



**SEATCA**  
SOUTHEAST ASIA TOBACCO CONTROL ALLIANCE

**The Collaborative Funding Program for  
Southeast Asia Tobacco Control Research**

**A COMPARATIVE ANALYSIS  
BETWEEN PRESENT AND  
FUTURE TOBACCO-  
RELATED HEALTH COSTS  
IN THAILAND**

**Sathirakorn Pongpanich, Ph.D.**

**Financial support from  
The Rockefeller Foundation and  
Thai Health Promotion Foundation (ThaiHealth)**

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Supported by  
**Southeast Asia Tobacco Control Alliance (SEATCA)**  
Under The Collaborative Funding Program for Tobacco Control Research

Financial support from  
**Thai Health Promotion Foundation (ThaiHealth)**  
and **The Rockefeller Foundation**

**December 2006**

## ACKNOWLEDGEMENTS

The research team is indebted to the Thai Health Promotion Foundation (ThaiHealth) and The Rockefeller Foundation and for the support offered to this study. We wish to extend our thanks to Dr. David Collins, Dr. Helen Lapsley and Dr. Hana Ross for their comments and suggestions to this report. The researchers would like to express our sincere gratitude to the directors of the hospitals below for providing us with all the necessary information for this study and survey:

1. Chiang Mai Province: Maharaj Hospital (Government) and McCormic Hospital (Private)
2. Khon Khen Province: Sri Nakin Hospital (Government) and Rajapruk Hospital (Private)
3. Chon Buri Province: Chon Buri Hospital (Government) and Bangkok-Pattaya Hospital (Private)
4. Songkhla Province: Prince of Songkhla University Hospital (Government) and Bangkok-Had Yai Hospital (Private)
5. Bangkok Area: Chulalongkorn University Hospital (Government) and Bangkok Hospital (Private)

Special thanks to the officials at the National Statistical Office, the Department of Business Economics, Thailand Tobacco Monopoly, the Customer Department, the Excise Department, and the Office of the National Economic and Social Development Board, who provided data and information that were crucial to the completion of this study. Finally, the author is very grateful to Dr. Hana Ross from the University of Illinois at Chicago for giving comments and suggestions to this research study, and Ms. Bungon Ritthiphakdee and Ms. Menchi G. Velasco both of Southeast Asia Tobacco Control Alliance (SEATCA) for their guidance and assistance.

## EXECUTIVE SUMMARY

This study provides policy-makers with a long-term health care cost impact analysis comparing individual and government health care cost of smoking-related diseases to government tobacco-related revenue based on data collected between September 2003 and February 2004.

The researcher calculated the health care cost (both direct and indirect) of 3 major diseases, (lung cancer, coronary heart disease, and chronic obstructive pulmonary disease); these diseases are mostly attributable to tobacco consumption. The results from this study confirmed that health care cost of smoking-related diseases is increasing. Therefore, both individuals and government will have to bear this burden. In reality, there are many more diseases caused by tobacco consumption that will have to be included in the calculation of health care cost of smoking-related diseases (SRD).

The cost calculated in this study should be considered underestimated. Even though it is underestimated, the study showed trends that the health care cost of these 3 diseases is higher and exceeds the government revenue from tobacco products in the year 2006 through 2007 and is expected to continue increasing in the future. This study considered partial social cost which eventually will add more to the health care cost and societal expenses. The study clearly shows that government revenue from taxing tobacco consumption is not sufficient to cover all smoking-related diseases. The Thai government, given its limited budget and numerous health and other obligations (such as the recent subsidization of fuel subsidies), has few options in terms of what it can tax to supplement the tax on tobacco products. In addition, the results from this study are intended to encourage the government to tax more tobacco to cover the costs associated with smoking and, at the same time, to pinpoint the financial problems that might occur from the consequences of tobacco consumption and how the government should enforce strong policy and planning for future well-being of the Thai population.

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## INTRODUCTION

Although Thailand has been considered a leader in tobacco control because of its comprehensive laws and taxation system, Thailand's policy only developed after its General Agreement on Tariffs and Trade (GATT) dispute with the United States in 1990. The GATT panel concluded that Thailand was discriminating against foreign cigarettes and it would have to open its market. Subsequently, the government passed the Tobacco Products Control Act and the Non-Smokers' Health Protection Act in 1992. These two laws, among other things, banned the use of all forms of advertising and promotion, criminalized cigarette sales to minors, required health warnings on packaging, designated smoke-free public spaces, and mandated full ingredient disclosure by brand of cigarette. Furthermore, the government has also increased the excise tax three times, allegedly for health reasons.

Thailand has not had as much success in implementing its policy as it has had in formulating it. The task of smoking reduction becomes more complicated now because Thailand must deal with a faltering economy, increasingly aggressive tobacco companies, and tariff reductions. Therefore, the government must take some concrete steps to ensure that Thais will not succumb to the temptation of smoking.

In order to facilitate government action in correcting weaknesses obstructing effective implementation of existing tobacco policies, this study demonstrated a comparative analysis between current and long-term tobacco-related health care costs, both direct and indirect, which are and will be borne by the individual and government and the revenues generated by the Thai Tobacco Monopoly (TTM), taxes and international tobacco trade income.

The Thai government has a vested interest in controlling tobacco consumption for 2 reasons. First, the government pays for most medical services because the Constitution entitles citizens to universal access to health care. Second, the country sacrifices its own development due to losses in both human and natural resources. Thus, there are both immediate and long-term costs associated with tobacco. As some of these are not easily quantifiable, this research addresses major costs that can be expressed in monetary terms. The Health Systems Research Institute estimates that it costs 7 billion baht to treat tobacco-related diseases each year. Because the effects of smoking are long-term, more people become ill from the 27 smoking-attributable diseases every year, and medical costs continue to increase as the smoking population ages. This means a strain on public funds because Thais are legally entitled to health care. Not only does the government own the most hospitals and employ the most medical personnel, but it also provides free health care for the underprivileged. Low-income earners, veterans, the elderly, the physically disabled, and children under 12 qualify for care if they meet the means-test standard. In addition, the government subsidizes treatment for those who do not qualify for free care. The government is especially burdened by smoking-related disease because smokers tend to fall within the lower income brackets.

In addition to the money the government sacrifices now, it also sacrifices money in the form of lost production in the future. There is a strong positive correlation

between a society's economic performance and health because ill health compromises the labor force and increases the ratio of dependents to productive adults.

However, these costs were not weighed against a total tobacco tax and Thai Tobacco Monopoly contribution of 39.2 billion baht to the national budget in 1997. In addition, tobacco also helps the economy by creating jobs; over 500,000 farmers cultivated tobacco and over 6,000 people were employed by the Thai Tobacco Monopoly (Source: 1987-1997 Annual Reports of the Thai Tobacco Monopoly).

As stated above, cigarettes carry both benefits by creating jobs and costs for individuals and society. The most significant cost of cigarette smoking is the cost of lost lives and productivity from disease and premature deaths from tobacco use, as well as the associated health care costs borne by patients and the government (net of health care costs that smokers would have incurred from other diseases if they had not smoked). There are also the costs associated with exposure to second-hand smoke, and the opportunity cost of using scarce income on cigarettes rather than on food or other necessary things. Fire damage from lit cigarettes can also be substantial and tobacco growing can have environmental costs through deforestation, pesticide use and soil degradation. Epidemiological studies in many countries indicate that cigarette smoking directly or indirectly causes many diseases, both by the substances in cigarettes and by destroying the body's resistance and increasing susceptibility to becoming ill. Thousands of studies in countries around the world have found that habitual smokers face especially heightened risk in three important groups of diseases. These are malignant neoplasms, cardiovascular diseases and respiratory diseases (Kunaluck, 1996). Details of these diseases are summarized in the Appendix section.

Smoking has also been found to be an important cause of other diseases. Data from the numerous studies around the world indicated that women's exposure to smoking and smoke poses grave risks to their own health and to their babies, before and after birth. Spontaneous abortion, preterm births, low birth-weight full-term babies, and foetal and infant deaths all occur more frequently among mothers who smoke during their pregnancies (US Department of Health And Human Services 2001-2003). In men, erectile dysfunction is strongly associated with smoking (Jeremy 1998, 2000).

In Thailand, the results of many studies also point to a relationship between cigarette smoking and disease. Based on the statistics of lung cancer patients who received treatments between 1967 and 1999, concluded that there was a significant relationship between smoking and lung cancer (Theera 2000). Around 78% of his 1,750 lung cancer patients were smokers, most of them heavy smokers. The results of Sirikunya *et al.* (1999) also pointed to similar conclusions. Cigarette smoking is highly related to laryngeal cancer. Around 85% of laryngeal cancer patients were smokers. Table 1 provides the numbers of deaths and death rates for some of the main smoking-related diseases in Thailand, from 1999 to 2003.

**Table 1 Number of deaths and death rate per 100 000 population, by smoking-related disease, Thailand**

Disease	1999		2000		2001		2002		2003	
	Number	Rate								
1. Malignant neoplasm of trachea, bronchus and lung	2913	4.9	2936	4.9	3500	5.7	4220	6.9	5486	8.9
2. Malignant neoplasm of lip, oral cavity and pharynx	651	1.1	404	0.7	574	0.9	675	1.1	762	1.2
3. Malignant neoplasm of cervix uteri	380	0.6	318	0.5	408	0.7	672	1.1	871	1.4
4. Malignant neoplasm of stomach	388	0.6	245	0.4	365	0.6	458	0.7	648	1
5. Malignant neoplasm of bladder	105	0.2	74	0.1	84	0.1	146	0.2	202	0.3
6. Malignant neoplasm of larynx	98	0.2	62	0.1	59	0.1	125	0.2	171	0.3
7. Malignant neoplasm of pancreas	148	0.2	89	0.1	202	0.3	523	0.8	479	0.8
8. Other heart disease	42962	71.9	40556	67.1	36355	59.4	25695	41.7	13406	21.7
9. Cerebrovascular disease	6297	10.5	5962	9.9	4283	7	6631	10.8	8260	13.4
10. Hypertensive disease	3053	5.1	2054	3.4	2029	3.3	2987	4.9	3403	5.5
11. Acute rheumatic fever and chronic rheumatic heart disease	554	0.9	561	0.9	267	0.4	165	0.3	51	0.1
12. Ischaemic heart disease	2784	4.7	1870	3.1	2199	3.6	4849	7.9	6251	10.1
13. Pneumonia	6859	11.5	5532	9.1	5522	9	8645	14	8334	13.5
14. Respiratory tuberculosis	3445	5.8	2443	4	3150	5.2	4701	7.6	5941	9.6

Source: Health Statistic Department, Ministry of Public Health, 2003

Cigarette smoking has a significant cost for smokers, their families and society. The cost of smoking can be both tangible and intangible. In this study, only the tangible components were measured. The costs of smoking-related diseases can be classified into two types:

- *direct cost* such as the health service cost, treatment cost, transportation cost to hospital, food and medical cost
- *indirect cost* in this study included forgone income that patients would have earned if they had worked more efficiently, or had not died early because of the illness.)

The human capital approach was used here to estimate the economic cost of diseases. The human capital principle would be applied to the present value of the expected lifetime income stream of a person.

## **OBJECTIVES OF THE STUDY**

### **General Objective**

The objective will be to provide policy-makers with a long-term health care cost impact analysis comparing individual and government health care cost of smoking-related diseases to government tobacco-related revenue.

### **Specific Objectives**

1. To estimate the current and future individual and government expenditure (5 years: 2003-2007) on the cost of tobacco consumption-related diseases (lung cancer, coronary heart disease, and chronic obstructive pulmonary disease)
2. To estimate the government tobacco-related revenue (5 years: 2003-2007).
3. To determine past trends (years: 1999-2002), and current trends based on existing data, in order to project these into the future to determine potential government financial liability in the health sector

### **Hypothesis and Specific Aim**

Hypothesis: Both current and future tobacco-related health care costs were substantially greater than government tobacco-related revenue.

Specific aim of this study was to provide the government or policy-makers with all the necessary information in order to safeguard the country's future financial situation and to enhance effective implementation of existing tobacco policies.

**Study Time Period:** July 2003 - August 2004

## DATA SOURCES AND METHODOLOGY

The study design employed in Thailand was *prospective and retrospective* and included method of *quantitative cost analyses (Direct and Indirect Cost Analysis)* which collected and studied primary data from surveys and secondary data from extant records from the Ministry of Public Health, Ministry of Finance, the Thai Tobacco Monopoly, public and private hospitals, academic institutions, foreign agencies, foundations, existing research and literature among other sources. This study examined the past and projected future trends to determine potential government financial liability in the health sector.

**Study Population and Data Collection:** The study covered the government health care expenditure on tobacco-related diseases for the Thai population. At the same time, the government revenue which was generated from tobacco products and consumption, is calculated and compared with the expenditure above. Data on the cost of treatments of tobacco-related diseases, and outpatient visit for tobacco-related diseases, disease specific inpatient costs per day and outpatient cost per visit and smoking attributable fractions and etc was used. Data on tobacco-related revenue was obtained from the Ministry of Finance, the Thai Tobacco Monopoly, academic institutions, foreign agencies, foundations, existing research and literature among other sources.

### Primary Data Gathering

**Questionnaire and Interview Surveys** on individual out of pocket cost of treatment of tobacco consumption-related diseases (lung cancer, coronary heart disease, and chronic obstructive pulmonary disease) were conducted in 5 regions around Thailand and in each region, the survey was conducted in both government and private hospitals which can provide all the treatment services for these 3 diseases. Therefore, this study selected one of each of the biggest hospital (number of beds) for both government and private hospitals in each region to represent and provide tobacco consumption-related disease cost information of Thailand.

- The North: Chiang Mai Province

Maharaj Hospital (Government) and McCormic Hospital (Private)

- The North East: Khon Khen

Sri Nakarin Hospital (Government) and Rajapruck Hospital (Private)

- The East: Chon Buri

Chon Buri Hospital (Government) and Bangkok-Pattaya Hospital (Private)

- The South: Songkhla

Prince of Songkhla University Hospital (Government) and Bangkok-Had Yai Hospital (Private)

- Bangkok Area

Chulalongkorn University Hospital (Government) and Bangkok Hospital (Private)

**Time Line for Data Collection:** September 2003-February 2004

### **Criteria to Recruit Participants for this Purposive Sampling Study:**

1. Patients who were ill with lung cancer, coronary heart disease, and chronic obstructive pulmonary disease with the history of tobacco smoking for the past 5-10 years and/or diagnosed by the physician that the cause of having diseases was tobacco consumption.
2. Regularly visited outpatients in the last one year
3. Aged 25 and older
4. Not handicapped
5. Willingness to participate in this study

### **Sample Size**

In each region and each hospital, the information was gathered for 3 categories of diseases (lung cancer, coronary heart disease, and chronic obstructive pulmonary disease) with the sample size of 30/disease/hospital by purposive sampling. Therefore, one region consisted of 180 cases and the total sample size was 900 cases.

Research Tools: Questionnaire and interview survey was divided into 3 main sections (Appendix).

Section 1: General Information: personal information, socio-economic information, etc.

Section 2: Health Information: Information on tobacco smoking and smoking-related diseases

Section 3: Individual Out of Pocket Cost of Treatment of Diseases and Related Costs

**Medical direct cost:** drugs, lab tests, x-ray, doctor fee, operation fee

**Non-medical direct cost:** Food, travel cost, accommodation cost

**Indirect cost:** forgone earning: the income or the output that would have been generated if the patients and/or relatives had not stopped working as a result of diseases (minimum wage times hours or days lost from work for patients and/or relatives)

The questionnaire and interview survey, in each site, were conducted by local research assistants who collected information and interviewed patients. At the same time, local researcher obtained additional information of each patient from medical records (in and outpatient) for the past year. Medical staff of the hospitals assisted in identifying actual cost of each visit to the hospital of each patient. All relatives who were accompanied the patients were interviewed after the patients received services from both in and outpatient departments.

After collecting all of this information, researchers analyzed and calculated direct medical cost, direct non-medical cost and indirect cost from both in and out patients of each disease by finding the mean values of each cost category and come up with estimated health care cost of each disease per patient per year.

## **Secondary Data Gathering**

In order to analyze the potential government financial liability by looking at the difference between individual and government expenditure on tobacco-related health care cost and the government revenue from tobacco-related consumption:

- The researchers examined thoroughly the information on tobacco generated revenue from the Thai Tobacco Monopoly, Excise Department, Ministry of Commerce and the National Statistic Bureau.
- Reviewed existing information from literature, articles, Thailand National Health Expenditure Account (years 1997-2002) and from other sources above (include direct cost of treatments and, in so far as to measure, indirect cost)

**Data Management and Analysis:** quantitative analysis represents the basis for the Cost/Income Comparison analysis and Cost analyses (direct and indirect) which will subsequently be performed to show tobacco income in relation to smoking-related health expenditures and production losses. Finally, an Economic Analysis will be done to determine present and future trends. In addition, STATA statistical software package was used to analyze and predict the trends for this study.

## LITERATURE REVIEW

### Health Care Cost of Lung Cancer

Cancer is the leading cause of death in Thailand. Several cancers can be prevented by a nationwide anti-smoking campaign. (Vatanasapt, Sriamporn *et al.* 2002) Relationships between cervical cancer and risk factors were investigated in Northeastern Thailand. Those whose partners smoke faced an increased risk of developing severe cervical cancer. Increased odds ratios were observed when the partner had smoking history both at present (3.31) and in the past (3.36). Much attention should be paid to the presence of other risk factors such as sexual behaviors and smoking habits in the prevention of cervical cancer in this region. (Settheetham-Ishida, Singto *et al.* 2004). Lung cancer (124,000), heart disease (111,000), and the chronic lung diseases of emphysema, bronchitis, and chronic airways obstruction (82,000) are responsible for the largest number of smoking-related deaths in the USA. (CDC, 2002) The risk of dying from lung cancer is more than 22 times higher among men who smoke cigarettes, and about 12 times higher for women compared to non-smokers. (Novotny TE and Giovino GA,1998) Cigarette smoking increases the risk for many types of cancer, including cancers of the lip, oral cavity, and pharynx; esophagus; pancreas; larynx (voice box) hing; uterine cervix; urinary bladder; and kidney. (US Department of Health and Human Services, 1989) Pipe smoking and cigar smoking increase the risk of dying from cancers of the lung, esophagus, larynx, and oral cavity. (US Department of Health and Human Services, 1989) Smokeless tobacco use increases the risk of developing oral cancer. (US Department of Health and Human Services, 1986)

A study by Janjareon, Wattana, (1988) conducted research on the economic loss suffered by cancer patients in order to estimate the loss to the economy caused by lung cancer. As Table 1 shows that the number of lung cancer cases is growing alarmingly in Thailand. Most are caused by smoking. The human capital concept was used and the cost was evaluated by using the prevalence approach. Records of patients from the Central Chest Hospital, Chulalongkorn Hospital, Ratchavitee Hospital and the National Cancer Institute of Thailand between 1985 and 1986 were examined. Both inpatients and outpatients who had lung cancer at different stages were covered in the study.

The study divided the economic loss into two categories: direct economic loss including the treatment cost of inpatients and outpatients; and indirect economic loss which calculated the loss in future income due to the early death of the patients. As some information was not available, the cost could not be estimated separately for each stage of lung cancer: only the total cost of treatment was determined.

The study also collected information on lung cancer patients from the Statistics Department of the Ministry of Public Health. According to this information, in 1985 there were 22,313 patients with lung cancer, of whom 1,885 were inpatients and 20,428 outpatients. Of these, 1,093 of the patients - around 5% - died during the year, earlier than the normal life expectancy.

The study found that the average health care cost for inpatients per person per day was baht 1,332.24. The average hospital stay for each person was 19.39 days, and the average cost for each patient per case was baht 25,600.24 (US\$640.00): the average age of the patients was 59 years. Outpatients would see a doctor 4.53 times in one year. The average health care cost per outpatient visit for medicines was baht 326.24 (US\$8.16). The average cost per person per case was baht 1,777.60 (US\$44.44), and the average age of the outpatients was 61 years old. Since most of these people are at retirement age, this loss might be overestimated (indirect economic loss calculated the loss in future income due to the early death of the patients. The people in this study were not in the working age group, therefore, indirect economic loss of this group should not be too high).

The direct economic loss in one year was found by calculating the number of inpatients and outpatients who received treatment within the year and multiplying it by the cost per patient. The study showed that the health care costs for inpatients was equal to baht 48,256,452 (US\$1,206,411.30) per year. The health care costs for outpatients was equal to baht 35,992,845 (US\$899,821.12) per year. This adds to total (gross) direct economic loss for the year of baht 84,249,297 (US\$2,106,232.42).

Indirect economic loss was also estimated. Data were not available to estimate the opportunity cost of time lost due to transportation and treatment, or the income lost due to illness of patients or time spent caring for them by relatives. The income forgone due to premature death was estimated by multiplying the total time lost in years by average annual income (and applying a 10% discount rate). The age range of the patients was between 25 and 64 years old. The loss of years was calculated by each age group, subtracting the average age at death from the life expectancy of that age group. The annual economic loss from early death was calculated at baht 201,692,305 (US\$5,042,307.62).

In summary, the total economic loss from lung cancer was estimated to be at least baht 286 million (US\$7.15 million) in 1985. This consisted of health care cost for inpatients of baht 48 million (US\$1.2 million), health care costs for outpatients of baht 36 million (US\$ 0.9 million) and loss of expected future income due to early death of baht 202 million (US\$5.05 million).

A study by Wanchai *et al.* (1991) focused on the treatment cost of smoking-related heart and lung diseases such as lung cancer, coronary heart disease and chronic obstructive pulmonary disease (COPD) caused by smoking. The human capital principle was also used in this study and the cost was evaluated using the prevalence approach. The records of lung cancer, coronary heart disease and COPD patients from the Srinakarint Hospital and Khon Kaen Hospital Center between 1989 and 1991 were examined. Full records of 540 patients were used; 90 patients were selected for each disease from each hospital, and were then divided into 3 categories: first stage, middle stage and final stage. An invitation letter was sent to 464 of the patients for interviews, and 259 or 56% of the patients responded. Based on the interviews with the patients or their relatives, it was found that 75% of the patients smoked.

The 3 categories were defined as follows:

- first stage: outpatients who came for treatment to the outpatient department at least three times a year.

- middle stage: patients treated as inpatients
- final stage: inpatients who were treated in intensive care.

The study divided the cost into direct cost, indirect cost and the cost of patients using clinic care and medicines from drug stores. Direct costs included health care services, beds, medical supplies and cost of operations. Indirect cost was based on the number of days the patients or family members were absent from work as a result of the illness.

The study showed that the average direct cost for lung cancer patients at each stage was baht 5,777.85 (US\$144.45) per person per year. The average direct cost for coronary heart disease patients at each stage was baht 4,186.58 (US\$104.66) per person per year, and the average direct cost for COPD patients at each stage was baht 16,388.03 (US\$409.70) per person per year. Therefore, the average direct cost for these 3 diseases at each stage was baht 8784.41 (US\$219.61) per person per year.

Based on interviews with patients and their relatives, the cost of medications to the patients was estimated. The 3 diseases were evaluated together. The average cost of medicines that the patients bought from pharmacies was baht 386.70 (US\$9.67) per person per year. The average cost of medicines the patients bought at the clinics was baht 277.90 (US\$6.95) per person per year. These add to a total average cost for medications of baht 664.60 (US\$16.61) per person per year.

The cost of absence from work was also estimated from interviews with patients and their relatives. The 3 diseases were evaluated together. The average number of days of absence of the patients or their relatives was 47, with an average loss in income per day of baht 116 (US\$2.90). Therefore, the average indirect cost was baht 5,452 (US\$136.30) per person per year.

Thus, the average total cost for the patients of these 3 smoking-related diseases was equal to baht 14,901 (US\$372.52) per person per year. This included the average direct cost of the treatment of the 3 diseases at each stage (baht 8,784.41 or US\$219.61), out-of-pocket spending on medicines (baht 664.60 or US\$16.61) and lost income (baht 5,452 or US\$136.30).

The prevalence of lung cancer in Thailand among men is 25 per 100,000 and for women is 12 per 100,000. Therefore, the approximate number of people with lung cancer in Thailand at the time of the study was 6,750 men and 3,300 women thus totaling 10,050 persons. The study found that 74.6% of the patients with one of the 3 diseases were smokers. Therefore, at the time of the study, there would have been approximately 7,500 smokers with lung cancer. As the average cost of the patients with the three diseases was about baht 15,000 (US\$375) per person per year, the annual loss from lung cancer of smokers was about baht 112,500 000 (US\$2,812,500) per year. Adding the other 2 diseases, the average cost was equal to baht 1,274,810,352 (US\$31,870,258.80) per year.

The study by Theera (1994) attempted to estimate the economic loss from lung cancer caused by smoking. The human capital principle was used in this study, and the incidence approach was used to estimate the cost of treatment and the lung cancer

patients' opportunity cost of work. In addition to this, the study evaluated the cost of smoking before illness.

Theera stated that lung cancer was the second most prevalent cancer found in males. The ratio of lung cancer patients to all cancer patients had increased from 4.8% in 1971 to 12.5% in 1990. Based on this trend, in 1993 there would have been 10,000 new lung cancer patients. The probability of these patients' recovering or living more than five years was only about 3.6%. Among the lung cancer patients in the study, 72% were heavy smokers (more than 20 cigarettes a day for at least 20 years), 6% were light smokers and 22% were non-smokers. Thus, 7200 heavy smokers and 600 light smokers were predicted to become new lung cancer patients in 1993.

The total lifetime cost of smoking for all 7,800 smokers was estimated at baht 2,233,798,000 (US\$55,844,950). Heavy smokers averaged just over 24.8 cigarettes per day, and 36.6 years of smoking. Light smokers smoked half the number of cigarettes, but for the same average number of years. At 1993 prices (baht 0.85 or 2 american cents per cigarette), the lifetime cost of cigarettes of heavy smokers and light smokers was estimated to be around baht 297,840 (US\$7,446) and baht 148,920 (US\$3,723) per person, respectively. With regard to income loss caused by illness, lack of data hampered an estimate. The study used the average annual income of a middle level government official in that year, baht 180,000 (US\$4,500), as the average income of the patient. Thus, the total income loss of 10,000 patients (included both smokers and non-smokers) was equal to baht 1,800,000,000 (US\$45,000,000) per year. Using the average income of a middle level government official as a proxy for the smokers' average income could bias the estimate up or down. On the one hand, the income of government officials is generally lower than market rates. On the other hand, smokers are generally from the lower-income groups. And the ages of officials at the average government salary level may not correspond well to the age of lung cancer sufferers.

The study also estimated the medical cost using selected patients in Siriraj hospital from September 1988 to December 1993 (108 admissions) as the sample. The average medical cost was around baht 300,000 (US\$7,500) per person. This cost was for a public hospital, which was cheaper than a private one. The study analyzed the cost by method of treatment. The breakdown by type of care and average cost per case was as follows: 2% of patients were treated by surgical methods (baht 40,000 per case or US\$1,000), 7% by surgery and adjunctive treatment (typically chemotherapy) (baht 340,000 per case or US\$8,500), 60% by chemotherapy and radiation (baht 300,000 per case or US\$7,500), and the remaining 31% received supportive treatment (baht 150,000 or US\$3,750). The total medical cost was equal to baht 2,511,000,000 (US\$62.775 million).

Kunaluck (1996) attempted to estimate the economic cost of lung cancer caused by smoking using both the human capital and the willingness to pay principles. A survey was conducted to collect information on the social and economic backgrounds of lung cancer patients, their smoking behavior, their willingness to pay, and hospital data including medical and material costs. The sample consisted of 288 patients from Siriraj Hospital and 78 patients from the National Cancer Institute who were selected by stratified random sampling.

The cost of lung cancer was estimated per incident, including cost since the beginning period of illness until recovery or death. Two categories of direct costs were collected: cost of treatment and transportation cost. Treatment cost included medical costs of baht 21,330 (US\$533.25) per person, labor costs of baht 6,369 (US\$159.22) per person, materials costs of baht 3,044 (US\$76.10) per person, equipment costs (i.e. depreciation) of baht 53 (US\$1.32) per person, and imputed building costs of baht 273 (US\$6.82) per person and land rent of baht 261 (US\$6.52) per person. Transportation costs for patients were baht 3,571 (US\$89.27) per person, and for patients' relatives were baht 823 (US\$20.57) per person. The total direct cost was baht 35,724 (US\$893.10) per person. The indirect cost consisted of baht 8,251 (US\$206.27) plus baht 3,030 (US\$75.75) per person for the opportunity cost of lost time spent by patients and by their relatives during transportation and treatment, baht 6,126 (US\$153.15) per person in income loss of patients and baht 1,303 (US\$32.57) per person income loss of patients' relatives. Thus, the total indirect cost was baht 18,710 (US\$467.75) per person.

From the results above, the annual cost of lung cancer was estimated to be baht 54,434 (US\$1,360.85) per person. The study also calculated the economic loss caused by lung cancer. From the value of cost in 1994, the value of cost in 1995 could be calculated (using an 11.5% rate of return). Assuming that there were 10,000 patients in 1995, there would be an economic loss of around baht 9,300 million (US\$232.50 million).

The differences in the direct and indirect costs reported by the studies in Table 2 reflect their different approaches. Wattana and Wanchai used the prevalence approach, multiplying the number of patients by cost in one year. Theera and Kunaluck evaluated cost using the incidence approach, multiplying the number of new patients by the cost since the beginning of the illness until recovery or death. The advantages of the prevalence approach are that it has lower research costs and is faster than the incidence approach. The disadvantage is that it does not capture costs of chronic diseases beyond the year under study. However, the incidence approach requires a reliable estimate of the number of new lung cancer patients who get the disease each year, which may be problematic.

**Table 2 Summary of cost associated with lung cancer studies in Thailand**

Year of study	Title	Author	Sample size (persons)	Average direct cost (baht/person /year)	Average indirect cost (baht/person/ year)
1988	Economic loss in cancer patients	Wattana		25 600.24 <sup>a</sup> 1 777.60 <sup>b</sup>	184 530.92
1991	Determining the cost of treatment for smoking-related heart and lung diseases	Wanchai et al.	540	5 777.85	5 452.00
1994	Cigarette smoking-lung cancer: life and economic loss	Theera	108	300,000	180,000
1996	Economic loss assessment of lung cancer caused by smoking	Kunaluck	366	35,724.00	18710.00

source: Various studies as noted in table, HNP Discussion Paper No 15, WHO.

Note: a: inpatients b: outpatients. Indirect costs calculated over lifetime, discounted at 10%, 1 US\$ is baht 40

The cost definitions of each study also differ. In Wattana's study, the health care cost consisted of the medical cost as direct cost, and forgone earnings due to early death as indirect cost. In Wanchai's study, the health care cost included the medical cost as direct cost, income loss from work absence as indirect cost, and the cost to patients of clinic care and pharmacy-bought medicine. In Theera's study, the health care cost included the medical cost as direct cost and income loss from work absence as indirect cost. In Kunaluck's study, the direct cost included medical cost, labor cost, material cost, equipment cost, building cost and land rent. The indirect cost consisted of the opportunity cost of time loss due to transportation and the treatment process, income loss from the illness, and income loss of patients' relatives. Kunaluck's study also estimated the forgone earnings resulting from premature lung cancer mortality.

The data used in the studies of Wattana, Wanchai, and Theera tended to underestimate cost because they were collected from public hospitals, which are generally subsidized by the government. Kunaluck had more detailed cost information, such as medical cost and material cost, and thus reflected the cost better. Wanchai's study estimated the number of lung cancer patients attributable to tobacco use as the fraction of all lung cancer patients in Thailand who smoke. This method can overestimate cost because smoking is not the only cause of lung cancer. Population attributable risk factors - the fraction of disease cases that can be attributed to smoking (or other risk factors) have been estimated for some countries, and could be used instead.

### **Health Care Cost of Coronary Heart Diseases**

Coronary Heart Disease and Cardiovascular Disease: In 1985, male and female employees of the Electricity Generating Authority of Thailand took part in a cardiovascular risk factor survey. Vascular diseases were the most frequent cause of death during follow-up (n = 46), and were positively associated with baseline smoking. (Sritara, Cheepudornwit *et al.* 2003) The International Collaborative Study of Cardiovascular Disease in Asia (InterASIA) estimated the prevalence and distribution of cardiovascular disease risk factors in the general population of both China and Thailand. The study provides important information on the current prevalence and control of both cardiovascular disease and its risk factors in the region. (He, Neal *et al.*, 2004) The study demonstrates risk factors for stroke in Thai patients at King Chulalongkorn Memorial Hospital. One of the risk factors for stroke with their relative risks was current smoking. (Piravej and Wiwatkul, 2003) Cigarette smoking causes reduced circulation by narrowing the blood vessels (arteries). Smokers are more than 10 times as likely as non-smokers to develop peripheral vascular disease. (Fielding JE, 1998) and approximately doubles a person's risk for stroke. (Novotny TE and Giovino GA, 1998) Cigarette smokers are 2-4 times more likely to develop coronary heart disease than non-smokers. (US Department of Health and Human Services, 1989) and a two- to threefold increased risk of dying from coronary heart disease. (Novotny TE and Giovino GA, 1998)

A study by Wanchai was conducted in 1991 on the treatment cost for smoking-related heart, chronic obstructive pulmonary disease (COPD) and lung diseases. The estimated average direct cost of coronary heart disease was baht 4,186.58 (US\$104.66) per person per year while the average direct cost of these three diseases

caused by smoking was baht 8,784.41 (US\$219.61) per person per year. The average cost of patients using clinic care and drug store medicines was baht 664.60 (US\$16.61) per person per year. The average indirect cost (absence from work) of these three diseases caused by smoking was baht 5,452 (US\$136.30) per person per year.

Although the prevalence of coronary heart disease in Thailand was not available, the death rate of heart disease was 50 per 100,000 persons. The study assumed that the death rate for heart disease meant the death rate by coronary heart disease. So the number of those who died by coronary heart disease was estimated to be 27,250 persons. The study showed that 75% of patients with one of the three diseases are smokers. Thus, there were 20,328 coronary heart disease patients in 1991 who were smokers. The average cost of these three diseases caused by smoking was baht 14,901 (US\$372.52) per person per year (included: direct cost, indirect cost and cost of patients using clinic care and pharmacy-bought medicine). So the cost of coronary heart disease patients was baht 302,907,528 (US\$7.573 million) per year.

Jayanton *et al.* in 2001 estimated expenditure and quality of life lost due to chronic obstructive pulmonary disease (COPD) and coronary heart disease caused by smoking. The study population included male and female patients with a clinical diagnosis of COPD or coronary heart disease who had smoked for at least five years (in the case of coronary heart disease) or ten years (in the case of COPD) and had attended hospitals as outpatients or were admitted as inpatients during the study period. The comparison group comprised the people who accompanied patient to hospitals who did not have any chronic diseases or disabilities (patient's relatives). They were matched with the patients according to sex, age and place of residence. Data were collected between June and December 1998, using a standard questionnaire and records containing data on personal and socio-demographic characteristics, history of smoking and of the disease, direct and indirect medical cost and other indirect costs. The direct medical cost included medical cost, materials cost, X-ray cost, laboratory cost, service cost and surgery cost. The direct non-medical cost included food cost, traveling cost and accommodation cost. The indirect cost was the income loss of patients and relatives due to illness. An instrument developed by the WHO to assess quality of life (WHOQOL-BREF) was used to measure each subject's assessment of their quality of life. Each patient's expenses and the quality of life lost compared to the comparison group were analyzed by various statistics. Multiple regression was also used in a multivariable analysis to adjust for relevant variables.

In the above study, the average direct medical costs of both coronary heart disease and COPD were calculated at baht 13,265.28 (US\$331.63) per person per year. The direct non-medical costs were baht 1,002.48 (US\$25.06) per person per year. The total direct cost of treatment associated with coronary heart disease that was estimated by using the geometric mean approach was baht 15,063.24 (US\$376.58) per person per year while the total direct costs of the comparison group were baht 284.28 (US\$7.10) per person per year. The indirect costs of treatment associated with coronary heart disease were estimated to be baht 669.36 (US\$16.73) per person per year, while the indirect costs of the comparison group were baht 24.48 (US\$0.61) per person per year. Thus, the total expenditure on treatment associated with coronary heart disease that was estimated using the geometric mean approach was baht 17,746.44 (US\$443.66) per person per year while the expenditure of the comparison

group was baht 351.12 (US\$8.78) per person per year. There were trends that decreased with age and the duration of illness, but increased with disease severity and in patients classified as having heart failure. Adjusting for sex, age, education, occupation and income differences, patients with coronary heart disease paid baht 14,767.06 (US\$369.18) per person per year more than the comparison subjects.

The prevalence of coronary heart disease in Thai people aged over 30 years was reported at 1.05% (Janphen 1996, quoted in Jayanton, 2001), and the proportion of coronary heart disease due to smoking was 20.60% (Amormat 1997, quoted in Jayanton, 2001). In 2001, the number of Thai people aged over 30 was 26,290,174 persons (Department of Local Administration, 2001). Assuming an estimated economic loss from coronary heart disease of baht 14,767.06 (US\$369.18) per person per year, the estimated total expenditure of coronary heart disease patients in a year would have been 14,767.06 x 1.05% x 20.60% x 26,290,174 or baht 840 million (US\$21 million).

The estimated economic losses due to coronary heart disease (CHD) of the two studies were different. Jayanton (2001) estimated that in 1998 the economic loss due to coronary heart disease caused by smoking was baht 14,767 (US\$369.17) per person per year. Wanchai (1991) used the average cost of three diseases caused by smoking to estimate the economic loss due to coronary heart disease. The average cost of the three illnesses in 1991 from Wanchai's study was baht 14,901 (US\$372.52) per person per year. Adjusting to 1998 prices gives baht 21,519 (US\$537.97) per person per year for all three diseases. However, these costs based on the Wanchai's study can be made CHD specific by using Wanchai's estimate for this type of illness. Therefore, the average cost for CHD is baht 10,303.17 (US\$ ) per person per year (direct coronary heart disease 4,186.58 B/person/year + medication 664.60 B/person/year + indirect costs 5,452 B/person/year), adjusted for inflation bath 14,879 (US\$371.97), which is quite close to Jayanton estimates of bah 15,063.24 (US\$376.58).

**Table 3 Summary of the cost associated with coronary heart disease, studies in Thailand**

Year of study	Title	Author	Sample size (persons)	Average direct cost (baht/person/year)	Average indirect cost (baht/person/year)
1991	Determining the cost of treatment for smoking-related heart and lung diseases	Wanchai et al.	540	4,186.58	5,452.00
2001	Expenditure and quality of life lost due to diseases caused by smoking	Jayanton et al.	-*	15,063.24	669.36

Source: Wanchai at al (1991), Jayanton et al (2001), HNP Discussion Paper No 15, WHO.

\*data not available.

However, there are differences between the two studies. In Wanchai's study, direct cost is only the medical cost and medicines, but in Jayanton's study, direct cost

included the medical and non-medical cost. But even the estimates of direct medical cost differ: the estimated direct medical cost in Wanchai's study was baht 4,186.58 (US\$104.66) per person per year (in 1991) and baht 12,663.85 (US\$316.60) per person per year (adjusted to 1991 prices) in Jayanton's study.

The indirect cost estimates of the two studies adjusted for inflation were also different because of differences in the framework for estimation and cost definition. The Wanchai study included only the income loss of patients due to illness but Jayanton also included the income loss of the patients' relatives. Despite that, Wanchai's estimated value was baht 5,452 (US\$136.30) per person per year while Jayanton's estimated value was much smaller, baht 352.52 (US\$8.81) per person per year. The large gap between the two estimated values was because Wanchai used open questions in his questionnaire. He asks the patients how many days were lost due to illness but he did not specify in what time period. Jayanton was more specific. For example, he asked how many days were lost due to illness in one year. Moreover, Wanchai estimated the average days lost due to 3 diseases caused by smoking and used the average number of days lost to these 3 diseases to estimate the indirect cost or coronary heart disease.

Both studies have weaknesses. First, the medical costs from public hospitals were used to estimate the medical costs. Because of subsidies that public hospitals receive from government, the real costs of treatment cannot be ascertained. Neither study estimated the income loss or other costs related to premature mortality due to coronary heart disease, and only Jayanton study partly accounted for average health care costs among non-smokers.

### **Health Care Cost of Chronic Obstructive Pulmonary Diseases (COPD)**

Respiratory Disease and Other Effects: COPD substantially affects the national healthcare resource and healthcare cost especially among the older persons. Identifying the accurate prevalence and incidence reflects the scale of problem posed by COPD. The current findings also suggest that tobacco smoking is the prime important cause of COPD. (Maranetra, Chuaychoo *et al.*, 2002) Cigarette smoking is associated with a tenfold increase in the risk of dying from chronic obstructive lung disease. About 90% of all deaths from chronic obstructive lung diseases are attributable to cigarette smoking. (Novotny TE and Giovino. GA, 1998; US Department of Health and Human Services, 2001)

A study by Wanchai in 1991 estimated the average direct cost of treatment of COPD at baht 16,388.03 (US\$409.70) per person per year and the average direct cost of all 3 diseases (COPD, CHD, Lung Cancer) caused by smoking was baht 8,784.41 (US\$219.61) per person per year. The average cost of patients using clinic care and drug store medicine was baht 664.60 (US\$16.61) per person per year, and the average indirect cost (absence from work) of these 3 diseases caused by smoking was baht 5,452 (US\$136.30) per person per year. Thus, the average cost of these 3 diseases caused by smoking was baht 14,901 (US\$372.52) per person per year (included: direct cost, indirect cost and cost of patients using clinic care and pharmacy medicine). The prevalence of COPD patients in Thailand was 143.1 per 100,000 (Chitanondh 1991, quoted in Wanchai 1991). The Thai population in 1992 was 54 million. Thus, the number of COPD patients was estimated to be 77,382 persons, and

74.6% of them - 57,727 persons - were assumed to be smokers. The cost of COPD patients in the study was calculated as the average cost of 3 diseases caused by smoking multiplied by the estimated number of COPD patients who were smokers; this came up to baht 860,190,027 (US\$21.505 million) per year.

Jayanton (2001) estimated the expenditure and quality of life of patients with COPD caused by smoking. From his study, the direct medical cost was baht 6,081.12 (US\$152.02) per person per year. The direct non-medical cost was baht 100.68 (US\$2.52) per person per year. Thus, the total direct cost of treatment associated with COPD estimated using the geometric mean approach was baht 6,457.80 (US\$161.44) per person per year, while the total direct cost of the comparison group was baht 65.04 (US\$1.63) per person per year. The indirect costs of treatment associated with COPD were estimated to be baht 217.32 (US\$5.43) per person per year while the indirect cost of the comparison group was baht 8.76 (US\$0.22) per person per year. The total treatment cost associated with chronic obstructive pulmonary disease estimated by using the geo-matrix mean approach was baht 7,656.72 (US\$191.42) per person per year while the expenditure of the comparison group was baht 138.60 (US\$3.46) per person per year. There were no trends according to age, duration of illness or severity. After adjustment for sex, age, education, occupation and income differences, patients with COPD paid baht 7,520.65 (US\$188.016) per person per year more than the comparison group.

**Table 4 Summary of the cost associated with COPD studies in Thailand**

Year of study	Title	Author	Sample size (persons)	Average direct cost (baht/person/year)	Average indirect cost (baht/person/year)
1991	Determining the cost of treatment for smoking-related heart and lung diseases	Wanchai et al.	540	16,388.0	5,452.00
2001	Expenditure and quality of life lost due to diseases caused by smoking	Jayanton et al.	-*	6,457.08	217.32

Source: Wanchai et al (1991), Jayanton et al (2001), HNP Discussion Paper No 15, WHO. \*data not available.

Table 4 shows the estimated health care cost due to COPD of the two studies were very different. Jayanton (2001) estimated the economic loss due to COPD caused by smoking at baht 7,520.65 (US\$188.016) per person per year in 1998. The direct cost for COPD patients from Jayanton (2001) was equal to baht 6,457.08 (US\$161.43) per person per year while the average cost for COPD patients in 1991 from Wanchai's study was baht 16,388.03 (US\$409.70) per person per year. Adjusted to 1998 values, it was baht 23,811.81 (US\$595.29) per person per year, which is much higher than Jayanton's estimates. As with the other disease estimates, there are many reasons to explain the difference.

Wanchai used the average cost of the 3 diseases caused by smoking to estimate the loss due to COPD. By contrast, Jayanton estimated the cost of COPD patients specifically. Their definitions of direct and indirect costs differ. Wanchai's study assumed that the medical cost of COPD patients depended on the severity of disease,

and estimated costs for first, middle and last stages of the disease; Jayanton assumed that the medical cost was constant for all stages of the illness.

## RESULTS OF THE STUDY

In this study, the health care cost caused by smoking in Thailand in 2003 was estimated using the methods from the Jayanton (2001) study with additional information on patient expenditures obtained from private providers as stated above, but using a prevalence approach rather than the incidence approach. This avoids the difficulty of having to estimate the number of new patients and, finally, arithmetic mean approach was used here rather than geometric mean in Jayanton's study.

The estimation of the direct and indirect cost caused by smoking is based on the epidemiological concept of the percentage of population-attributable risk (PAR%), the percentage of prevalence of a disease in a population that is caused by a risk factor, in this case, by smoking. We applied PAR to estimate the cost of smoking as it relates to the 3 smoking-related diseases (lung cancer, heart disease, COPD).

### Annual Health Care Cost of Chronic Obstructive Pulmonary Disease (COPD)

For the survey on COPD, we recruited a total of 300 participants with a history of smoking in the past five to ten years from 5 regions around Thailand who were suffering from COPD. The results will be divided into 6 categories of individual out-of-pocket costs: direct medical cost from both in and outpatients, direct non-medical cost from both in and outpatients, total direct cost of COPD, total indirect cost of COPD, total health care cost for COPD from this study and country health care cost for COPD.

**1) Direct medical cost from both in and outpatients:** This study found that most of the expenditure was on drugs and medical goods. The direct medical cost was equaled to (mean = baht 7,915.18, SD= 61.51). (Table 5)

**Table 5 Summary of direct medical cost from both in and outpatients for COPD**

Direct Medical Cost (Baht/year)	Patients with COPD (n=300)	
	Mean	SD
Drugs and Medical Goods	7,398.12	41.04
X-ray Fee	48.66	61.20
Laboratory Test	104.50	99.96
Oxygen, Respirator	79.31	96.96
EKG Test	39.44	42.72
Doctor Fee	195.29	108.36
Other expenditures	49.86	88.68
<b>Total</b>	<b>7,915.18 (US\$197.88)</b>	<b>61.51</b>

2) **Direct non-medical cost from both in and outpatients:** included direct expenditure on food, travel cost and accommodations by patients with COPD (mean = baht 1,414.38, SD= 125.67). (Table 6)

**Table 6 Summary of direct non-medical cost from both in and outpatients for COPD**

Direct Non-Medical Cost (Baht/year)	Patients with COPD (n=300)	
	Mean	SD
Expense on Food	359.38	96.00
Travel Cost	554.69	83.52
Accommodations	500.31	15.0
<b>Total</b>	<b>1,414.38 (US\$35.36)</b>	<b>125.67</b>

3) **Total direct cost of COPD:** Direct medical cost from both in and outpatients was equaled to (mean = baht 6,017.41, SD= 60.32) while direct non-medical cost from both in and outpatients was equaled to (mean = baht 1,159.96, SD= 118.52). Therefore, the direct cost of both in and outpatients with COPD per year was (mean = baht 8,953.15, SD =40.45) (Table 7)

**Table 7 Summary of direct cost from both in and outpatients for COPD weighted by % of out- and in-patients.(out of pocket expenses)**

Direct Cost (Baht/ year)	Patients with COPD (n=300)	
	Mean	SD
Medical Cost		
Outpatient	978.43	46.61
Inpatient	8,149.33	79.55
Total	6,017.41	60.32
Non-Medical Cost		
Outpatient	895.68	109.35
Inpatient	1,568.22	90.69
Total	1,159.96	118.52
Total Direct Cost		
Outpatient	1,874.11	65.97
Inpatient	11,591.66	52.61
<b>Total</b>	<b>8,953.15 (US\$223.83)</b>	<b>40.45</b>

4) **Total indirect cost of COPD:** Included income forgone from both the patients with COPD who did not go to work and relatives who had to leave work to take care

of the patients (minimum wage times hours or days loss from work for patients and/or relatives). All relatives who accompanied the patients were interviewed after the patients received services from both in and outpatient department. The indirect cost of patients with COPD was equaled to (mean = 863.39, SD = 89.52) while indirect cost of patient's relatives was equaled to (mean = 594.12 SD = 141.84), total indirect cost was equaled to (mean = 1,457.51, SD = 165.37). (Table 8)

**Table 8 Summary of indirect cost from both COPD patients and relatives**

Indirect Cost (Baht/year)	Patients with COPD (n=300)	
	Mean	SD
Income forgone of patients	863.39	89.52
Income forgone of relatives	594.12	141.84
<b>Total Indirect Cost</b>	<b>1,457.51 (US\$36.44)</b>	<b>165.37</b>

**5) Total health care cost for COPD/ person/ year** from this study consisted of total direct cost and total indirect cost which can be calculated to (mean = 10,740.81 SD = 79.35) (Table 9)

**Table 9 Summary of total health care cost from COPD patient/ person/ year**

Total Health Care Cost (Baht/year)	Patients with COPD (n=300)	
	Mean	SD
Direct Cost	8,953.15	40.45
Indirect Cost	1,457.51	165.37
<b>Total Cost</b>	<b>10,740.81 (US\$268.52)</b>	<b>79.35</b>

**6) Country health care cost and economic lost of COPD:** From this study, the expenditure for one COPD patient from smoking for year 2003 is approximately equal to baht 10,740.81 (US\$268.52). The number of COPD patients who were 45 years old and older from 1999-2003 ranged from 360,000 to 960,000 (mean approximately = 660,000) (Health Information Division, Bureau of Health Policy and Plan). We applied **proportion of disease attributable to an exposure (PAR)** to estimate the cost of smoking as it relate to COPD. (this study used relative risk from Taiwan since the data is not available in Thailand)

$$PAR = (RR-1)PE / 1 + (RR-1)PE$$

RR= Relative Risk = 3.07 (for male and female not available, Taiwan 2004),  
 PE = Proportion Exposed to COPD = 60% (MOPH, Thailand, 2003 both male & female)

$$\begin{aligned} PAR &= (3.07-1).60 / 1 + (3.07 -1).60 \\ &= 1.242/2.242 \\ &= 0.55 \end{aligned}$$

The proportion of these COPD patients who get this disease from smoking is around 56% of the total COPD cases. Therefore, for the year 2003, the total cost of expenditure of patients (both male and female) on treatment of COPD was approximately equal to baht 10,740.81 X 660,000 X 55% or equal to baht 3,898,914,030 (US\$97.473 million).

Government expenditure on COPD which included all the expenses subsidized by the government was last studied by Janjareon, Wattana (1988) and her estimates for 1986 were equal to baht 4,400 million/year (US\$110 million). Using constant average inflation rate at 5% (Ministry of Public Health and Bank of Thailand, 2003), we calculated the current value of government expenditure on COPD (2003) to be approximately equal to 10,057 million baht/year (US\$251.42 million).

Therefore, the total cost or economic lost of COPD in 2003 was approximately equal to 10,057+3,969 = 14.02 billion baht (US\$0.35 billion) which represents 0.23% of GDP (5,930.4 billion of baht or US\$ 148.26 billion) in the year of 2003 (Bank of Thailand, 2005). In addition, it also accounted for 5.7% of total 2003 health care expenditure in Thailand (246 billion baht or US\$6.15 billion) (National Health Account of Thailand, 2003)

Table 10 below demonstrates the estimation and projection of the health care cost of COPD, using year 2003 as a base year with average 5% inflation and discount rate and assuming no population growth. (Ministry of Public Health, and Bank of Thailand, 2004).

**Table 10 Estimation of total cost or economic lost of COPD from 1999-2007**

		Millions of baht							
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
COPD	11,366	11,964	12,594	13,257	13,955	14,652	15,385	16,154	16,962

### **Annual Health Care Cost of Coronary Heart Disease (CHD)**

For the survey on CHD, the researchers recruited a total of 300 participants with a history of smoking in the past five to ten years from 5 regions around Thailand who were ill with CHD. The results will be presented in 6 categories of individual out-of-pocket costs: direct medical cost from both in and outpatients, direct non-medical cost from both in and outpatients, total direct cost of CHD, total indirect cost of CHD, total health care cost for CHD from this study and country health care cost for CHD

**1) Direct medical cost from both in and outpatients:** This study showed that most of the expenditure was on drugs and medical goods. The direct medical cost equaled to (mean = baht 28,227.86, SD= 52.36). (Table 11)

**Table 11 Summary of direct medical cost from both in and outpatients for CHD**

Direct Medical Cost (Baht/year)	Patients with CHD (n=300)	
	Mean	SD
Drugs and Medical Goods	25,710.62	35.40
X-ray Fee	469.21	67.44
Laboratory Test	642.95	133.32
Treatment and Rehab.	349.52	69.00
EKG Test	366.14	110.76
Doctor Fee	299.25	94.20
Other expenditures	390.17	206.64
<b>Total</b>	<b>28,227.86 (US\$705.70)</b>	<b>52.36</b>

2) **Direct non-medical cost from both in and outpatients:** included direct expenditure on food, travel cost and accommodations by patients with CHD (mean = baht 1,722.28, SD= 74.24). (Table 12)

**Table 12 Summary of direct non-medical cost from both in and outpatients for CHD**

Direct Non-Medical Cost (Baht/year)	Patients with CHD (n=300)	
	Mean	SD
Expense on Food	480.32	107.52
Travel Cost	1,241.96	63.12
<b>Total</b>	<b>1,722.28 (US\$43.06)</b>	<b>74.24</b>

3) **Total direct cost of CHD:** Direct medical cost from both in and outpatients was equaled to (mean = baht 28,310.44 SD=58.24) while direct non-medical cost from both in and outpatients was equaled to (mean = baht 2,796.17, SD=69.85). Therefore, the direct cost of both in and outpatients with CHD per year was (mean = baht 31,106.61, SD =57.54) (Table 13)

**Table 13 Summary of direct cost from both in and outpatients for CHD weighted by % of out- and in-patients.**

Direct Cost (Baht/ year)	Patients with CHD (n=300)	
	Mean	SD
Medical Cost		
Outpatient	1,562.18	34.80
Inpatient	29,754.36	80.52
Total	28,310.44	58.24
Non-Medical Cost		
Outpatient	875.44	47.76
Inpatient	1,952.34	58.32
Total	2,796.17	69.85
Total Direct Cost		
Outpatient	2,437.62	29.04
Inpatient	31,706.70	63.48
<b>Total</b>	<b>31,106.61 (US\$777.6y)</b>	<b>57.54</b>

**4) Total indirect cost of CHD:** Included income forgone from both the patients with CHD who did not go to work and relatives who had to leave work to take care of the patients (minimum wage times hours or days loss from work for patients and/or relatives). All relatives who were accompanied with patients were interviewed after the patients received services from both in and outpatient departments. The indirect cost of patients with CHD was equaled to (mean = 997.45, SD = 595.20) while indirect cost of patient's relatives was equaled to (mean = 854.86, SD = 507.72). Therefore, total indirect cost was equaled to (mean = 1,852.31, SD = 205.46). (Table 14)

**Table 14 Summary of indirect cost from both CHD patients and relatives**

Indirect Cost (Baht/year)	Patients with CHD (n=300)	
	Mean	SD
Income forgone of patients	997.45	595.20
Income forgone of relatives	854.86	507.72
<b>Total Indirect Cost</b>	<b>1,852.31 (US\$46.31)</b>	<b>205.46</b>

**5) Total health care cost for CHD/person/ year** from this study consisted of total direct cost and total indirect cost which can be calculated to (mean =32,958.92, SD =63.52) (Table 15)

**Table 15 Summary of total health care cost from CHD patient/ person/ year**

Total Health Care Cost (Baht/year)	Patients with CHD (n=300)	
	Mean	SD
Direct Cost	31,106.61	57.54
Indirect Cost	1,852.31	205.46
<b>Total Cost</b>	<b>32,958.92 (US\$823.97)</b>	<b>63.52</b>

**6) Country health care cost and economic lost of CHD:** From this study, the expenditure for one CHD patient from smoking in year 2003 was approximately equal to baht 32,958.92 (US\$823.97). The number of CHD patients who were aged 30 years and older from 1999-2003 with the prevalence rate of coronary heart disease is around 1.05% (Chuprapawan, Health Information Division, Bureau of Health Policy and Plan). In 2003, there were approximately 35 million Thais who were 30 years old and older (National Statistics Office, 2003). We applied **proportion of disease attributable to an exposure** (PAR) to estimate the cost of smoking as it relate to CHD. (this study used relative risk from Taiwan since the data is not available in Thailand)

$$PAR = (RR-1)PE / 1 + (RR-1)PE$$

RR= Relative Risk = 2.82 (average for both male& female, Taiwan 2003),

PE = Proportion Exposed to CHD = 19% (MOPH, Thailand, 2003)

$$\begin{aligned} PAR &= (2.82-1)(.19) / 1 + (2.82 -1)(.19) \\ &= 0.3458/1.3458 \\ &= 0.256 \end{aligned}$$

The proportion of these CHD patients who get this disease from smoking is around 25.6% of the total CHD cases. Therefore, for the year 2003, the total cost or expenditure of patients on treatment of CHD was approximately equal to baht 32,958.92. X 25.6% (1.05% X 35,000,000) or equal to baht 3,100,775,194 (US\$77.519 million).

Government expenditure on CHD which included all the expenses subsidized by the government was last studied by Thiptaradol in 1990 and it was equal to baht 7,829 million/year. Using constant average inflation rate of 5%, we therefore calculated the current value of government expenditure on CHD (2003) to be approximately equal to 17,065 million baht/year (US\$426.62 million).

Therefore, the total cost or economic lost of CHD in 2003 was approximately equal to 3,100 + 17,065 = 20,165 million baht and it represented 0.33% of GDP in the year 2003 (baht 5,930.4 billion or US\$148.26 billion) (Bank of Thailand, 2005). In addition, it also accounted for 8.27% of total 2003 health care expenditure in Thailand (246 billion baht or US\$6.15 billion) (National Health Account of Thailand, 2003)

Table 16 below demonstrates the estimation and projection of the health care cost of CHD, using year 2003 as a base year with 5% inflation and discount rate and, assuming no population growth. (Ministry of Public Health and Bank of Thailand, 2003).

**Table 16 Estimation of total cost or economic lost of CHD from 1999-2007**

Millions of baht

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
CHD	16,424	17,288	18,198	19,156	20,165	21,173	22,231	23,343	24,510

### Annual Health Care Cost of Lung Cancer (LC)

For the survey on LC, the researchers recruited a total of 300 participants with a history of smoking in the past five to ten years from 5 regions around Thailand who were ill with LC. The results will be presented in 6 categories of individual out-of-pocket costs: direct medical cost from both in and outpatients, direct non-medical cost from both in and outpatients, total direct cost of LC, total indirect cost of LC, total health care cost for LC from this study and country health care cost for LC.

**1) Direct medical cost from both in and outpatients:** This study showed that most of the expenditure was on drugs, medical goods and operation/advance treatment. The direct medical cost equaled to (mean = baht 57,618.49, SD= 75.43). (Table 17)

**Table 17 Summary of direct medical cost from both in and outpatients for LC**

Direct Medical Cost (Baht/year)	Patients with LC (n=300)	
	Mean	SD
Drugs and Medical Goods	24,062.51	50.41
X-ray Fee	1,693.44	67.90
Laboratory Test	6,976.65	90.48
Operation/ Advance Treatment	19,063.17	98.89
EKG Test	2,672.87	51.72
Doctor Fee	1,669.36	113.01
Other expenditures	1,480.49	90.10
<b>Total</b>	<b>57,618.49</b> <b>(US\$1440.46)</b>	<b>75.43</b>

**2) Direct non-medical cost from both in and outpatients:** included direct expenditure on food, travel cost and accommodations by patients with LC (mean = baht 5,865.78, SD= 97.36). (Table 18)

**Table 18 Summary of direct non-medical cost from both in and outpatients for LC**

Direct Non-Medical Cost (Baht/year)	Patients with LC (n=300)	
	Mean	SD
Expense on Food	1,268.74	95.59
Travel Cost	1,952.91	80.14
Accommodations	2,644.13	20.04
<b>Total</b>	<b>5,865.78 (US\$ )</b>	<b>97.36</b>

**3) Total direct cost of LC:** Direct medical cost from both in and outpatients is equal to (mean = baht 55,473.71, SD= 64.25) while direct non-medical cost from both in and outpatients is equal to (mean = baht 6,156.58, SD=92.35). Therefore, the direct cost of both in and outpatients with LC per year was (mean = baht 61,630.29, SD = 48.29) (Table 19)

**Table 19 Summary of direct cost from both in and outpatients for LC weighted by % of out- and in-patients.**

Direct Cost (Baht/ year)	Patients with LC (n=300)	
	Mean	SD
Medical Cost		
Outpatient	10,698.25	49.62
Inpatient	46,736.22	69.03
Total	55,473.71	64.25
Non-Medical Cost		
Outpatient	1,465.18	107.99
Inpatient	5,004.37	79.03
Total	6,156.58	92.35
Total Direct Cost		
Outpatient	12,163.43	39.06
Inpatient	51,740.59	45.91
<b>Total</b>	<b>61,630.29 (US\$1540.76)</b>	<b>48.29</b>

**4) Total indirect cost of LC:** Included income forgone from both the patients with LC who did not go to work and relatives who had to leave work to take care of the patients (minimum wage times hours or days loss from work for patients and/or relatives). All relatives who accompanied the patients were interviewed after the patients received services from both in and out patient department. The indirect cost of patients with LC was equaled to (mean = 29,956.43, SD = 79.86) while indirect cost of the patient's relatives was equaled to (mean = 9,742.16, SD = 100.38).

Therefore, the total indirect cost was equal to (mean = 39,698.59, SD = 107.45). (Table 20)

**Table 20 Summary of indirect cost from both LC patients and relatives**

Indirect Cost (Baht/year)	Patients with LC (n=300)	
	Mean	SD
Income forgone of Patients	29,956.43	79.86
Income forgone of Relatives	9,742.16	100.38
<b>Total Indirect Cost</b>	<b>39,698.59 (US\$992.46)</b>	<b>107.45</b>

5) **Total health care cost for LC/person/ year** from this study consisted of total direct cost and total indirect cost which can be calculated to (mean =101,328.88, SD = 92.81) (Table 21)

**Table 21 Summary of total health care cost from LC patient/person/ year**

Total Health Care Cost (Baht/year)	Patients with LC (n=300)	
	Mean	SD
Direct Cost	61,630.29	48.29
Indirect Cost	39,698.59	107.45
<b>Total Cost</b>	<b>101,328.88 (US\$2533.22)</b>	<b>92.81</b>

6) **Country health care cost and economic lost of LC:** This study found that the expenditure for one LC patient from smoking/ year 2003 was approximately equaled to baht 101,328.88 (US\$2533.22). The number of LC patients aged 45 years and older in 2003 was approximately 42,100 (Settheetham-Ishida, Singto *et al.* 2004). We applied **proportion of disease attributable to an exposure (PAR)** to estimate the cost of smoking related to LC. (this study used relative risk from Taiwan since the data is not available in Thailand)

$$PAR = (RR-1)PE / 1 + (RR-1)PE$$

RR= Relative Risk = 3.05 (average for both male& female, Taiwan 2003),

PE = Proportion Exposed to LC= 45% (MOPH,Thailand, 2003)

$$\begin{aligned} PAR &= (3.05-1)(.45) / 1 + (3.05 -1)(.45) \\ &= 0.9225/1.9225 \\ &= 0.48 \end{aligned}$$

The proportion of these LC patients who got this disease from smoking was 48% of the total LC cases. Therefore, for the year 2003, the total cost or expenditure of patients on treatment of LC was approximately equaled to baht 101,328.88X 42,100 X 48% or equal to baht 2,047,654,000 (US\$51.19 million).

The information on government expenditure on LC which included all the expenses subsidized by the government was available only from the Health Statistics Department, Ministry of Public Health which indicated that the expenditure on LC from the Ministry Hospitals in 2003 was approximately equaled to baht 4,500 million or US\$112.5 million (Ministry of Public Health, 2003).

Therefore, the total cost or economic lost of LC in 2003 was approximately equaled to 2,047 + 4,500 = 6.547 billion baht (US\$0.164 billion) and represents 0.11 %of GDP in the year of 2003 (5,930.4 billion baht or US\$148.26 billion) (Bank of Thailand, 2005). In addition, it also accounted for 2.66% of total 2003 health care expenditure in Thailand (baht 246 billion US\$6.15 billion) (National Health Account of Thailand, 2003)

Table 22 below demonstrates the estimation and projection of the health care cost of LC, using year 2003 as a base year with 5% inflation and discount rate and, assuming no population growth or smoking epidemic. (Ministry of Public Health and Bank of Thailand, 2003).

**Table 22 Estimation of total cost or economic loss of LC from 1999-2007**

		Million baht							
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
LC	5,332	5,613	5,908	6,219	6,547	6,874	7,218	7,578	7,958

**Table 23 Costs summary of COPD, coronary heart disease and lung cancer in 2003 (Baht)**

Disease	Direct Cost/ person/ year	Indirect Cost/ person/ year	Total Cost/ person/ year	Total Cost + Gov't. Exp./ year	% GDP	% Total Health Spending
COPD	8,953.15	1,457.51	10,740.81	13.95 billion	0.23	5.7
CHD	31,106.62	1,852.31	32,958.92	20.16 billion	0.34	8.28
LC	61,630.29	39,698.59	101,328.88	6.54 billion	0.11	2.66
<b>TOTAL</b>	<b>101,690.06</b> (US\$2,542)	<b>43,008.41</b> (US\$1,075)	<b>145,028.61</b> (US\$3,625)	<b>40.65 billion</b> (US\$1.01 bil )	<b>0.68%</b>	<b>16.64%</b>

Health care cost of smoking-related diseases (lung cancer, coronary heart disease, and chronic obstructive pulmonary disease) for the period 1999-2007 from this study is shown in Table 24. These numbers are the sum of Tables 10, 16 and 22 above.

**Table 24 Summary of total health care cost of 3 smoking-related diseases (SRD) or economic loss from 1999-2007**

Millions of baht									
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
SRD	33,122	34,865	36,700	38,632	40,667	42,699	44,587	47,075	49,430

### The Thai Government Tobacco Related Revenue

The significant contribution of the tobacco industry to government revenue consists of 2 parts. First, the Thailand Tobacco Monopoly (TTM), the only cigarette producer, has contributed around 3.5%-4.5% of government revenue. In 2003, this was slightly more than baht 38 billion. Nearly 70% of this was from excise tax on cigarettes and other tobacco products. Another 15.65% was in the form of returns to government ownership in TTM. Another 8.6% was from value-added tax. The second part is tax revenue from imported tobacco and tobacco products, which has increased considerably over the past decade. In 2003, Thailand imported cigarettes with a total value of around US\$65 million or around baht 2,513 million. The Thai government earned around baht 2,943 million (US\$73.57) from excise tax on these imported products. Revenue from tariff and value-added tax was not reported. Based on the prevailing tax rates in 2003, tariff revenue should be about baht 524 million + 550 million, and revenue from value-added tax should be around baht 3,186 million + 582 million (Table 25). Thus, the Thai government's dependence on tobacco is fairly high. In 2003, the total government revenue from cigarettes was around baht 43 billion - more than 5% of total government revenue. Of this, more than baht 38 billion was tax revenue.

**Table 25 Thai government revenue from tobacco, 2003 (million baht)**

Total	Revenue from TTM						Revenue from Import			
	Total	Tariff	Excise	Vat	TTM	Other	Total	Tariff*	Excise	Vat*
			Tax		Profit				Tax	
<b>43,207</b>	<b>37,053</b>	524	25,722	3,186	5,802	1,818	<b>6,153</b>	550	5,020	582

Note\*= estimated values. Tariff revenue is assumed to equal 20% of imported cigarette value.

Source: Excise Department, Thailand and Customs Department, Thailand, 2003

From the economic perspective, tobacco taxes represent only redistribution of existing resources. Therefore, taxes collected on tobacco can be collected on alternative products without reducing people's spending power.

Although the economic implication of alternative taxation sources is an interesting and important issue, it is beyond the scope of this study. This study will show that government revenue from taxing tobacco consumption is not sufficient to cover costs of all SRD.

Table 26 below shows the revenue of the Thai government from tobacco for the period 1999-2007. The estimation of the revenues in year 2004-2007 was projected using the annual average increase rate of the Excise Department.

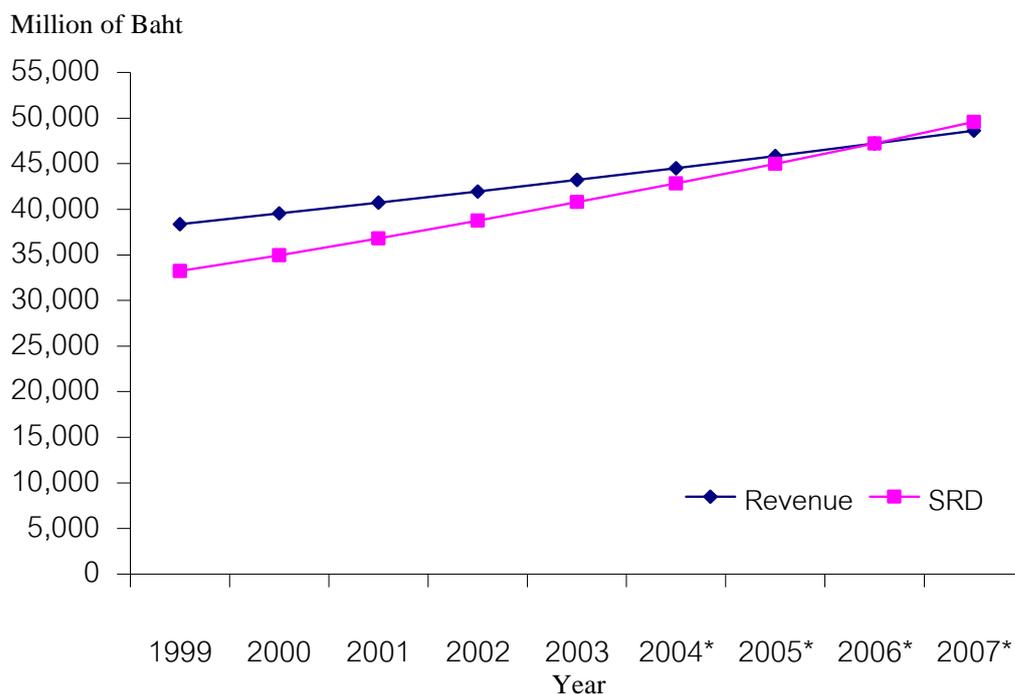
**Table 26 Thai government revenue from tobacco, 1999-2007 (million baht)**

Year	1999	2000	2001	2002	2003	2004*	2005*	2006*	2007*
Revenue	38,354	39,541	40,727	41,949	43,207	44,503	45,838	47,213	48,630

\*Thai government revenues from tobacco in the years 2004-2007 were estimated through the average increase in the revenue on tobacco around 3% per year (Excise Department, 2003)

### Health Care Cost of Smoking-Related Diseases v.s. Government Revenue from Tobacco

Information from Tables 24 and 26 was used to plot a graph below to determine and compare potential government financial liability in the health sector or on the other hand, to demonstrate whether or not the government will have enough resources to cope with all expenditures on smoking-related diseases.



In this study, the researcher chose 3 major diseases, (lung cancer, coronary heart disease, and chronic obstructive pulmonary disease), which accounted for most of the illnesses caused by tobacco consumption. Studies in the US (Rice *et al.* 1986, Luce and Schweitzer, 1978 and Barlett *et al.*, 1994) indicated that expenditure on these 3 diseases accounted for most of expenditure which was spent on health care cost of smoking and accounted for 0.62%-1.15% of GDP. Similar to the studies in Australia

(Collins and Lapsley, 1991, 1996) and Canada (Collishaw and Mayers, 1984, Xie *et al*, 1996 and Kaiserman, 1997) indicated the same pattern as in the US. In reality, there are many more diseases that are caused by tobacco consumption and will have to be included in the health care cost of smoking-related diseases. Also, the estimates in this report are conservative as they do not take into account future economic growth and advances in medical field, which will lead to higher cost of medical care. Therefore, the cost that had been calculated in this study should be considered underestimated. Even though it is underestimated, we could see from the increasing trend in the graph above that the health care cost of these 3 diseases is higher than the government revenue from tobacco in years 2006 through 2007 and can be expected to continue increasing in the future. This study considered partial social cost which eventually will indirectly add more to the health care cost and societal expenses. In addition, the results from this study are intended to encourage the government to try to earn more from tobacco-related revenue and, at the same time, to pinpoint the financial problems that might occur from tobacco consumption and how the government can effectively enforce strong policy and planning for future well-being of the Thai population.

## CONCLUSIONS AND RECOMMENDATIONS

This study showed that government revenue from tobacco is not enough to finance the cost of SRD. Therefore, government needs to increase the tobacco tax and if it is still not enough, it may need to increase revenue by taxing other products to supplement tobacco revenue to pay for these differences. This means that instead of spending the new revenue realized on some other useful activities, it will have to be dedicated to paying for SRD. If one assumes a total cessation of the use of tobacco products, government revenue from tobacco would be zero, but costs of SRD would be 0 also, therefore, saving government resources; but such an assumption is unrealistic given that although use of tobacco products declined between 1992 and 2002, this decline has stopped in recent years, leveling off at what probably represents a hard-core of tobacco consumers. Therefore, government tobacco revenues will continue to increase, particularly when higher levels of tobacco taxes are added, but SRD costs will also continue to increase. Although the economic implication of alternative taxation sources is an interesting and important issue, it is beyond the scope of this study. This study clearly showed that government revenue from taxing tobacco consumption was not sufficient to cover all SRD. The Thai government, given its limited budget and numerous health and other obligations (such as the recent subsidization of fuel subsidies), has few options in terms of what it can tax to supplement the tax on tobacco products to cover the future short - fall of income to treat SRD. One way to reduce health care cost of smoking-related diseases is to reduce smoking. The major types of policies available to reduce tobacco consumption, together with the evidence for their effectiveness (Collins D and Lapsley H, 2000) are taxation, restrictions on advertising and other promotion, health information and counter advertising, smoking restrictions and bans on sales to youth. Thailand has some of the world's strongest anti-tobacco legislation, but it is weak in enforcement. Although cigarette sales to children younger than 18 years have been prohibited in Thailand for almost ten years, this was only known by a small proportion of the shopkeepers. (Jirojwong, 2003). This is just one example of the lack of enforcement and knowledge. The Thai government needs to strengthen its enforcement mechanisms, educate the police and citizens, enact stiffer penalties and publicize the result of enforcement.

In recent years, studies have shown that where tobacco consumption and consequent SRDs have declined (ThaiHealth, 2003), general long-term health care costs have increased thereby creating a greater economic burden to government-funded health care programs. However, these findings fail to take into account the contribution of ex-smokers who live longer compared to a smoker and future savings due to lower rate of SRDs. Although these related issues are beyond the scope of this study, it would be interesting to study the identified general long-term health care costs of ex-smokers compared to a smoker and a non-smoker. Such study would determine costs effectiveness of smoking cessation.

The main recommendation here is to educate, encourage and stimulate government, police, the Thai people and others to be aware of tobacco consumption problems and the need to enforce existing laws and policies. This can be done through educational training to make sure that everyone understands the consequences of smoking. At the same time, it should empower the Thai people with accurate and up-to-date

information regarding smoking. This will lead to the establishment of Social Pressure that everyone in the society look after and watch out for the community. Strong enforcement should be followed by strong punishment, as well. Otherwise, there will be nobody who would follow tobacco rules and legislation. In addition, this study advocates for government, as well, to support cessation programs, and not just only education.

Another recommendation is that, if the government wants to do more to reduce smoking, policy-makers could consider a national health campaign to coincide with a sharp rise in the tax rates on cigarettes and other tobacco products. Public information and high prices can do much to deter new smokers and encourage established smokers to cut back or quit.

Results from this study indicated that expenditure on CHD is the highest among other tobacco-related diseases. Therefore, it is recommended that government analyze the most cost effective way to treat CHD and set the policy for health providers to use this technique. This way, the allocation of resources to CHD treatment can be used efficiently and will lead to a reduction in the national cost of CHD treatment.

Another recommendation is that the government should stop paying for all the costs of treating smokers' illnesses in the future. This should persuade many smokers to stop when they realize the future economic burden to themselves and their families. The Thai government should announce that in the future it will not pay the entire health care costs of treating patients with tobacco-related illnesses if such patients' case records indicate life-long tobacco products usage. This announcement could be made several years ahead of the policy's activity date and in conjunction with enhanced support for smoking cessation programs provided by health clinics, hospitals, NGOs and other relevant organizations. Such enhanced support should be subsidized by a specific set-aside from government tobacco tax income. In addition, the Ministry of Public Health (MOPH) (in coordination with the Ministry of Finance, academic researchers and interested stakeholders) needs to determine, as closely as possible, the exact amount of deficit between tobacco-related income and health expenditure and then develop methods for fairly calculating/prorating health subsidy reductions in the future. The government should make it very clear that public and private hospitals will not be liable for the unpaid expense; rather, patients and their families will have to cover a portion of health treatment. Where this represents a hardship, extended payment plans can be arranged. However, if such plans are so numerous that they add to the deficit, the government will have to recalculate its share of subsidy at a further reduced level.

Of course, such a policy could lead to an endless spiral of cycle, which would be self-defeating. Therefore, the government, specifically the finance and health ministries, will have to work concurrently with public, private and institutional insurance providers to add small amounts to the premiums of smokers and other users of tobacco products. To make this effective, the government should make health insurance for all users of tobacco products mandatory and should subsidize some of the cost of this for the poor through allocations from current tobacco income before the deficit gets larger. Of course, such subsidy will increase the deficit so the government may want to consider increasing tobacco tax even more to pay for such insurance subsidy: this should help decrease tobacco-related health expenditures in

the future and can be justified politically on that basis. This would represent a partial privatization of future government health liabilities.

In order to further motivate the public to stop smoking, the Thai MOPH should work with the media to have the number of monthly deaths related to tobacco printed next to lottery numbers and shown in teletype during popular television shows. These can be accompanied by a short statement of the Thai government's intention to reduce health care cost subsidies for tobacco users in the future.

Finally, the Thai government should establish a permanent mechanism to track tobacco-related health care costs and income. The government (MOPH) needs to coordinate this effort with the finance ministry and health care providers nationwide in order to plan realistic future policies and ensure adequate health resources for the entire system.

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# **APPENDICES**

## A1. Detailed information for smoking-related diseases

(Source: Public Health Statistics A.D. 2000 (2000). Office of the Policy and Public Health Planning, Bangkok, Thailand.)

Malignant neoplasm group consists of

Lips, oral cavity and pharynx cancer: 80% of them caused by smoking.

Oesophageal cancer: 79% of it caused by smoking.

Pancreatic cancer: 28% of it caused by smoking.

Laryngeal cancer: 79% of it caused by smoking.

Trachea, bronchus, lung cancers: 86% of them caused by smoking.

Cervix uteri cancer: 31% of it caused by smoking.

Urinary bladder cancer: 42% of it caused by smoking.

Kidney and other unspecified urinary organ cancers: 35% of them caused by smoking.

Stomach cancer.

*Cardiovascular disease group consists of*

Rheumatic head disease: 17% of it caused by smoking.

Hypertensive disease: 19% of it caused by smoking.

Ischaemic heart disease: 24% of it caused by smoking.

Other heart disease: 20% of it caused by smoking.

Cerebrovascular disease: 19% of it caused by smoking.

Atherosclerosis: 41% of it caused by smoking.

Aortic aneurysm: 5% of it caused by smoking.

Other arterial. disease: 43 % of it caused by smoking.

*Respiratory disease*

Respiratory tuberculosis: 29% of it caused by smoking.

Pneumonia: 28% of it caused by smoking.

Chronic bronchitis and emphysema: 82% of them caused by smoking.

Asthma: 25% of it caused by smoking.

Chronic obstructive pulmonary disease: 82% of it caused by smoking.

## A2. Smokers from Thai population with 11 + years old, 2003

	Male	female	total
Population 11+ years old	25,999,070	26,463,722	52,462,792
Number of smokers	11,473,514	765,619	12,239,133
Percentage	44.1%	2.9%	23.3%

### A3. Estimated numbers and percentage of smokers from 1976 to 2003

Year	Population (Million)	number of smokers	
		Million	%
1976	28.7*	8.6	10.1
1981	35.1*	9.8	27,8
1986	38.1*	10,4	27.4
1989	40.5*	10.1	25.0
1991	43.3*	11.4	26.3
	38.3***	11.4	29.7
1993	45.7**	10.4	22.8
	40.7***	10.4	25.5
1996	48.0**	11.2	23.4
1999	49.9**	10.2	20.5
2001	51.2**	10.5	20.6
2003	52.5**	12.2	23,3

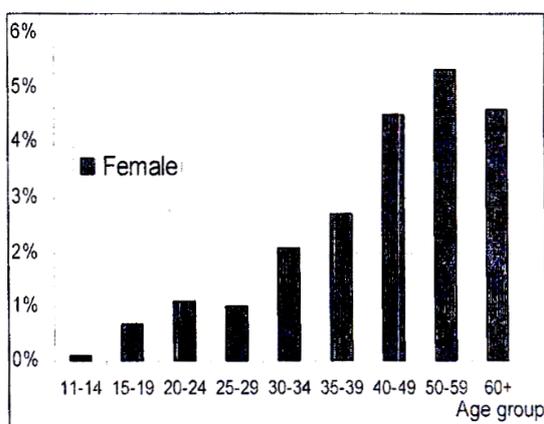
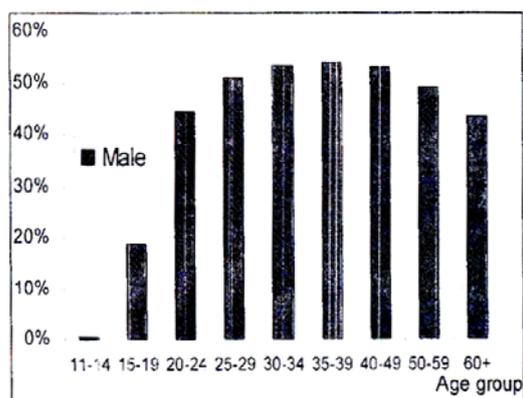
Source: Nation statistic office and <http://www.tobaccofreeasia.net/Menu/Index.htm>

Note Population with aged 10+\*, 11+\*\*, 15+\*\*\*

### A 4. Percentage of smokers within gender and age group, 2003

age group	11-14	15-19	20-24	25-29	30-34	35-39	40-49	50-59	60+	Total
male	0.20	18.80	44.20	50.70	51.10	53.80	52.70	49.00	43.30	44.10
female	0.10	0.70	1.10	1.00	2.10	2.70	4.50	5.30	4.60	2.90

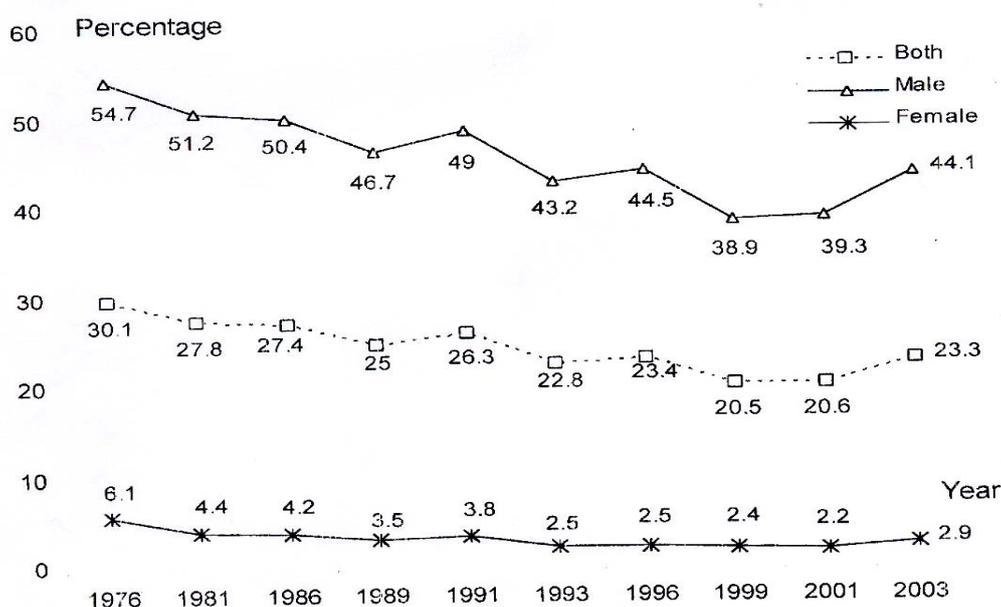
**A 5. Percentage of smokers within gender and age group, 2003**



**A 6. Estimated numbers and percentage of smokers by gender from 1976 to 2003**

Year	number of smokers (M)			Percentage (%)		
	Both	Male	Female	Both	Male	Female
1976	8.6	7.7	0.9	30.1	54.7	6.1
1981	9.8	9.0	0.8	27.8	51.2	4.4
1986	10.4	9.6	0.8	27.4	50.4	4.2
1989	10.1	9.4	0.7	25.0	46.7	3.5
1991	11.4	10.6	0.8	26.3	49.0	3.8
1993	10.4	9.8	0.6	22.8	43.2	2.5
1996	11.2	10.6	0.6	23.4	44.5	2.5
1999	10.2	9.6	0.6	20.5	38.9	2.4
2001	10.5	10.0	0.5	20.6	39.3	2.2
2003	12.2	11.5	0.7	23.3	44.1	2.9

### A 7. Estimated numbers and percentage of smokers by gender from 1976 to 2003



Source: National Statistical Office and <http://www.tobaccofreeasia.net/Meliu/Index.htm>

### A 8. Percentage of smokers by sex and age group during 1986-2003

Age group	Male						Female					
	1986	1991	1996	1999	2001	2003	1986	1991	1996	1999	2001	2003
10-14	0.7	0.8	0.5	0.5	0.2	0.2	0.3	0.1	0.1		0.1	0.1
15-19	23.6	23.4	18.3			18.8	0.8	0.7	0.3	0.3	0.6	0.7
20-24	54.2	54.3	47.7	24.0	26.0	44.2	1.7	1.3	1.1			1.1
25-29	65.3	62.2	54.4			50.7	3.0	2.5	1.5			1.0
30-3,1	66.6	64.0	55.9			53.1	4.0	3,4	2.4			2.1
35-39	69.6	63.7	58.3	49.8	49,9	53.8	5.8	5.6	1.6	3,0	2.6	2.7
40-49	71.7	65.3	56.4			52.7	8.8	7.5	3.8			4.5
50-59	75.5	64.8	57.9			49.0	10.5	9.0	5.9			5.3
60+	67.3	56.7	48.7	45.1	40.9	43.3	8,7	8.2	4.8	4.8	4.3	4.6

Source: Re-analyze from the Nation statistic office's data

## A 9. Relationship between smoking and income quintile 2003

	Percentage within income quintile					Total
	Lowest	Low	Medium	High	Highest	
.Smoke regularly	22.0	20.7	18.4	16.1	13.8	18.1
.smoke occasionally	3.9	3.7	4.0	4.1	3.3	3.8
,ever smoke regularly	3.2	4.2	3.4	3.5	3.2	3.5
*ever smoke occasionally	1.8	2.6	2.7	2.7	3.1	2.6
.never smoke	69.1	68.8	71.5	73.6	76.6	72.0

## A 10. The estimation of tobacco consumption in 2025

	2000	2025
Total population	64 million	80 million
Population > 15 years	47 million	63 million
Prevalence male smokers	42.6%	25%.
Prevalence female smokers	2.6%	15%
Overall adult prevalence	22.6%	20%
Numbers smokers aged 15+	10.5 million	13 million

Source: <http://www.tobaccofree;isia.net/Menu/Index.litm>



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## About SEATCA

The Southeast Asia Tobacco Control Alliance (SEATCA) works closely with key partners in ASEAN member countries to generate local evidence through research programs, to enhance local capacity through advocacy fellowship program, and to be catalyst in policy development through regional forums and in-country networking. By adopting a regional policy advocacy mission, it has supported member countries to ratify and implement the WHO Framework Convention on Tobacco Control (FCTC)

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