u> [Online] 1996. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[27] Kanchana Disayathikom, Walaiporn Patcharanarumon, and Viroj Tangcharoensathien. <u>District hospital costing manual.</u> [Online] 2001. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[28] Sukulya Kongsawasdi. <u>District hospital costing manual – a training manual for managers of district hospital.</u> [Online] 1995. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[29] Walaiporn Patcharanarumon, Kanchana Disayathikom, and Viroj Tangcharoensathien. <u>Provincial hospital costing manual.</u> [Online] 2001. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[30] Prawase Wasi. <u>Health care reform.</u> [Online] 1996. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[31] Charas Suwanwela. <u>New paradigm of health system.</u> [Online] 2000. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[32] Sathirakorn Pongpanich, Watana Suwansaeng Juncharoen, Samrith Srithamrongsawat, Nualanant Tuntiket, and Jitrpranee Vasavit. <u>National health account in Thailand 1996, 1998.</u> [Online] 2000. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[33] Riewpaiboon A. (2008). Measurement of costs. <u>J Med Assoc Thai</u>. 91(Suppl 2):S28-37.

[34] Supasit Pannarunothai, Renu Srisamit, Supak Pitipakorn, Kamol Virapradit, and Boonrat Warachit. <u>Hospital financing: clinical budget holding to increase efficiency in provincial hospitals.</u> [Online] 2001. Available from: http://dspace.hsri.or.th/dspace [March 10, 2010]

[35] Mandelblatt JS, et al. (2002). Cost and benefits of different strategies to screen for cervical cancer in less-developed countries. <u>J Natl Cancer Inst.</u> 94:1469-83.

[36] van den Akker-van Marle ME, van Ballegooijen M, van Oortmarssen GJ, Boer R, and Habbema JDF. (2002). Cost-effectiveness of cervical cancer screening: comparison of screening policies. J Natl Cancer Inst. 94:193-204.

[37] Goldie SJ, et al. (2005). Cost-effectiveness of cervical-cancer screening in five developing countries. N Engl J Med. 353:2158-68.

[38] Sherris J, Wittet S, Klein A, Sellors J, Luciani S, Sankaranarayanan R, and Barone MA. (2009). Evidence-based, alternative cervical cancer screening approaches in low-resource settings. Intl Persp Sex Repro Health. 35:147-52.

[39] Hakama M. (1990). A screening programme that worked: discussion paper. J Royal Soc Med. 83:322-4.

[40] National Health Security Office. Manual for National Health Security Fund Management: Capitation Cost Management under Universal Coverage Scheme. [Online] 2009. Available from: http://www.nhso.go.th [March 10, 2010]

[41] Hakama M, Chamberlain J, Day NE, Miller AB, and Prorok PC. (1985). Evaluation of screening programmes for gynaecological cancer. Br J Cancer. 52:669-673.

[42] Sawaya GF. (2009). Cervical-cancer screening – new guidelines and the balance between benefits and harms. N Engl J Med. 361:1-3.

[43] Drummond MF, Sculpher MJ, Torrance GW, O'Brien BJ, and Stoddart GL. (2005). Methods for the economic evaluation of health care programmes. 3rd ed. Oxford: Oxford University Press.

[44] Tulchinsky TH, Varavokova EA. (2000). The New Public Health: An Introduction for the 21st Century. San Diego: Academic Press.
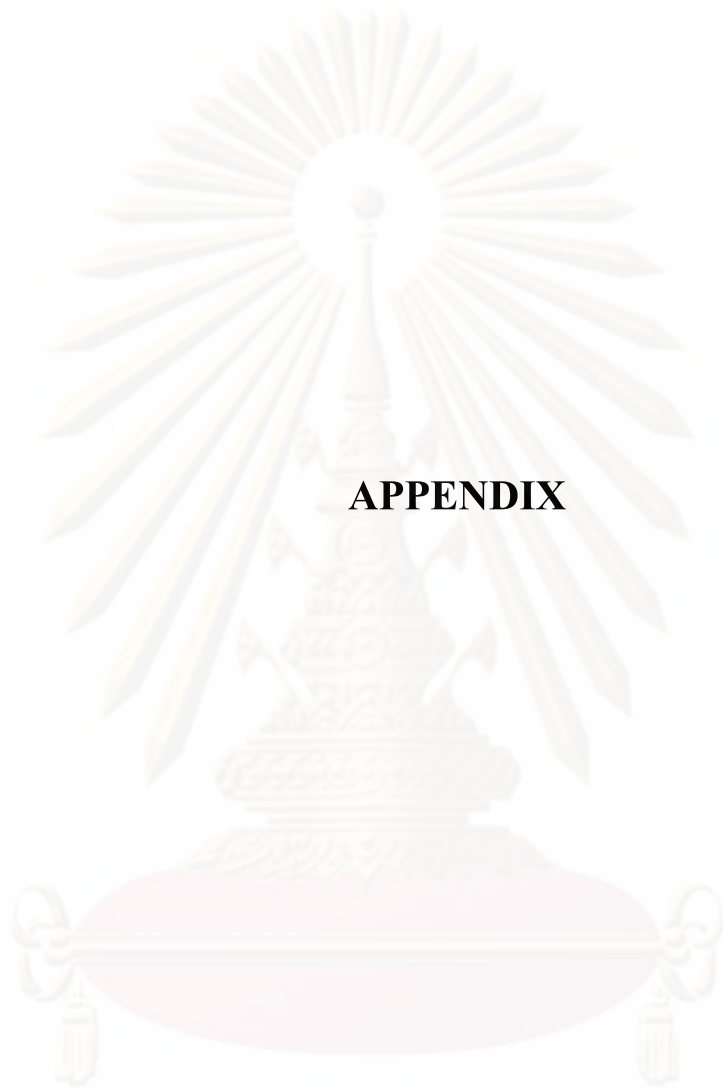
APPENDIX

ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

ชื่อโครงการวิจัย **การวิเคราะห์ต้นทุนการคัดกรองมะเร็งปากมดลูก จังหวัดร้อยเอ็ด**

ชื่อผู้วิจัย **นายแพทย์วัชระ เอี่ยมรัศมีกุล**   ตำแหน่ง นายแพทย์เชี่ยวชาญ (ด้านเวชกรรมป้องกัน)

สถานที่ติดต่อผู้วิจัย

 ที่ทำงาน   โรงพยาบาลพนมไพร สำนักงานสาธารณสุขจังหวัดร้อยเอ็ด

 ที่บ้าน   99 หมู่ 3 ตำบลพนมไพร อำเภอพนมไพร จังหวัดร้อยเอ็ด 45140

 โทรศัพท์ที่ทำงาน 043-591321 ต่อ 102 โทรศัพท์ที่บ้าน 043-591342

 โทรศัพท์มือถือ 081-8721706 E-mail : wachara.e@gmail.com

คำชี้แจง

 ยินดีต้อนรับสู่โครงการวิจัยเรื่อง "การวิเคราะห์ต้นทุนการคัดกรองมะเร็งปากมดลูก จังหวัด
ร้อยเอ็ด" ก่อนที่ท่านจะตัดสินใจเข้าร่วมในการวิจัย มีความจำเป็นที่ท่านควรทำความเข้าใจเกี่ยวกับ

โครงการนี้ ว่าทำเพราะเหตุใด และเกี่ยวข้องกับอะไร กรุณาเวลาใช้เวลาในการอ่านข้อมูลต่อไปนี้
อย่างละเอียดรอบคอบ และสอบถามข้อมูลเพิ่มเติมหรือข้อมูลที่ไม่ชัดเจนได้ตลอดเวลา

โครงการวิจัยนี้เป็นการศึกษาต้นทุนของการคัดกรองมะเร็งปากมดลูกในจังหวัดร้อยเอ็ด ซึ่ง
มีการให้บริการคัดกรองทั้งโดยวิธีแป๊ปสเมียร์และวิธีวีไอเอ โดยยังไม่เป็นที่ทราบแน่ชัดว่าต้นทุนที่
แท้จริงของการคัดกรองทั้งสองวิธีมีค่าเท่าใด ดังนั้นโครงการนี้จึงมีวัตถุประสงค์เพื่   อศึกษาต้นทุน
รวมและต้นทุนต่อหน่วยของการคัดกรองมะเร็งปากมดลูกแต่ละวิธีดังกล่าว กลุ่มประชากร คือ
โรงพยาบาลในสังกัดกระทรวงสาธารณสุขที่อยู่ในจังหวัดร้อยเอ็ด จำนวนทั้งหมด   17 โรงพยาบาล
โดยมีเกณฑ์การคัดเข้า คือ เป็นโรงพยาบาลที่มีแผนปฏิบัติการและจัดสรรงบประมาณสำห   รับการ
ให้บริการคัดกรองมะเร็งปากมดลูกในปี 2552 และมีเกณฑ์การคัดออก คือ โรงพยาบาลที่ไม่มีการ
แผนปฏิบัติการหรือไม่มีการจัดสรรงบประมาณสำหรับการให้บริการคัดกรองมะเร็งปากมดลูกในปี
2552 โครงการวิจัยนี้แบ่งโรงพยาบาลออกเป็น 3 กลุ่ม คือ กลุ่มโรงพยาบาลทั่วไป จำนวน 1 แห่ง
กลุ่มโรงพยาบาลขนาด 60 เตียง จำนวน 4 แห่ง และกลุ่มโรงพยาบาลขนาด 30 เตียง จำนวน 12 แห่ง
เลือกตัวแทนของแต่ละกลุ่มโดยเลือกโรงพยาบาลทั่วไป 1 แห่ง โรงพยาบาล 60 เตียง 2 แห่งโดยการ
สุ่ม และโรงพยาบาล 30 เตียง 4 แห่งโดยการสุ่ม เก็บข้อมูลโดยเจ้าหน้าที่โครงการบันทึ   กข้อมูล
ต้นทุนตามแบบฟอร์มที่กำหนด ศึกษาแผนปฏิบัติการและการจัดสรรงบประมาณสำหรับการ
ให้บริการของโรงพยาบาล และสัมภาษณ์ผู้มีส่วนเกี่ยวข้องในการคัดกรอง ซึ่งผลการศึกษาที่ได้จะ
เป็นประโยชน์ต่อเจ้าหน้าที่ผู้ให้บริการด้านสุขภาพ ผู้บริหารงานสาธารณสุขของหน่วยงานที่
สนับสนุนและจัดสรรงบประมาณ และผู้กำหนดนโยบายด้านสาธารณสุข โดยผู้วิจัยได้วางแผนใน
การนำเสนอผลการศึกษาต่อผู้ที่จะได้รับประโยชน์ดังกล่าวผ่านการจัดทำรายงานการศึกษา การ
ประชุมวิชาการและการประชุมวางแผนและประเมินผลของหน่วยงาน

การเข้าร่วมในโครงการนี้เป็นไปโดยสมัครใจ และท่านสามารถปฏิเสธที่จะเข้าร่วมหรือ
ถอนตัวจากการวิจัยได้ทุกขณะ โดยไม่ต้องให้เหตุผลและไม่สูญเสียประโยชน์หรืองบประมาณที่พึง
ได้รับสนับสนุนใดๆ หากท่านมีข้อสงสัยให้สอบถามเพิ่มเติมได้โดยสามารถติดต่อผู้วิจัยได้
ตลอดเวลา และหากผู้วิจัยมีข้อมูลเพิ่มเติมที่เป็นประโยชน์หรือโทษเกี่ยวกับการวิจัย ผู้วิจัยจะแจ้งให้
ท่านทราบอย่างรวดเร็ว

ข้อมูลที่เกี่ยวข้องกับท่านจะเก็บเป็นความลับ หากมีการเสนอผลการวิจัยจะเสนอเป็น
ภาพรวม ข้อมูลใดที่สามารถระบุถึงตัวท่านได้จะไม่ปรากฏในรายงาน การวิจัยนี้มีของที่ระลึก
เล็กๆน้อยๆ เพื่อเป็นการขอบคุณและชดเชยการเสียเวลาของท่าน

หากท่านไม่ได้รับการปฏิบัติตามข้อมูลดังกล่าว ท่านสามารถร้องเรียนได้ที่คณะกรรมการ
พิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย ชั้น 4 อาคาร
สถาบัน 2 ซอยจุฬาลงกรณ์ 62 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์ 0-2218-8147
โทรสาร 0-2218-8147 E-mail: eccu@chula.ac.th"

หนังสือแสดงความยินยอมเข้าร่วมการวิจัย

ทำที่ สำนักงานสาธารณสุขจังหวัดร้อยเอ็ด

วันที่.......เดือน...............พ.ศ. ....

เลขที่ ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย.................……

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วมโครงการวิจัย *การ วิเคราะห์ต้นทุนการคัดกรองมะเร็ง งปากมดลูก จังหวัดร้อยเอ็ด* ของผู้วิจัยชื่อ นายแพทย์วัชระ เอี่ยม รัศมีกุล ที่อยู่ที่ติดต่อ โรงพยาบาลพนมไพร สำนักงานสาธารณสุขจังหวัดร้อยเอ็ด โทรศัพท์ 043-514473

ข้าพเจ้า **ได้รับทราบ** รายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียด ขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้น จากการวิจัยเรื่องนี้ โดยได้อ่านรายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด และ **ได้รับ คำอธิบาย** จากผู้วิจัย **จนเข้าใจเป็นอย่างดี** แล้ว ข้าพเจ้าจึง **สมัครใจ** เข้าร่วมในโครงการวิจัย นี้ ตามที่ ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย โดยข้าพเจ้ายินยอมตอบแบบสอบถาม อนุญาตให้ผู้วิจัย เก็บบันทึกข้อมูล

ข้าพเจ้ามีสิทธิ**ถอนตัว**ออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ **โดยไม่ต้องแจ้งเหตุผล** ซึ่งการถอนตัวออกจากการวิจัยนั้น จะ ไม่มีผลกระทบในทางใดๆ ต่อ ข้าพเจ้าทั้งสิ้น ข้าพเจ้าได้รับคำ รับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูล ใดๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะ **เก็บรักษาเป็นความลับ** โดยจะนำเสนอข้อมูลการวิจัยเป็น ภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย

ข้าพเจ้าสามารถร้องเรียนได้ที่คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย ชั้น 4 อาคารสถาบัน 2 ซอยจุฬาลงกรณ์ 62 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์ 0-2218-8147 โทรสาร 0-2218-8147 **E-mail: eccu@chula.ac.th**

ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน ทั้งนี้ข้าพเจ้าได้รับสำเนาเอกสารชี้แจงผู้เข้าร่วมการวิจัย และสำเนาหนังสือแสดงความยินยอมไว้แล้ว

ลงชื่อ..   ลงชื่อ..

(นายแพทย์วัชระ เอี่ยมรัศมีกุล)   (..)

ผู้วิจัยหลัก   ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ..

(..)

พยาน

Patient/Participant Information Sheet

Title of research project "Cost identification analysis of cervical cancer screening in Roi Et
     Province, Thailand"

Principle researcher's name Mr.Wachara Eamratsameekool **Position** Master Degree student

Office address Phanomphrai hospital, Roi Et Provincial Health Office

Home address 99 Mu 3, Tumbon Phanomphrai, Phanomphrai District, Roi Et Province 45140

Telephone (office) 043-591321 ext 102 **Telephone (home)** 043-590227

Cell phone 08-1872-1706 **E-mail:** wachara.e@gmail.com

Instruction

You are being invited to take part in a research project titled *"Cost identification analysis of cervical cancer screening in Roi Et Province, Thailand."* Before you decide to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and do not hesitate to ask if anything is unclear or if you would like more information.

This research project involves cost identification analysis of cervical cancer screening in Roi Et Province where both Pap smear and VIA are provided. The exact unit costs of both methods are unknown. Thus the objectives of the project are to explore the total cost and unit cost for each method. Targeted population is 17 public hospitals under the Ministry of Public Health administration. Inclusion criteria are hospitals with action plan and budget allocation for cervical cancer screening in fiscal year 2009. Exclusion criteria are hospitals without action plan or no budget allocation for cervical cancer screening in fiscal year 2009. This study divided the hospitals into three groups: first, one general hospital; second, four 60-bed hospitals; and third, twelve 30-bed hospitals. Samples from each group were randomly selected as follow: one for general hospital, two for 60-bed hospitals, and four for 30-bed hospitals. Data were collected by two trained research assistants and were recorded into research questionnaires. Action plans were

followed accordingly and budget allocation for providing the services was recorded. Staffs related to screening services were interviewed. Study results would benefit healthcare providers, healthcare managers who supported and provide financial supports, and local health policy makers. Researcher plans to disseminate research findings through study reports, scientific meeting, and organizational planning & evaluating meetings.

Participation to the study is voluntary and you have the right to deny and/or withdraw from the study at any time, no need to give reason, and there will be no bad impact such as budget loss or reduction to you. If you have any question or would like to obtain more information, the researcher can be reached at all time. If the researcher has new information regarding benefit on risk/harm, participants will be informed as soon as possible.

Information related directly to you will be kept confidentially. Results of the study will be reported as total picture. Any information which could be able to identify you will not appear in the report. This study will provide an appropriate compensation for time loss/inconveniences for your kind cooperation.

If you feel researcher does not perform upon participants as indicated in the information, you can report the incident to the Ethical Review Committee for Research Involving Human Research Subjects, Health Sciences Group 1, Chulalongkorn University (ECCU) at Institute Building 2, 4th Floor, Soi Chulalongkorn 62, Phyathai Rd., Pathumwan, Bangkok 10330, Thailand, Tel: 0-2218-8147 Fax: 0-2218-8147 E-mail: eccu@chula.ac.th

Informed Consent Form

At Provincial Health Office, Roi Et Province

Date ………………………………………

Code number of participant ……………………………………………

I who have signed here to participate in this research project Title "Cost identification analysis of cervical cancer screening in Roi Et Province, Thailand." Principle researcher's name is Mr.Wachara Eamratsameekool. Contact address is Phanomphrai hospital, Phanomphrai district, Roi Et Provincial Health Office, Telephone 043-514473.

I have **read** about rationale and objectives of the project, what I will be engaged with in details, risk/ harm and benefit of this project. The researcher has explained to me and I **clearly understand with satisfaction.** I willingly **agree** to participate in this project and consent the researcher to response to questionnaires and allow the researcher to record data into the form.

I have **the right** to withdraw from this research project at any time as I wish with no need to **give any reason**. This withdrawal **will not have any negative impact upon me.** Researcher has guaranteed that procedure acted upon me would be exactly the same as indicated in the information. Any of my personal information will be **kept confidential.** Results of the study will be reported as total picture. Any of personal information which could be able to identify me will not appear in the report.

If I am not treated as indicated in the information sheet, I can report to the Ethical Review Committee for Research Involving Human Research Subjects, Health Sciences Group 1, Chulalongkorn University (ECCU) at Institute Building 2, 4th Floor, Soi Chulalongkorn 62, Phyathai Rd., Bangkok 10330, Thailand, Tel: 0-2218-8147 Fax: 0-2218-8147 **E-mail: eccu@chula.ac.th**

I have signed hereby before the witness and I also have received a copy of information sheet and informed consent form.

Sign ………………..……………   Sign ………………..……………

(Wachara Eamratsameekool)   (………………………..………)

Researcher   Participant

Sign ………………..……………

(………………………..………)

Witness

Research timeline

Activities	September 2009		October 2009		November 2009		December 2009		January 2010	
Phase 1 Preparation										
Organize project management	x									
Develop research project materials		x								
Request for Ethical Review Committee approval prior to initiation		x								
Set up information system for data collection			x							
Prepare and train data collectors			x							
Design questionnaire and set up data tracking system for service statistics and questionnaires data			x							
Set up system to collect monitoring and evaluation data			x							
Letters to inform and schedule for visits to sampled hospitals							x			
Phase 2 Implementation										
Carry out data collection							x	x		
Carry out interviews							x	x		

Activities	September 2009		October 2009		November 2009		December 2009		January 2010	
Phase 3 Analysis and Reporting										
Collect and analyze data on costs and screening service coverage								X	X	
Analyze interview survey data									X	
Analyze costs									X	
Analyze programmatic lessons learned									X	
Prepare reports for all stakeholders									X	
Disseminate results to stakeholders									X	

Research Assistant Training

On 18th December 2009 at Roi Et Provincial Health Office, Thailand

List of participants

1. Wachara Eamratsameekool, Researcher

2. Piyalak Pakdisamai, Research assistant

3. Chuennapa Khomkhum, Research assistant

No.	Time	Detail	Trainer	Materials
1	08.00	Welcome and Introduction	Wachara Eamratsameekool	
2	08.30	Tools introduction	Wachara Eamratsameekool	Interview guidelines Cost identification table and recording form
3	09.00	Practice 1	Wachara Eamratsameekool	Interview guidelines Cost identification table and recording form
4	11.00	Summary 1	Wachara Eamratsameekool	
5	12.00	Lunch		
6	13.00	Practice 2	Wachara Eamratsameekool	Cost identification table and recording form
7	14.00	Summary 2	Wachara Eamratsameekool	
8	15.00	Action planning	Wachara Eamratsameekool	Action plan
9	16.00	Co-ordination and data processing	Wachara Eamratsameekool	
10	16.30	Closing		

แบบการสัมภาษณ์

เรื่อง "การวิเคราะห์ต้นทุนการคัดกรองมะเร็งปากมดลูก จังหวัดร้อยเอ็ด"

(Cost identification analysis of cervical cancer screening in Roi Et Province, Thailand)

คำแนะนำสำหรับการสัมภาษณ์ผู้ให้บริการ VIA/Cryotherapy

วันเดือนปีที่ทำการสัมภาษณ์: _____/_____/_____

โรงพยาบาล: _____

ประเภทโรงพยาบาล:

( ) โรงพยาบาลจังหวัด

( ) โรงพยาบาลชุมชน ขนาด ๖๐ เตียง

( ) โรงพยาบาลชุมชน ขนาด ๓๐ เตียง

เวลาเริ่มต้นทำการสัมภาษณ์: _____ น.

คำชี้แจง

กรุณาใช้แบบฟอร์มนี้ในการสัมภาษณ์ผู้ให้ข้อมูลแต่ละราย

ผู้สัมภาษณ์: อ่านข้อความให้การยินยอมต่อไปนี้ให้ผู้ตอบแบบสอบถามฟังก่อนเริ่มทำการสัมภาษณ์

สวัสดีค่ะ ดิฉันมาที่นี่ในนามของนายวัชระ เอี่ยมรัศมีกุล นิสิตระดับปริญญามหาบัณฑิต วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย เพื่อดำเนินโครงการวิจัยที่ ๑๑๘/๕๒ เรื่อง "การวิเคราะห์ต้นทุนการคัดกรองมะเร็งปากมดลูก จังหวัดร้อยเอ็ด " (Cost identification analysis of cervical cancer screening in Roi Et Province, Thailand) เรากำลังดำเนินการ สัมภาษณ์ เพื่อรวบรวมข้อมูลเกี่ยวกับต้นทุนการคัดกรอง สำหรับการป้องกันโรคมะเร็งปากมดลูกใน สถาน บริการต่างๆ ในจังหวัดร้อยเอ็ด เราจะขอสอบถามท่านเกี่ยวกับการให้บริการ VIA ร่วมกับการจี้เย็น ที่เรียกว่า การให้บริการในครั้งเดียว (Single Visit Approach - SVA) และการคัดกรองโดยวิธีเดิม คือ แป๊ปสเมียร์

เราต้องการทราบว่าโรงพยาบาลของท่านมีต้นทุนของการคัดกรองมะเร็งปากมดลูกเป็น เช่นใด และดำเนินการโดยผู้ใด เพื่อที่จะได้นำข้อมูล และบทเรียนที่ได้รับไปใช้ประโยชน์ร่วมกับ อำเภอและพื้นที่อื่นๆ ในการพัฒนาการป้องกันและควบคุมมะเร็งปากมดลูกต่อไป

ในฐานะผู้อำนวยการ โรงพยาบาล เราขออนุญาตท่านและบุคลากรที่เกี่ยวข้องได้ให้ข้อมูล ที่โรงพยาบาลแห่งนี้ เราจะขอบคุณมากหากท่านเข้าร่วมในการศึกษานี้ เนื่อง จากความคิดเห็นของ ท่านเกี่ยวกับการให้บริการนี้มีความสำคัญมาก คำตอบของท่านจะถูกเก็บเป็นความลับ และจะไม่มี

การบันทึกชื่อของท่านไว้ การสัมภาษณ์จะใช้เวลา ๖๐ นาที หากท่านมีคำถามระหว่างการสัมภาษณ์

ท่านสามารถถามได้ทันที และสามารถยุติการสัมภาษณ์ได้ทุกเวลา

ท่านยินดีเข้าร่วมในการศึกษานี้หรือไม่คะ?

      ผู้สัมภาษณ์ : ถ้าผู้ถูกสัมภาษณ์ยินยอมเข้าร่วมในการศึกษานี้ กรุณาทำเครื่องหมาย "x" ใน

ช่องว่าง และลงลายมือชื่อในบรรทัดที่อยู่ข้างใต้ หากผู้ถูกสัมภาษณ์ไม่ยินยอมเข้าร่วมในการศึกษา

ให้สิ้นสุดการสัมภาษณ์ทันที

ผู้ถูกสัมภาษณ์ยินยอมเข้าร่วมในการให้ข้อมูล

      ( ) ยินยอม

      ( ) ไม่ยินยอม **ยุติการสัมภาษณ์**

ลายมือชื่อผู้สัมภาษณ์:

_____

เวลาสิ้นสุดการสัมภาษณ์ (ชั่วโมง และนาที) _____

ข้อคิดเห็น/หมายเหตุ:

_____

_____

_____

Questionnaire

For the study "Cost identification analysis of cervical cancer screening in Roi Et Province,

Thailand"

Instruction for VIA/Cryotherapy provider interview

Date of interview: _____/_____/_____

Hospital: _____

Type of hospital:

( ) General or provincial hospital

( ) Community hospital 60-bed

( ) Community hospital 30-bed

Interview start time: _____ AM/PM.

Instruction

Please use this interview form for each interviewee

Interviewer: Read the following consent to interviewee before interview

Hello, I am here in the name of Mr.Wachara Eamratsameekool, a Master Degree student at the College of Public Health Sciences, Chulalongkorn University, for the research no. 119/52 under the title "Cost identification analysis of cervical cancer screening in Roi Et Province, Thailand." We will interview to collect data about cost of cervical cancer screening in hospitals in Roi Et Province. We would like to ask you about VIA and cryotherapy services under single visit approach (SVA) and conventional screening – Pap smear.

We would like to know how much your hospital cost for cervical cancer screening, and who are providing such services. The data and lesson learned will be used along with other districts and other areas for the improvement in cervical cancer prevention and control services.

If you are hospital director, we would like to ask for your and your staff permission to provide related data and information in this hospital. We thank you very much if you will participate in the study because your responses about the services are important. Your answers will be confidential and your name will not be recorded. The interview should take around 60 minutes. If you have any question during the interview, you can ask immediately and you can stop the interview at any time.

Would you like to participate in this study?

Interviewer: if interviewee agrees to participate in the study, please mark "X" in the space provided and signs your name on the line below. If the interviewee does not agree to participate, stop the interview immediately.

Interviewee agree to participate the study

( ) Agree

( ) Not agree, stop the interview

Interviewer signature:

_____

End time (hours, minutes) _____

Suggestion/note:

_____

_____

_____

Data Collection Form for Labor Cost

Hospital...   Group.............. Number of beds………………

Date of collection.....................................   Data collector...

No.	Code	Cost center name	Staff 1	Staff 2	Staff 3	Staff 4	Total	Ratio	Labor cost allocation
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									

Data Collection Form for Material Cost

Hospital.. Group.............. Number of beds………………

Date of collection..................................... Data collector...

No.	Cost center name	Medications	Medial supplies	Other supplies	Electrics, Buildings, transportation	วัสดุอาหาร	ค่าใช้สอยและวัสดุซ่อมแซม	วัสดุเชื้อเพลิง	สาธารณูปโภค	อื่นๆ
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										
14.										
15.										
16.										
17.										
18.										
19.										

Data Collection Form for Capital Cost

Hospital... Group.............. Number of beds………………

Date of collection................................... Data collector...

No.	Capital name	Code	Received date	Cost center	Cost per unit	Useful life	Depreciation
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							

Figure 7 Cost structure for Cervical Cancer Screening

VITAE

Name: Wachara Eamratsameekool, MD.

Date and Place of Birth: 12 October 1964, Phanomphrai, Roi Et, Thailand

Education credentials: Doctor of Medicine, Chulalongkorn University; 1987

Work Experience: Community Hospital Director

Current Position and Office: Preventive Physician, Roi Et Provincial Health Office, Roi Et 45140, Thailand