ECONOMIC AND CLINICAL OUTCOMES OF EASY ASTHMA AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE CLINIC AT WANGTONG HOSPITAL, PHITSANULOK

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE IN PHARMACY
(PHARMACY ADMINISTRATION)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2012

Thesis
entitled

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ECONOMIC AND CLINICAL OUTCOMES OF EASY ASTHMA AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE CLINIC AT WANGTONG HOSPITAL, PHITSANULOK

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science in Pharmacy
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ACKNOWLEDGEMENTS

First of all, I would like to express my respectful gratitude and deep appreciation to my major advisor, Associate Professor Dr. Petcharat Pongcharoensuk, for her valuable advice in many aspects and guidance in this research.

My Sincere and grateful appreciation also expressed to Dr. Oraluck Pattanaprateep, my co-advisor, for her valuable suggestions, helpful discussion, valuable suggestion and kindness.

Moreover, my special appreciation is also expressed to my external examiner, Dr. Nilawan Upakdee for her kindness in providing suggestions during thesis defense.

I am very grateful and wish to express my deepest thanks to informants from Easy Asthma and COPD Clinic at Wangtong Hospital, Phitsanulok.

Grateful acknowledgement is extended to all professors and staffs at the Division of Pharmacy Administration, Faculty of Pharmacy for their valuable advice and providing suggestions for improvement and thanks also go to my friends in Pharmacy Administration class for their cheerfulness and kind support.

Finally, my special thanks go to my beloved parents for their entirely care, dedication, love and give continuous support throughout my life.

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ECONOMIC AND CLINICAL OUTCOMES OF EASY ASTHMA AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE CLINIC AT WANGTONG HOSPITAL, PHITSANULOK

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ABSTRACT

The study aims to determine economic and clinical outcomes before and after implementation of Easy Asthma/COPD Clinic at Wangtong Hospital, and to determine factors affecting disease control among patients at the clinic. This comparative study was carried out using patient data from January 1, 2010 to December 31, 2011. The program started in October 2010. Patients with the diagnosis of asthma and COPD and who had treatment data continuously for 9 months both before and after attending the clinic were included in the study. Data of economic and clinical outcomes were obtained from the hospital's electronic database and data records of the National Health Security Office website respectively. Data were analyzed using descriptive statistics, Wilcoxon signed-rank test, paired-samples t-tests, and logistic regression.

A total of 105 and 171 asthma and COPD patients were assessed. The results revealed that the trends of healthcare utilization were similar in asthma and COPD patients. The average number of outpatient visits and expenditure per patient increased 18.90-25.76% and 32.31-85.38%, respectively, after program implementation. On the other hand, the average use and expenditure per patient associated with emergency services, hospitalization, and number of bed days decreased 3.26-29.54%, 23.60-71.79%, and 32.68-73.17%, respectively. Use of inhaled corticosteroid (ICS) and inhaled bronchodilator per patient increased after intervention (5.76-55.33% and 29.76-72.35%, respectively). For clinical outcomes, there was significant improvement in all outcomes ($P<0.05$) with more patients having better control of the diseases. For cost benefit analysis, the program was cost beneficial from a provider and societal perspective (benefit to cost ratio of 1.30:1 and 1.63:1, respectively). The results from logistic regression showed that disease control was positively associated with % Peak Expiratory Flow Rate but negatively associated with payment method, daytime and nighttime symptoms, and reliever drug use.

The outcomes of this study indicate that the interventions in Easy Asthma/COPD Clinic can improve clinical outcomes of the patients as well as economic outcomes of the health system, and it should be implemented in all community hospitals.

KEY WORDS: EASY ASTHMA AND COPD CLINIC / ECONOMIC OUTCOMES/CLINICAL OUTCOMES/DISEASE CONTROL

134 pages

ผลลัพธ์ทางเศรษฐศาสตร์และคลินิกของคลินิกโรคหอบหืดและโรคปอดอุดกั้นเรื้อรัง โรงพยาบาลวังทอง จังหวัดพิษณุโลก

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อกำหนดผลลัพธ์ทางเศรษฐศาสตร์และคลินิกในก่อนและหลังการดำเนินการคลินิกโรคหอบหืดและปอดอุดกั้นเรื้อรัง โรงพยาบาลวังทอง จังหวัดพิษณุโลก และเพื่อกำหนดปัจจัยที่มีผลต่อการควบคุมโรคของผู้ป่วยที่เข้าคลินิก รูปแบบการศึกษาเป็นงานวิจัยเชิงเปรียบเทียบโดยใช้ข้อมูลผู้ป่วยระหว่างวันที่ 1 มกราคม พ.ศ. 2553 ถึง 31 ธันวาคม พ.ศ. 2554 และโปรแกรมเริ่มต้นในเดือนตุลาคม พ.ศ. 2553 โดยมีเกณฑ์คัดเข้าในผู้ป่วยที่ได้รับการวินิจฉัยว่าเป็นโรคหอบหืดและโรคปอดอุดกั้นเรื้อรังและมีข้อมูลการรักษาต่อเนื่อง 9 เดือนทั้งก่อนและหลังเข้าคลินิก ข้อมูลผลลัพธ์ทางเศรษฐศาสตร์และคลินิกได้จากฐานข้อมูลอิเลคทรอนิกส์ของโรงพยาบาลและข้อมูลในเวปไซต์ของสำนักงานหลักประกันสุขภาพแห่งชาติ ตามลำดับ วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา, Wilcoxon signed-rank test, paired-samples t-tests และ การวิเคราะห์ความถดถอยโลจิสติค

ผู้ป่วยโรคหอบหืดทั้งหมด 105 คน และโรคปอดอุดกั้นเรื้อรัง 171 คนถูกนำมาประเมิน ผลการศึกษาพบว่า แนวโน้มการใช้ทรัพยากรทางสุขภาพคล้ายคลึงกันในผู้ป่วยทั้งสองกลุ่ม อัตราการใช้บริการผู้ป่วยนอกและค่าใช้จ่ายโดยเฉลี่ยต่อคนเพิ่มขึ้นร้อยละ 18.90-25.76 และ ร้อยละ 32.31-85.38 ตามลำดับหลังการดำเนินงาน แต่อัตราการใช้บริการและค่าใช้จ่ายโดยเฉลี่ยต่อคนที่เกี่ยวกับการบริการฉุกเฉิน, การนอนโรงพยาบาล และจำนวนวันนอนลดลงร้อยละ 3.26-29.54, ร้อยละ 23.60-71.79, และ ร้อยละ 32.68-73.17 ตามลำดับ การใช้ยาพ่นสูดสเตียรอยด์และยาพ่นสูดขยายหลอดลมโดยเฉลี่ยต่อคนเพิ่มขึ้นหลังการดำเนินงาน (ร้อยละ 5.76-55.33 และร้อยละ 29.76-72.35 ตามลำดับ) สำหรับผลลัพธ์ทางคลินิกพบว่าดีขึ้นอย่างมีนัยสำคัญทางสถิติ ($P<0.05$) โดยผู้ป่วยควบคุมอาการของโรคได้ดีขึ้น สำหรับการวิเคราะห์ต้นทุนผลได้พบว่ามีความคุ้มทุนในมุมมองผู้ให้บริการและสังคม (อัตราส่วนผลได้ต่อต้นทุนเท่ากับ 1.30:1 และ 1.63:1 ตามลำดับ) ผลจากการวิเคราะห์ความถดถอยโลจิสติคพบว่าการควบคุมโรคมีความสัมพันธ์เชิงบวกกับร้อยละความจุปอด แต่มีความสัมพันธ์ในเชิงลบกับวิธีการจ่ายเงิน, อาการหอบในช่วงกลางวันและกลางคืน และ การใช้ยาบรรเทาอาการเมื่อหอบกำเริบ

ผลลัพธ์ของการศึกษานี้บ่งชี้ว่ากิจกรรมในคลินิกโรคหอบหืดและโรคปอดอุดกั้นเรื้อรังสามารถช่วยให้ผลลัพธ์ทางคลินิกของผู้ป่วยตลอดจนผลลัพธ์ทางเศรษฐศาสตร์ในระบบบริการสุขภาพดีขึ้น และควรสนับสนุนให้มีการดำเนินการของคลินิกในโรงพยาบาลชุมชนทุกแห่ง

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CHAPTER I
INTRODUCTION

Background and Rationale

Asthma and chronic obstructive pulmonary disease (COPD) are respiratory diseases of considerable importance due to their high morbidity and mortality rates and high consumption of healthcare resource (1-3). Acute exacerbations requiring hospital admissions are a major problem because of their negative impact on quality of life, and costs (4). These two respiratory conditions have differences in pathogenic and therapeutic response.

Asthma is a reversible inflammatory airway condition characterized by episodes of intense breathlessness and wheezing. The worldwide prevalence of this disease is between 100 and 150 million, with an estimated 180,000 deaths occurring annually as a result of asthma (5). In Thailand, there has been a rise in the prevalence of asthma over the last decade with 10-15% of children (6) and 3-7% of adults (7) affected by the disease.

Chronic obstructive pulmonary disease (COPD) is characterized as a chronic airflow limitation that is not fully reversible. The airflow limitation is usually progressive and is associated with an abnormal inflammatory response of the lungs to gaseous or particulate irritants (8). Worldwide, this progressive condition contributes to mortality and chronic morbidity, particularly among populations who smoke or are exposed to substantial air pollution (9). COPD is a major cause of morbidity and mortality in adults with 210 million people diagnosed worldwide and 3 million people deaths annually. The WHO predicts that COPD will become the fourth leading cause of death worldwide by 2030 (10). The COPD prevalence in Thailand is 7,035 cases per 100,000 populations in 2010 (11).

Despite the availability of effective asthma and COPD medication and standard disease management guidelines, it remains a poorly controlled disease (12). Poorly controlled disease imposes a substantial economic burden on healthcare

resources, primarily through hospitalization (the greatest direct expenditure) and lost productivity (the greatest indirect cost) (13). Poor compliance with inhaled therapy either intentional or unintentional is a common cause of uncontrolled disease (14, 15). Inadequate use of long-term anti-inflammatory medication and high use of bronchodilators were observed in both developed and developing countries (12, 16). International disease management guidelines for asthma and COPD require sophisticated and expensive equipment and might be too complex to be used in clinical practice (17), especially in a low-income practice setting. In clinical practice, specialists and general practitioners do not often follow the guidelines. As part of most guidelines, evidence are predominantly derived from randomized controlled trials in developed countries, which may not apply to “real world” clinical practice (18, 19).

Two large-scale surveys of asthma management in Europe (Asthma Insights and Reality in Europe; AIRE) (20) and the USA (Asthma in America; AIA) (21) showed asthma control in these regions falls far from the goals defined for asthma management. As well, data from an asthma control survey in Thailand suggest that the burden of asthma is high, because of the high rate of hospitalization (15%), visits to the emergency department (22%) and absence from work (24%) (22). Under-usage of lung function tests, inappropriate use of inhale corticosteroid, and guidelines are not being followed are the key barriers to obtaining asthma control in Thailand.

Many countries created programs or interventions for asthma and COPD control. In Thailand, National Health Security Office set up an “Easy Asthma/COPD Clinic” in hospitals to propose the effective way of implementing asthma and COPD guideline and support budget for inhaled corticosteroid. The clinic is easy enough to be run by general practitioners in community hospitals throughout the country. Personnel in the clinic comprise of doctors, nurses and pharmacists working together following the same guidelines. The clinic also equipped with necessary medication, peak flow meter and patient education program. The “Easy Asthma/COPD Clinic” is expected to be a cost-effective solution to the problem in asthma and COPD management of the country.

Wangtong Hospital is a 60-bed community hospital, located in Phitsanulok. Asthma and COPD are important health problems at the hospital. In fiscal year 2010, COPD was the third rank of most frequent admission in the hospital. In

addition, it was found that most of asthma and COPD patients did not get continuing and standard treatment. Due to these problems, Wangtong Hospital has implemented an Easy Asthma/COPD Clinic program since October 2010 to provide standard treatment system for asthma and COPD patients.

This study was designed to evaluate economic outcomes including utilization of service, medical expenditure, inhaled corticosteroid and bronchodilator utilization, benefit to cost ratio and clinical outcomes before and after implementation of the Easy Asthma/COPD Clinic at Wangtong Hospital. Furthermore, we would study about factors that influence disease control of patients who entered the clinic in post-intervention period.

Objectives

1. To determine economic and clinical outcomes before and after implementation of the Easy Asthma/COPD Clinic at Wangtong Hospital.

2. To determine factors affecting disease control in patients who entered the clinic.

Expected Outcome and Benefit

The results of this study can be beneficial for administrative team to manage health-care resources for asthma and COPD more efficiently.

Definition of terms

Acute exacerbation (23)

A sustained worsening of the patient’s condition from the stable state and beyond normal day-to-day variation, which is acute in onset and necessitates a change in regular medication.

Economic outcomes (24)

Direct and indirect costs compared to consequences of medical treatment alternatives typically expressed as ratios of cost to consequence.

Clinical outcomes (24)

Medical events that occur as a result of disease or treatment (e.g., disability, hospitalization)

Resource utilization (24)

The use of various types of health services such as drug, laboratory, operation and other services for treatment of an illness.

Utilization rate (24)

The number of times that a patient comes for treatment in a health care facility during a period of time such as 1 year.

Medical expenditure (24)

The total expenses (as charges) of various health services, both outpatient and inpatient that a patient used for treatment of all illnesses.

Conceptual Framework

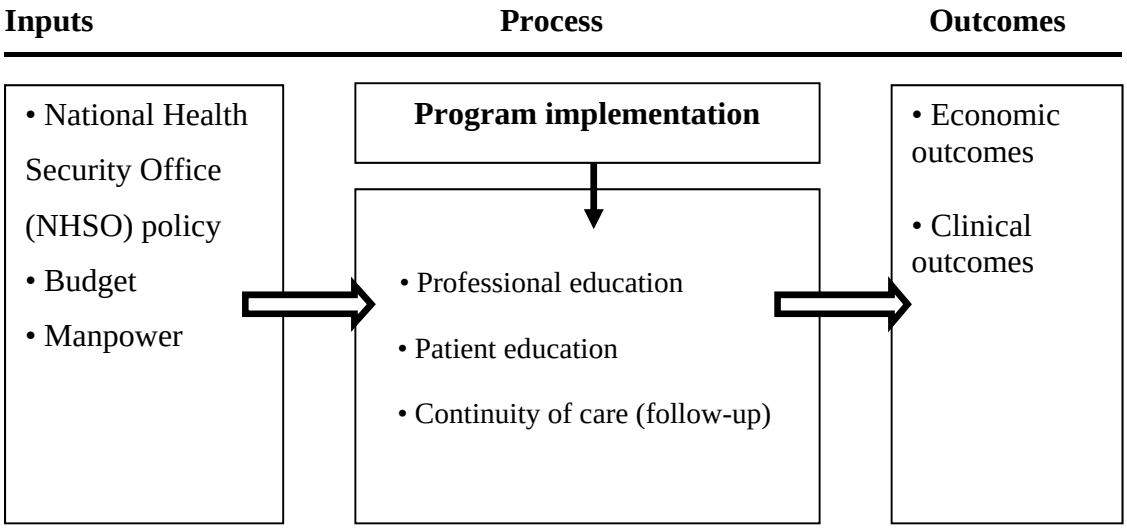

Figure 1.1 Conceptual Framework of Economic and Clinical Outcomes of Easy Asthma and COPD Clinic at Wangtong Hospital, Phitsanulok

CHAPTER II
LITERATURE REVIEW

Four parts for literature review are presented. Part I is asthma and Chronic Obstructive Pulmonary Disease. Part II is burden of asthma and Chronic Obstructive Pulmonary Disease. Part III is outcomes research in asthma and Chronic Obstructive Pulmonary Disease. And the last part is Easy Asthma/COPD Clinic in Thailand.

Part I Asthma and Chronic Obstructive Pulmonary Disease

1. Asthma

1.1 Definition (25)

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread, but variable, airflow obstruction within the lung that is often reversible spontaneously or with treatment.

1.2 Diagnosis (25-28)

A diagnosis of asthma usually is based on the patient's symptoms, medical history, a physical examination, and laboratory tests that measure pulmonary (lung) function.

Measurements of lung function

Measurement of lung function provides an assessment of the severity of airflow limitation, its reversibility and its variability, and provides confirmation of the asthma. Various methods are available to assess airflow limitation, but two methods have gained widespread acceptance for use in patients over 5 years of

age. These are spirometry, particularly the measurement of forced expiratory volume in 1 second (FEV_1) and forced vital capacity (FVC), and peak expiratory flow (PEF) measurement. Predicted values of FEV_1, FVC, and PEF based on age, sex, and height have been obtained from population studies. They are useful for judging whether a given value is abnormal or not.

Spirometry is the recommended method of measuring airflow limitation and reversibility to establish a diagnosis of asthma. The degree of reversibility in FEV_1 which indicates a diagnosis of asthma is generally accepted as 12% and 200 ml from the pre-bronchodilator value. Because many lung diseases may result in reduce FEV_1, a useful assessment of airflow limitation is the ratio of FEV_1 to FVC. The FEV_1/FVC ratio is normally greater than 0.75 to 0.80, and possibly greater than 0.90 in children. Any values less than these suggest airflow limitation.

Peak expiratory flow measurement are made using a peak flow meter and can be an important aid in both diagnosis and monitoring of asthma. Most commonly, PEF is measured first thing in the morning before treatment is taken, when values are often close to their lowest, and last thing at night when values are usually higher. One method of describing diurnal PEF variability is as the amplitude (the difference between the maximum and the minimum value for the day), expressed as a percentage of the mean daily PEF value, and averaged over 1-2 weeks. Another method of describing PEF variability is the minimum morning pre-bronchodilator PEF over 1 weeks. This latter method has been suggested to be the best PEF index of airway lability for clinical practice because it requires only a once-daily reading, correlates better than any other index with airway hyperresponsiveness, and involves a simple calculation. Diurnal variation in PEF of more than 20% suggests a diagnosis of asthma.

1.3 Classification (25)

The global Initiative for Asthma (GINA) revised its guidelines in 2006 to advocate management based on the level of control rather than on disease severity. The classification of asthma is defined as three levels of control; namely, ‘controlled’, ‘partly controlled’ and ‘uncontrolled’ (Table 2.1).

Table 2.1 Classification of asthma by levels of asthma control (25)

Characteristic	Controlled (all of the following)	Partly controlled (any measure present in any week)	Uncontrolled
Daytime symptoms	None (twice or less per week)	More than twice a week	Three or more features of partly controlled asthma present in any week
Limitations of activities	None (twice or less per week)	Any	Three or more features of partly controlled asthma present in any week
Nocturnal symptoms/ awakening	None	Any	Three or more features of partly controlled asthma present in any week
Need for reliever/rescue treatment	None (twice or less per week)	More than twice a week	Three or more features of partly controlled asthma present in any week
Lung function (PEF or FEV_1)	Normal	<80% predicted or personal best (if known)	Three or more features of partly controlled asthma present in any week
Exacerbations	None	One or more per year	One in any week

1.4 Pharmacological therapy

Inhaled corticosteroid

GINA guideline recommended that all patients in all levels of severity use inhaled corticosteroid (ICS) as preventive therapy (25). ICS are currently the most effective anti-inflammatory medications for the treatment of persistent asthma. Their clinical benefits include decreased asthma symptoms, improved lung function, fewer exacerbations, fewer hospitalizations and fewer asthma-related deaths (29, 30).

Short- acting beta-2 agonist

Short-acting beta-2 agonists (SABAs) such as salbutamol and terbutaline are the mainstay drugs for acute relief of asthma symptoms, and the prevention of exercise induced bronchoconstriction. Asthma management guidelines recommend that an inhaled SABA be prescribed as standard reliever therapy and should be carried by all patients with symptomatic asthma (25).

Long-acting beta-2 agonist

Long-acting beta-2 agonists (LABAs), or 'symptom controllers,' provide prolonged bronchodilation, reduction in day- and night-time symptoms, improved quality of sleep and reduced requirement for SABAs (31).

Combination therapy

The addition of LABA to ICS should be considered when asthma symptoms or suboptimal lung function persist on a medium dose of ICS, or when it is desirable to reduce the current dose of ICS while maintaining optimal asthma control (32).

Leukotriene receptor antagonist

Leukotriene receptor antagonists (LTRAs; montelukast and zafirlukast) may be an alternative treatment for mild persistent asthma. Placebo-controlled trials have demonstrated that LTRAs improve lung function, reduce symptoms and asthma exacerbations in adults and children (33).

Cromone

Cromones (cromoglygate and nedocromil) are anti-inflammatory agents that may be used as an alternative to ICS for the long-term treatment of asthma. Cromones have the advantage of having a well-established safety profile, with no significant adverse effects (34).

Methylxanthine

Theophylline can be used as add-on therapy to patients not controlled by low doses of ICS and maintenance treatment in patients with severe asthma who require multiple drugs to achieve symptom control (25).

Anticholinergic

Ipratropium and tiotropium are inhaled anticholinergic bronchodilators with a slower onset of action (30-60 minutes) than SABAs. Ipratropium has a duration of action of approximately four hours, whereas tiotropium's duration of action is close to 24 hours. The addition of ipratropium to a SABA has shown benefit in the initial management of moderate-to-severe asthma exacerbations (35).

Anti- IgE treatment

Omalizumab is a recombinant monoclonal anti-immunoglobulin (Ig) E antibody approved for the treatment of patients with severe allergic asthma, who are already being treatment with ICS and who have raised serum IgE levels. Elevated serum levels of IgE in response to common aeroallergens are a key component in the pathogenesis of atopic asthma. Omalizumab prevents free serum IgE from attaching to mast cells and other effector cells and prevents IgE mediated inflammatory changes (36).

Systemic corticosteroid

Systemic corticosteroids are useful for treating the airway oedema and increased bronchial secretions associated with the inflammation in acute asthma exacerbations (37). The early use of systemic corticosteroids delivered by either oral or intravenous routes during moderate-to-severe exacerbations is a principal treatment choice in asthma management guidelines (25).

2. Chronic Obstructive Pulmonary Disease (COPD)

2.1 Definition (38)

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease with some significant extrapulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases.

2.2 Diagnosis (38)

A clinical diagnosis of COPD should be considered in any patient who has dyspnea, chronic cough or sputum production, and/or a history of exposure to risk factors for the disease. The diagnosis should be confirmed by spirometry. The presence of a postbronchodilator $FEV_1/FVC < 0.70$ confirms the presence of airflow limitation that is not fully reversible.

2.3 Classification (38)

The recent Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines define airflow obstruction as $FEV_1/FVC < 0.7$, and classify COPD into four stages based on the post-bronchodilator FEV_1 (Table 2.2)

Table 2.2 Classification of COPD based on post-bronchodilator FEV_1 (38)

Stage	Characteristic
I. Mild	$FEV_1/FVC < 0.7$; $FEV_1 \geq 80\%$ predicted With or without symptoms (cough, sputum)
II. Moderate	$FEV_1/FVC < 0.7$; $50\% \leq FEV_1 < 80\%$ predicted With or without chronic symptoms (cough, sputum, dyspnea)
III. Severe	$FEV_1/FVC < 0.7$; $30\% \leq FEV_1 < 50\%$ predicted With or without chronic symptoms (cough, sputum, dyspnea)
IV. Very severe	$FEV_1/FVC < 0.7$; $FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted Respiratory failure or clinical signs of right heart failure

2.4 Pharmacological therapy

Inhaled bronchodilator

The GOLD guideline state "inhaled bronchodilators provide symptom relief in patients with COPD and may increase exercise capacity" (38). Inhaled bronchodilators include short- and long-acting beta-2 agonists, and short- and long-acting anticholinergics.

Inhaled corticosteroid

The progression of COPD is associated with inflammation. The GOLD guidelines recommended that anti-inflammatory drugs such as ICS should be considered in patients with a documented response or those who have severe COPD with frequent exacerbations (38).

Combination therapy

Most studies that have explored the value of combination therapy have shown significant improvements over single agents alone (39). In a six-month RCT of 1,704 patients with moderate to very severe COPD, the combination of budesonide and eformoterol demonstrated significant improvements in lung function, dyspnoea and QOL scores compared to either agent alone (40).

Budesonide/eformoterol 320/9 μg demonstrated significantly greater improvements in pre-dose FEV1 versus budesonide (P = 0.026) and one-hour post-dose FEV1 versus budesonide (P < 0.001).

Methylxanthine

In practice, methylxanthines are rarely used because of their narrow therapeutic index and potential for significant adverse effects. Systematic reviews have provided evidence that theophylline improves FEV1 and arterial blood gas tensions compared to placebo in patients with COPD (41). All studies that have demonstrated efficacy of theophylline in COPD were done with slow release preparations. Low dose (100 mg twice daily) slow release theophylline has been shown to reduce exacerbations in patients with COPD but does not increase post-bronchodilator lung function (42).

Systemic corticosteroid

Short courses of systemic corticosteroids are recommended for severe exacerbations of COPD (38). The most appropriate corticosteroid dosage regimen for exacerbations of COPD remains controversial, as the regimens used in RCTs differ greatly, and clinical and systematic reviews do not provide adequate guidance on these regimens (43).

Antibiotic

Antibiotics are recommended for exacerbations with an increase in cough, dyspnoea, sputum volume or purulence. Current evidence does not support long-term antibiotic use to prevent exacerbations in patients with COPD (44).

Oxygen therapy

Continuous supplemental oxygen should be used to improve exercise capacity and survival in patients with moderate-to-severe COPD who have severe hypoxaemia (PaO_2 < 55 mm Hg or SaO_2 < 88%) (38).

Mucolytic

Mucolytics should be considered in patients with COPD who have a chronic cough productive of sputum (38). A systematic review of 26 RCTs (7,335 patients) reported a 20% reduction in the number of exacerbations per patient with oral mucolytics compared to placebo (45).

3. Overlap of asthma and COPD

Asthma and COPD have important similarities and differences. Both are chronic inflammatory diseases that involve the small airways and cause airflow limitation, both result from gene-environment interactions and both are usually characterized by mucous and bronchoconstriction. Differentiation between asthma and COPD is important because the prognosis, treatment goals and several aspects of the guideline recommended management strategies differ for these diseases. Once COPD is established, the only interventions that influence life expectancy are smoking cessation and oxygen therapy (38). By contrast, most patients with asthma have a normal life expectancy if they maintain regular preventive anti-inflammatory medication (25).

Although overlaps exist in the disease characteristics of asthma and COPD, careful history, physical examination and lung function testing often reveal information that facilitates distinction between these diseases, allowing better tailoring of therapy. A misdiagnosis of COPD or asthma may lead to inadequate management of patients and to escalating healthcare costs. An early and accurate diagnosis can help ensure optimal and cost-effective management of patient care.

Asthma and COPD tend to be treated with the same medications, with variations on emphasis. Asthma is optimally treated with regular anti-inflammatory medications (preferably ICS), and short-acting bronchodilators are used when needed. COPD is usually treated with long-acting bronchodilators, which provide symptomatic benefits, and ICS to reduce the frequency of exacerbations. Whilst chronic inflammation underlies both asthma and COPD, the nature of the inflammation differs, as does the response to anti-inflammatory medications (46).

Part II Burden of Asthma and Chronic Obstructive Pulmonary Disease

1. Burden of Asthma

1.1 Prevalence

Asthma has become more common in both children and adults around the world in recent decades. It is estimated that as many as 300 million people of all ages and all ethnic backgrounds suffer from asthma (47). Two large multinational studies have assessed the prevalence of asthma around the world : the European Community Respiratory Health Survey (ECRHS) in adults (48) and the International Study of Asthma and Allergies in Childhood (ISAAC) in children (49). The global prevalence of asthma ranges from 1% to 18% of the population. Trends in asthma prevalence vary between countries. In Thailand, there has been a rise in the prevalence of asthma over the last decade with 10-15% of children (6) and 3-7% of adults (7) affected by the disease. The increase in the prevalence of asthma has been associated with an increase in atopic sensitization, and is paralleled by similar increases in other allergic disorders such as eczema and rhinitis. The rate of asthma increases as communities adopt western lifestyles and become urbanized (50). With the projected increase in the proportion of the world's population living in urban areas, there is likely to be a marked increase in the number of asthmatics worldwide over the next two decades. It is estimated that there may be an additional 100 million people with asthma by 2025 (47).

1.2 Morbidity

The hospitalization of patients with asthma is another measure of asthma severity, but data cannot be obtained in most low and middle income countries (51). In countries or regions where asthma management plans have been implemented, hospitalization rates have decreased (52, 53). Asthma is often severe in poor people and minorities (54). Survey of asthma control in Thailand revealed that morbidity of asthma in Thailand was high and data from Ministry of Public Health in Thailand found that number of hospitalization in asthma patients was increasing every year from 66,679 persons in 1995 to 100,808 persons in 2007 (55).

1.3 Mortality

Annual worldwide deaths from asthma have been estimated at 250,000 (47). There are large differences between countries, and the rate of asthma deaths does not parallel prevalence. Mortality of asthma in Thailand was increasing from 806 persons in 1999 to 1,697 persons in 2005 and average mortality rate was 1,000 persons per year (55). Mortality seems to be high in countries where access to essential drugs is low. Many of the deaths are preventable, being a result of suboptimal long-term medical care and delay in obtaining help during the final attack. In many areas of the world, people with asthma do not have access to basic asthma medications and health care (47). The countries with the highest death rates are those in which controller therapy is not available. In many countries, deaths due to asthma have declined recently as a result of better asthma management (52).

1.4 Co-morbidities

The links between rhinitis and asthma are importance. Epidemiological studies have consistently shown that asthma and rhinitis often co-exist in the same patients. In epidemiological studies, over 70% of people with asthma have concomitant rhinitis (56). However, only 15 to 40% of rhinitis patients have clinically demonstrable asthma. Patients with severe persistent rhinitis have asthma more often than those with intermittent disease (57). Allergic and non-allergic rhinitis are associated with asthma. Although differences exist between rhinitis and asthma, upper and lower airways may be considered as a unique entity influenced by a common and probably evolving inflammatory process, which may be sustained and amplified by intertwined mechanisms (58).

The prevalence of rhinitis has been studied in some large epidemiological studies. According to the European Community Respiratory Health Survey (ECRHS), the prevalence of rhinitis is around 35% in Europe and Australia(59). According to the International Study of Asthma and Allergy in Childhood (ISAAC), the prevalence of allergic rhinitis ranges from very low to 50% of adolescents (60), with an average of over 30% (61). The prevalence of allergic rhinitis is increasing in developing countries. Co-morbidity between allergic rhinitis and asthma in Thailand was observed by Trakultivakorn *et al* who found that 55-75%

of asthmatic children had allergic rhinitis while 13.9-25% of rhinitis children had asthma (6).

1.5 Disability – adjusted life years (DALYs)

The number of disability – adjusted life years (DALYs) lost due to asthma worldwide has been estimated about 15 million per year, which is similar to that for diabetes, liver cirrhosis and schizophrenia. Worldwide, asthma accounts for around 1% of all DALYs lost, which reflects the high prevalence and severity of asthma (47). In Thailand, DALYs lost due to asthma accounts 1.5% in male and 2.2% in female (11).

1.6 Economic burden

The economic burden of asthma is considerable both in terms of direct medical costs (such as hospital admissions and the cost of pharmaceuticals) and indirect medical costs (such as time lost from work and premature death) (62). The costs of asthma are high in severe or uncontrolled asthma (63). Emergency treatment is more expensive than planned treatment. Many children with undiagnosed asthma miss school and require emergency department visits, albeit that those with a current diagnosis of asthma report more resource use (64). Children of low socioeconomic status are more likely to require resource because of their asthma (65). In low and middle income countries, childhood asthma has significant adverse effects on the child's daily activities, schooling, family life and finances (66).

Developed economies can expect to spend 1 to 2% of their health-care budget on asthma (47). Investigations have shown that the financial burden on patients with asthma in different Western countries ranges from $300 to $1,300 per patient per year (67). In Asia, despite a lower prevalence of asthma than in the West, the cost of disease management is a significant and an increasing economic burden. In Japan, the annual direct medical cost associated with managing asthma has been estimated to be US$8.2 billion. This accounted for 1.9% of the annual cost of medical care and 18.9% of the annual cost of medical care for respiratory diseases (68). The indirect costs represent not just costs relating to the patient but, if the patient is a child, also to their family. In England, 69% of parents of asthmatic children reported having to take time off from work because of their child's asthma, and 13% had lost their jobs (69). In Europe, the total cost of asthma currently is approximately €17.7 billion

($21.65 billion) per year. Outpatient costs account for the highest proportion at approximately €3.8 billion ($4.65 billion), followed by expenses for antiasthma drugs (€3.6 billion, or $4.4 billion). Inpatient care accounts for a relatively minor cost of just €0.5 billion ($0.61 billion). As poor asthma control is responsible for significant work impairment, productivity losses add up to €9.8 billion ($11.99 billion) per year(69). The economic burden of asthma disproportionately affects those with the most severe disease. In both Western and developing countries, patients with severe asthma are responsible for approximately 50% of all direct and indirect costs, even though this patient population represents just 10 to 20% of all asthma sufferers (70). By contrast, the 70% of asthma patients with "mild" disease account for only 20% of total asthma costs (70).

2. Burden of Chronic Obstructive Pulmonary Disease

2.1 Prevalence

The Burden of Obstructive Lung Disease (BOLD) study found a global prevalence of 10.1%. Men were found to have a pooled prevalence of 11.8% and women 8.5% (71). Accurate estimates of prevalence in most countries are unknown, as there have been few published population-based studies on the prevalence of COPD worldwide, especially in developing countries. Even in countries where data are available, published prevalence rates vary appreciably across countries, due to different methods and criteria for detecting COPD in the community, such as symptoms of chronic bronchitis, physician-diagnosed COPD, or spirometric airflow limitation (72).

Using spirometric airflow limitation as a more objective diagnostic criteria for COPD, the prevalence of COPD is about 6% among men and women of all ages in Norway (73) and northern Italy (74). When COPD was defined in terms of a post-bronchodilator airflow limitation as an FEV_1/FVC ratio of < 0.7, the prevalence in populations ≥ 40 years of age in five major Latin American cities ranged from 7.8% in Mexico City to 19.7% in Montevideo (75). Using a similar protocol, a recent study from Salzburg, Austria, reported an overall prevalence of COPD of 26.1%, equal in men and women, and a prevalence for moderate-to-severe COPD of 10.7% (76). In Asian countries, epidemiologic studies are scant, patchy, or localized.

Population-based studies are rare, because of limitations in resources, the complexity of organization, and the unavailability of lung function equipment. According to the WHO estimates, the number of COPD cases in Asia exceeds by three times the total number of COPD cases for the rest of the world (77). The Asia Pacific Round Table group, consisting of a panel of regional respiratory experts, used a statistical model with a standardized protocol to project and compare the prevalence of moderate-to-severe COPD in 12 Asian countries or cities (78). The projected prevalence rates range from 3.5% for Hong Kong and Singapore to 6.7% in Vietnam, with an overall prevalence rate of 6.3% for the region, which is considerably higher than that estimated by the WHO for the region (3.8%) (Table 2.3).

Smoking is a major risk factor in men (79). In non-smoking women, unexpectedly, the prevalence of COPD is also high in high income countries, as well as in low and middle income countries. In low and middle income countries, COPD in women may be associated with biomass burning.

Table 2.3 Model projection of the prevalence of moderate-to-severe COPD in person ≥ 30 years of age for 12 countries/cities in the Asia-Pacific region (78)

Model	Country	Moderate-to-Severe COPD Cases	Prevalence %
1	Australia	558,000	4.70
2	China	38,160,000	6.50
3	Hong Kong	139,000	3.50
4	Indonesia	4,806,000	5.60
5	Japan	5,014,000	6.10
6	South Korea	1,467,000	5.90
7	Malaysia	448,000	4.70
8	Philippines	1,691,000	6.30
9	Singapore	64,000	3.50
10	Taiwan	636,000	5.40
11	Thailand	1,502,000	5.00
12	Vietnam	2,068,000	6.70
	Total	**56,553,000**	**6.30**

2.2 Morbidity

COPD is a major cause of chronic morbidity worldwide (80). Global Burden of Disease Study estimates morbidity of COPD by years of living with disability (YLD). The result was 1.68 YLD per 1,000 population, representing 1.8% of all YLDs, with a greater burden in men than in women (1.93% vs. 1.42%) (81). Morbidity includes physician visits, and hospitalizations. COPD databases for these outcome parameters are not readily available and usually are less reliable than mortality databases. Despite the limitations in the data for COPD, the European White Book provides good data on the mean number of consultations for major respiratory diseases across 19 countries of the European Economic Community (82). In most countries, consultations for COPD greatly outnumbered consultations for asthma, pneumonia, lung and tracheal cancer, and tuberculosis. In the United States in 2000, there were 8 million physician office/hospital outpatient visits for COPD, 1.5 million emergency department visits, and 673,000 hospitalizations (83).

Hospitalization is an important health economic outcome as it accounts for more than half of all the health-care cost for COPD in most countries. The limited available Asian data indicate that morbidity due to COPD increases with age and is considerably greater in men than women (84, 85), in contrast to the narrower gender gap in most Western countries (86, 87), and the reversal of the gender ratio in the United States where female rates have exceeded male rates (88). Acute exacerbations of COPD are common cause of hospitalization. Hospitalizations attributable to COPD are sharply increasing in most countries. In Asia, hospitalization is the single largest item in the direct health-care cost for COPD (84). Hospitalizations for COPD are increasing in most Asian countries (85, 89). In some Asian countries such as Singapore, even as the trend for mortality rates fell, hospitalization rates continued to rise.

2.3 Mortality

According to WHO, COPD will move from fifth leading cause of death in 2002, to fourth place in the rank projected to 2030 worldwide (90). Almost 90% of COPD deaths occur in low- and middle-income countries. Total deaths from COPD are projected to increase by more than 30% in the next 10 years without interventions to cut risks, particularly exposure to tobacco smoke (38). In high income

countries, COPD is the major chronic disease for which deaths are increasing. Mortality rates in Asia are similar to or higher than those in the West (85, 91). There are a few Asian mortality reports using ICD codes for COPD. In Singapore, COPD is ranked as the sixth-leading cause of death, accounting for 4.6% of total deaths and 5.8% of those persons ≥ 55 years of age. In Taiwan, COPD mortality based on ICD codes ranked sixth as a cause of death in 2002, with a rising trend due to increased mortality in men (91). In Thailand, mortality rate of COPD was 6.4% in all ages group (92).

2.4 Co-morbidities

COPD is a multi-component and systemic disease. The components affect both the lungs and organs outside the lungs the so-called systemic effects of COPD (93) and can be of either a structural (including airway remodeling, emphysema, skeletal muscle wasting or osteoporosis) or functional nature (inflammation, apoptosis, senescence). Furthermore, these components are interdependent in a closely linked vicious cycle. Even allowing for common etiological factors, a link has been identified between COPD and other systemic diseases (94), such as cardiovascular disease, diabetes, osteoporosis and possibly peptic ulcer. COPD and other disorders associated with reduced lung function are strong risk factors for cardiovascular hospitalizations and deaths, independent of smoking. Studies suggest that cardiovascular risk should be monitored and treated with particular care in any adult with COPD and that COPD and other co-morbidities should be carefully considered in patients with chronic heart failure (95). COPD and lung cancer are common in the same patients. Although other risk factors for lung cancer exist, smoking is the major risk factor. The presence of moderate or severe obstructive lung disease is a significant predictor of lung cancer in the long term (96). The screening for lung cancer in patients at risk is, however, still a matter of debate.

2.5 Disability – adjusted life years (DALYs)

The burden of COPD assessed by disability-adjusted life years (DALYs) ranks eleventh worldwide in 2002. The WHO predicts that COPD will become the seventh rank worldwide by disability-adjusted life years (DALYs) in 2030 (90). In Thailand, DALYs lost due to COPD accounts 3.2% in male and 2.6% in female (11).

2.6 Economic burden

COPD is a costly disease with both direct costs (value of health care resources devoted to diagnosis and medical management) and indirect costs (monetary consequences of disability, missed work, premature mortality, and caregiver or family costs resulting from the illness) (82).

In developed countries, exacerbations of COPD account for the greatest burden on the health care system. In the European Union, the total direct costs of respiratory disease are estimated to be about 6% of the total health care budget, with COPD accounting for 56% (38.6 billion Euros) of this cost of respiratory disease (82). In the United States in 2002, the direct costs of COPD were $18 billion and the indirect costs totaled $14.1 billion (97). Costs per patient will vary across countries since these costs depend on how health care is provided and paid. The presence of COPD greatly increases the total cost of care for patients, especially when inpatient costs are considered. A US study of per patient direct costs (in $US 2005), using recent data yielded attributable cost estimates (costs deemed to be related to COPD) in the range of $2,700 to $5,900/patient annually, and excess cost estimates (total costs incurred by COPD patients minus total costs incurred by non-COPD patients) in the range of $6,100 to $6,600 annually (98). Most of the health burden from COPD comes from hospital visits in late disease (88).

In developing countries, direct medical costs may be less important than the impact of COPD on workplace and home productivity. Because the health care sector might not provide long-term supportive care services for severely disabled individuals, COPD may force two individuals to leave the workplace affected individual and a family member who must now stay home to care for the disabled relative. Since human capital is often the most important national asset for developing countries, the indirect costs of COPD may represent a serious threat to their economies.

3. Barriers to reducing the burden of asthma and COPD (47, 71)

Although effective drugs and evidence-based guidelines have been developed, no major change in morbidity and mortality can be recognized and data indicate that asthma and COPD in most patients are not well controlled. There are

many barriers to reducing the burden of asthma and COPD. These barriers are consist of:

1. Social barriers including poverty, poor education, and poor infrastructure.
2. Environmental barriers including indoor and outdoor air pollution, tobacco smoking, and occupational exposures.
3. Low public health priority due to the importance of other respiratory illness such as tuberculosis and pneumonia and the lack of data on morbidity and mortality from asthma and COPD.
4. The lack of symptom-based rather than disease-based approaches to the management of respiratory diseases including asthma and COPD.
5. Unsustainable generalizations across cultures and health care systems which may make management guidelines developed in high-income countries difficult to implement in low and middle-income countries.
6. Inherent barriers in the organization of health care services in terms of:
   a. geography
   b. education and training systems
   c. tendency of care to be “acute” rather than “routine”
   d. type of professional responding
   e. public and private care
7. The limited availability and use of medications including:
   a. omission of basic medications from WHO or national essential drug lists
   b. poor supply and distribution infrastructure
   c. cost
   d. cultural attitudes towards drug delivery systems, e.g. inhalers
8. Patient barriers including:
   a. cultural factors
   b. underuse of self-management
   c. lack of information
   d. over-reliance on acute care
   e. use of alternative unproven therapies

f. poor adherence and poor compliance in medication treatment

9. Inadequate government resources provided for health care including asthma and COPD.

10. The requirement of respiratory specialists and related organizations to care for a wide variety of diseases, which has in some regions resulted in a failure to adequately promote awareness of asthma and COPD.

Part III Outcomes research in Asthma and Chronic Obstructive Pulmonary Disease

Interventions in asthma and COPD can reduce the burden of asthma and COPD. The results of interventions illustrate in several outcomes such as clinical outcomes, quality of life, resource utilization and patient satisfaction. According to Cochrane Effective Practice and Organization of Care (EPOC) (99), an interventions in asthma and COPD were targeting patient behavior, such as patient education, or self-management interventions; 'professional' when aiming at professional practice behavior, for example professional education, audit and feedback; 'organizational' when interfering in the structure or organization of care, for instance revision of professional roles, or arrangements for follow-up (Table 2.4).

Table 2.4 Definitions of interventions in asthma and COPD care (99)

Interventions	Definitions
Patient education	Interventions designed to promote increased understanding of a target condition or to teach specific prevention or treatment strategies, or specific in-person patient education (e.g., individual or group sessions with nurse educator; distribution of printed or electronic educational materials). Interventions with patient education were included only if they also included at least 1 other strategy related to clinician or organizational change.
Professional education	Intervention designed to promote increased understanding of principles guiding clinical care or awareness of specific recommendations for a target condition or patient population (e.g. educational meetings, active distribution of educational materials, and educational outreach visits).
Expansion or revision of professional roles	Changes to the structure or organization of the primary health care team: • Adding a team member or "shared care" (e.g., routine visits with personnel other than the primary physician or nurse specialists in asthma/COPD care, pharmacists). • Expansion or revision of professional roles (e.g., nurse or pharmacist plays more active role in patient monitoring).
Case management	Any system for coordinating diagnosis, treatment, or ongoing patient management (e.g., arrangement for referrals, follow-up of test results) by a person or multidisciplinary team in collaboration with or supplementary to the primary care clinician.

Systematic review of outcomes of asthma and chronic obstructive pulmonary disease

A number of excellent intervention studies related to clinical, economic, and humanistic outcomes of asthma and COPD have been undertaken in the recent past. A systematic review was conducted to review and assess outcomes of asthma and COPD interventions from studies during 2000-2011. These studies were search through the Pubmed, Ovid, and Cochrane databases using the combination of keywords as follows.

interventions, disease management, health education, patient education, professional education, case management, self-care, patient care team, practice guidelines, comprehensive health care, program evaluation, economic outcomes, clinical outcomes, quality of life, health care utilization, health care costs, asthma or COPD

Inclusion criteria

1. Randomized controlled trials (RCTs), experimental, quasi-experimental, controlled before and after studies (CBAs) , and descriptive studies contained at least 1 asthma or COPD intervention.

2. Asthma or COPD studies had provided details at least one outcome measured such as clinical outcomes, quality of life, health-care utilization, health-care costs, and/or patient satisfaction.

3. The control group in the studies needed to have been provided usual care or single intervention.

4. Publication date during 2000-2011.

5. Only English language studies.

Exclusion criteria

1. Studies designed to evaluate the impact of specific therapeutic regimens of asthma or COPD such as oral or inhaled bronchodilator therapy, oxygen therapy.

2. Studies compared clinical practice guidelines of asthma or COPD.

Based on systematic reviews, 146 abstracts were reviews and 64 relevant articles were included in this study. Of the 64 articles were identified as 31 studies on asthma, 28 studies on COPD, and 5 studies on asthma and COPD. The studies included were 39 randomized controlled trials (RCT), 7 controlled before and after

studies (CBAs), 11 quasi-experimental, and 7 descriptive studies. Most studies reported quality of life and health-care utilization measures. Instruments for measurement of quality of life differed widely among the studies. Reported clinical outcomes, lung function and symptoms, generally demonstrated no significant differences between intervention and control groups in COPD studies. But, studies directed at asthma patients frequently showed a significant decline in symptoms and reduced health-care use. Disease management program in asthma and COPD shows improvements in quality of life and reductions in hospitalizations in triple interventions. Various studies reported quality of care measures (satisfaction), a great variety of instruments found mostly significant beneficial differences for multiple interventions. Improved compliance, enhanced knowledge, and inhalation technique were frequently found, often combined with significant improvement in quality of care. In Thailand, there are a few researches on outcomes of asthma and COPD and most of these studies focused on clinical outcomes. It will be interesting to evaluate economic and clinical outcomes in our study. Table 2.5, 2.6, 2.7 presented detail of the studies on outcomes of asthma and COPD from this review.

Table 2.5 Studies on outcomes of asthma

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Patient education					
Australia					
Shah et al., 2001 (100)	RCT	Asthma students from six high schools in rural Australia I: A structured education program for peers comprising three steps (N=138) C: normal care (N=113)	3	• QOL: 23 items (3 domains) • School absenteeism • Asthma attacks	Sign. mean total QOL scores Sign. decreased school absenteeism Sign. asthma attack increased in the control group only
Netherlands					
Kamps et al., 2004 (101)	RCT	Asthma child aged 2-16 yrs who had been referred by their general practitioner because of insufficient asthma control to the outpatient clinic I: Comprehensive education by asthma nurse (N=37) C: Pediatricians care (N=37)	12	• Health-care costs	Sign. Overall health-care costs were 4.1% lower for nurse-led outpatient management compared to traditional medical care by pediatricians
U.K					
McCann et al., 2006 (102)	RCT	Asthma child aged 7-9 yrs in schools at South of England I: whole-class asthma workshops, advice on asthma policy (N=106) C: received no asthma-related input (N=113)	12	• QOL: 4 domains • School absences • Knowledge • Symptom: Wheeze • Perceived self-esteem	Sign. improved in active domain NS Sign. increased asthma knowledge NS Sign. increased self-esteem in young females
Canada					
McGhan et al., 2010 (103)	RCT	Asthma child grades 2-5 from 34 schools in Alberta I: Childhood asthma education program by health professionals in schools (N=71) C: Usual care (N=126)	12	• QOL: PAQLQ • Asthma management and asthma control	Sign. improved overall QOL Sign. parent's perceived understanding and ability to cope with control asthma

I = intervention group, C= control group, Sign = Significant, NS = No significant, QOL = Quality of life, PAQLQ = Pediatric Asthma Quality of Life Questionnaire

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Taiwan					
Maa et al., 2010 (104)	Quasi-experimental study	Seventh-grade asthma students from middle school in Taoyuan I: School-based asthma education program: 1) general clinical features of asthma 2) appropriate school asthma care strategies 3) instruction the proper use of medical equipment (N=31)	18	• Lung function: % FEV_1, % FVC, % FEV_1/FVC predicted • Symptom: Disease-related symptoms	Sign. improved on % FEV_1, % FVC, % FEV_1/FVC predicted There was a trend towards improved asthma symptoms.
United states					
Rhee et al., 2011 (105)	RCT	Asthma patients aged 13-17 in a city and adjacent suburbs in upstate New York I: A peer-led asthma self – management program : 1) asthma education 2) psychosocial issues 3) asthma self-management skills (N=59) C: Usual care (N=53)	9	• QOL: PAQLQ • Attitude: The child attitude toward illness scale	Sign. higher QOL than control group Sign. more positive attitude than control group
Patient education, continuity of care (follow-up)					
United states					
Susan et al., 2002 (106)	RCT	Asthma patients aged ≤ 18 who were registered at primary care offices of Kaiser Permaneate Colorado I: Comprehensive education and follow-up to patients identified from an asthma registry or referred by providers (N=163) C: Usual care (N=135)	18	• The proportion of patients who received more than 1 dispensing of ICS during the observation period • Health-care utilization: ED visits; hospitalization	Sign. greater in intervention group NS

I = intervention group, C= control group, Sign = Significant, NS = No significant, QOL = Quality of life, PAQLQ = Pediatric Asthma Quality of Life Questionnaire

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Australia					
Pilotto et al., 2004 (107)	RCT	Asthma patients aged ≥18 years attended nurse-run asthma clinics I: Comprehensive education and follow-up patients by nurse (N=80) C: Usual care (N=90)	9	•Lung function: FEV_1 •Health-care utilization: ED visits, hospitalization, days off, visits	NS NS; NS; Sign. less time off work; Sign. more hospital outpatient department visits
U.K.					
Smith et al., 2005 (108)	RCT	Adult patients registered at the asthma clinic at five hospitals in Norfolk and Sufflok , U.K. I: Psychoeducational program of home visits and telephone calls from a supervised respiratory nurse specialist (N=47) C: Routine asthma care (N=45)	12	• QOL: SF36 (2 domains); LWAQ • Behaviour, compliance	Sign. more improvement in mental health score, physical functioning NS; Sign. better asthma quality of life score NS, Sign. more increase in PEF monitoring
United States					
Schatz et al., 2006 (109)	RCT	Asthma patients aged 18-56 of the San Diego Kaiser Permanente Medical Care Programme I: Self-management education and provision of inhaled budesonide and home visit (N=31) C: regular asthma care (N=31)	12	• QOL: AQLQ • Symptom : Symptom free days • Knowledge	NS NS Sign. better rating of asthma knowledge
United States					
Bunting BA. and Cranor CW, 2006 (110)	Quasi – experimental, longitudinal pre-post study	Asthma patients at Mission Hospitals, Asheville, North Carolina I: Education by a certified asthma educator, regular long-term follow-up by pharmacists (N=252)	60	• Lung function: FEV_1, asthma severity • Asthma-related costs	Sign. improved in FEV_1 and severity classification Overall asthma-related costs decreased.

I = intervention group, C= control group, Sign = Significant, NS = No significant, QOL = Quality of life, SF36 = Short-Form 36, LWAQ = Living With Asthma Questionnaire, AQLQ = Asthma Quality of Life Questionnaire

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Australia					
Donald et al., 2008 (111)	RCT	Asthma patients aged 18-55 admitted to one or both of two metropolitan Melbourne teaching hospitals I: Face to face session with an asthma educator and six telephone calls over 6 months (N=36) C: Usual care (N=35)	12	• Lung function: Morbidity • Health-care utilization: ED visits, readmissions	NS NS, Sign. less readmissions
Professional education, patient education					
United States					
Cabana et al., 2006 (112)	RCT	Pediatricians from 10 different regions and asthma patients aged 2-12 yrs from 10 cities I: Physician Asthma Care Education : 1) reviews asthma guidelines 2) communication skills and key education messages (N=51) C: Not attend the program (N=43)	12	• Provider behavior • Health-care utilization: ED visits, hospitalization	Sign. physicians in the intervention group were more likely to inquire about patients' concerns about asthma Sign. decreased ED utilization and hospitalization
Patient education, pharmacist intervention					
Canada					
Mclean et al., 2003 (113)	RCT	Uncontrolled asthma patients in from pharmacies in the community I: Pharmaceutical care (N=191) C: Usual care (N=214)	12	• Lung function: PEFR • QOL: AQLQ (4 domains) • Symptom: Dyspnea, cough, wheeze, phlegm • Health-care utilization: ED visits, hospitalization, days off, visits • Knowledge, compliance	Sign. Improvement in mean PEFR Sign. greater improvement in all domains Sign. greater improvement in all symptoms NS; NS; NS; Sign. reduction in No. of medical visits Sign. greater improvement

I = intervention group, C= control group, Sign = Significant, NS = No significant, QOL = Quality of life, AQLQ = Asthma Quality of Life Questionnaire

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Thailand					
Khienphet C., 2004 (114)	Quasi-experimental study	Asthma patients aged 19-56 at Taphanhin Crown Prince Hospital, Pichit I: Pharmacist counseling in medication and instruct inhaling technique (N=34)	6	• Lung function: PEFR, asthma severity • QOL: AQLQ • Knowledge, inhalation technique	Sign. improved in PEFR and severity classification Sign. improved overall QOL Sign. improved knowledge of disease and inhalation technique
Thailand					
Klaikaew L., 2009 (115)	Prospective descriptive study	Asthma patients aged >15 yrs at Songkhla Hospital I: Pharmacist counseling on non-adherence problems (N=114)	12	• Lung function: PEFR • Inhalation technique	Sign. 54.3% of patients had increased maximum expiratory flow rate. Sign. 44.1% of patients improved in inhalation technique.
Professional education, patient education, continuity of care (follow-up)					
United States					
Johnson et al., 2005 (116)	CBA	Patients in the McKesson Asthma Care Support Advisor program I: Asthma education, counseling, self-management plan, telephonic follow-up (N=196) C: Usual care (N=196)	12	•Health-care utilization: ED visits, hospitalization, length of stay • Compliance	Sign. fewer ED visits, hospitalizations, bed days, and asthma-related admissions Sign. higher rates of medication usage
United States					
Schoulau et al., 2005 (117)	CBA	Asthma patients of 6 rural and urban asthma clinics I: Collaborated use of guideline, asthma education, telephonic follow-up (N=101) C: Usual care (N=64)	12	• QOL: SF12 • Quality of care: Satisfaction • Health-care utilization: ED visits, Days off • Knowledge, behaviour, compliance	NS Sign. more likely to be satisfied with clinician NS; NS NS; Sign. better self-management; NS

I = intervention group, C= control group, Sign = Significant, NS = No significant, QOL = Quality of life, AQLQ = Asthma Quality of Life Questionnaire, SF12 = Short-Form 12

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Thailand Duangdee A., 2007 (118)	Retrospective descriptive study	Asthma patients from Easy Asthma Clinic at Banphai Hospital, Khon kaen I: Implementation of asthma guideline, asthma education, continuity of follow-up (N=331)	24	• Health-care utilization: ED visits, hospitalization • Severity of disease	Sign. decreased ED visits and admission rate Sign. disease severity in level control increased from 5.88% to 8.94%
Thailand Janworachaikul C., 2007 (119)	Retrospective descriptive study	Asthma patients aged > 15 from Easy Asthma Clinic at Yangtalad Hospital, Kalasin I: Implementation of asthma guideline, asthma education, continuity of follow-up (N=103)	36	• Health-care utilization: ED visits, hospitalization, readmission rate • Severity of disease	Sign. reduction in ED visits, hospitalization, and readmission rate Sign. proportion of control stage increased from 15.5% to 18.4%
Thailand Chermchitrphong et al ., 2007 (120)	Retrospective descriptive study	Asthma patients from Easy Asthma Clinic at Manjakiree Hospital, Khon Kaen I: Implementation of asthma guideline, asthma education, continuity of follow-up (N=87)	12	• Lung function: PEFR • The use of ICS • Health-care utilization: ED visits, hospitalization	Sign. increased the mean of PEFR Sign. increased the use of ICS Sign. reduction in number of ED visits, NS
Thailand Phatthararitthikul K., 2007 (121)	Retrospective descriptive study	Asthma patients from Easy Asthma Clinic at Nongsonghong Hospital, Khon Kaen I: Implementation of asthma guideline, asthma education, continuity of follow-up (N=32)	12	• Asthma attack at daytime and nighttime • The use of inhaled bronchodilator • Health-care utilization: Admission rate	Sign. asthma attack at daytime and nighttime decreased Sign. using inhaled bronchodilator decreased from 84.4% to 68.7%. Sign. admission rate decreased from 40.6% to 9.4%

I = intervention group, C= control group, Sign = Significant

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Thailand					
Chamnan et al., 2010 (122)	Quasi-experimental study	Asthma patients aged ≥ 16 from outpatient clinic at Srimuangmai Hospital, Ubon Ratchathani I: Implementation of asthma guideline, comprehensive self-management education, continuity of follow-up (N=57)	12 wks	• Health-care utilization: ED visits, hospitalization • QOL: AQLQ	Sign. decreased in ED visits and hospitalization Sign. overall AQL scores increased
Thailand					
Jeamboonsri P., 2010 (123)	Quasi-experimental study	Asthma patients from Easy Asthma Clinic at Mahavajiralongkorn Hospital, Ubon Ratchathani I: Implementation of asthma guideline, asthma education, continuity of follow-up (N=43)	6	• Patient satisfaction • Asthma symptom	Sign. increased patient satisfaction Sign. asthma symptom during the day and night reduced
Professional education, patient education, pharmacist intervention					
Germany					
Schulz et al., 2001 (124)	CBA	Asthma patients registered in a pharmacies in the city of Hamburg I: Training of pharmaceutical care (for pharmacists), assessed inhalation technique, detected and solved drug related problem (N=191) C: Usual care (N=205)	12	• Lung function: FEV_1;PEFR • QOL: SF36 (2 domains); LWAQ (11 domains) • Knowledge, inhalation technique, self-efficacy	NS; NS Sign. more improvement in mental scale, physical scale NS ; Sign. more improvement in summary and all subscales Sign. more improvement in knowledge, inhalation technique and self-efficacy

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, AQLQ = Asthma Quality of Life Questionnaire, SF36 = Short-Form 36, LWAQ = Living With Asthma Questionnaire

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Denmark					
Herborg et al., 2001 (125)	CBA	Asthma patients aged 16-60 yrs who purchased medication at the participating community pharmacies in the area I: Training of pharmaceutical care (for pharmacists), identify and resolve problems with drug therapy (N=264) C: Usual care (N=236)	12	• Lung function: PEFR • QOL: NHP; LWAQ • Symptom: Asthma symptom • Quality of care: Satisfaction • Health-care utilization: ED visits, hospitalization • Knowledge, compliance	NS Sign. more improvement on both measures Sign. better improved asthma status NS NS; NS Sign. more knowledge on asthma medications, less inhalation errors
U.K.					
Barbanel et al., 2003 (126)	RCT	Adults aged 18-65 yrs with a general practioner diagnosis of asthma who regularly visited the pharmacy for collection of prescribed medication I: Review of inhalation technique and personnel education from the pharmacists (N=12) C: Usual care (N=12)	3	• Symptom: North of England symptoms questionnaire	Sign. better symptom score
Australia					
Armour et al., 2007 (127)	RCT	Asthma patients aged 18-75 yrs registered in a pharmacy in New South Wales, Victoria and Queensland I: Pharmacist training, counseling and education on medication (N=191) C: Usual care (N=205)	6	• Lung function: FEV_1 • Symptom: Perceived Control of Asthma (PCAQ) • QOL: AQLQ (4 domains) • Knowledge, inhalation technique	NS Sign. better asthma control Sign. more beneficial effects in total score Sign. more asthma knowledge, Sign. increase of correct inhalation technique

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, NHP = Nottingham Health Profile, LWAQ = Living With Asthma Questionnaire, AQLQ = Asthma Quality of Life Questionnaire

Table 2.5 Studies on outcomes of asthma (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Australia					
Kritikos et al., 2007 (128)	RCT	Asthma patients aged ≥ 16 yrs registered in a pharmacy in the Central Sydney Area I: Pharmacist training, asthma education delivered by pharmacists (N=16) C: Usual care (N=16)	3	• Symptom: Asthma control • QOL: AQLQ • Knowledge, inhalation technique	Sign. less patients in the severe asthma/poor control category Sign . more improvement in quality of life Sign. higher asthma knowledge scores, sign. more increase of correct inhalation technique
Belgium					
Mehuys et al., 2008 (129)	RCT	Asthma patients aged 18-50 yrs registered in pharmacies, located in diverse areas of Flanders I: Pharmacist training, personnel education about asthma medication, assessed Asthma Control Test (ACT) (N=107) C: Usual care (N=94)	6	• QOL: AQLQ • Symptom: Asthma Control Test • Compliance, inhalation technique, knowledge	NS Sign. higher reduction in need of rescue medication and less night-time awakenings Sign. higher adherence to controller medication, Sign. better inhalation technique, NS
Thailand					
Lertsinudom et al., 2008 (130)	Retrospective descriptive study	Asthma patients from Easy Asthma Clinic at Srinagarind Hospital, Khon Kaen I: Pharmacist training, resolve drug related problems (N=303)	24	• Patient compliance, prevented DRPs	Sign. non-compliance was resolved 49.2%, DRPs were resolved 44.9%.

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, AQLQ = Asthma Quality of Life Questionnaire

Table 2.6 Studies on outcomes of COPD

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Patient education					
Netherland					
Monninkhof et al., 2003 (131)	RCT	COPD patients aged 40-75 from outpatient pulmonary clinic of the Medisch Spectrum Twente in Easchede I: Skill-oriented disease management (2-hour group interventions) and fitness intervention (N=127) C: regular care (N=121)	12	• QOL: SGRQ • Symptom: 6MWT, Symptom diary	NS. No differences in SGRQ scores NS
Spain					
Guell et al., 2006 (132)	RCT	COPD patients aged ≤ 75 yrs at outpatient clinic I: Pulmonary rehabilitation (N=18) C: Usual care (N=17)	4	• QOL: Chronic Respiratory Disease Questionnaire (CRQ) • Exercise capacity: 6MWT	Sign. changes in dyspnea and mastery domains of the CRQ Sign. differences in 6MWT of intervention group
U.K.					
Pushparajah et al., 2006 (133)	Quasi-experimental study	COPD patients who were admitted with acute exacerbation at Royal London Hospital I: Comprehensive education, pulmonary rehabilitation (N=95)	5	• Health-care utilization: Hospitalization, LOS	NS, NS (Overall there was no reduction in admission frequency and LOS)
Australia					
Cecins et al., 2008 (134)	Quasi-experimental study	COPD patients who entered a pulmonary rehabilitation program at Sir Charles Gairdner Hospital I: Pulmonary rehabilitation (N=187)	2	• Exercise capacity: 6MWT • QOL: CRQ • Health-care utilization: Hospitalization, LOS	Sign. improvements in 6MWT Sign. improvement in overall domains Sign. reduction in No. of admissions and total bed-days

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, SGRQ = St. George's Respiratory Questionnaire, CRQ = Chronic Respiratory Questionnaire, 6MWT = 6-Minute Walking test, LOS = Length of stay

Table 2.6 Studies on outcomes of COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
New Zealand					
Eaton et al., 2009 (135)	RCT	COPD patients who admitted with an exacerbation at Auckland City Hospital I: Pulmonary rehabilitation (N=39) C: Usual care (N=45)	3	• Health-care utilization: Readmissions, LOS, visits • Exercise capacity: 6MWT • QOL: SF-36	NS, NS, NS NS Sign. physical function
Thailand					
Wirach J., 2000 (136)	Quasi-experimental study	COPD patients from the outpatient department of Pasang Hospital and Banhong Hospital, Chiang Mai I: Pulmonary rehabilitation (N=20)	3	• Symptom: DyspneaVisual Analogue Scale • QOL: Quality of Life Index	Sign. mean scores of dyspnea in the intervention group decreased Sign. improved mean score of QOL
Thailand					
Buatongjun J., 2005 (137)	Quasi-experimental study	COPD patients from the outpatient department of Yala Hospital I: Pulmonary rehabilitation (N=20)	2	• Symptom: Dyspnea score (Modified Borg's scale)	Sign. mean scores of dyspnea in the intervention group decreased
Thailand					
Artkul S., 2005 (138)	Quasi-experimental study	COPD patients from the outpatient department of Trang Hospital I: Self Care Promotion Program: 1) interactive nursing care 2) didactic information 3) self-care exercises 4) supportive care (N=40)	3	• Symptom: Dyspnea score (Dyspnea Visual Analogue Scale)	Sign. mean scores of dyspnea in the intervention group decreased
Patient education, continuity of care (follow-up)					
Australia					
Egan et al., 2002 (139)	RCT	COPD patients ≥ 18, admitted to a major private hospital I: Comprehensive nursing assessment during hospitalization and provided follow-up care at 1 wks and 6 wks post discharge (N=33) C: Usual care (N=33)	5	• QOL : SGRQ (4 domains); HADS (2 domains) • Health-care utilization: Readmission	Sign. better on activity domain, other domains NS; Sign. less anxiety, depression NS NS

I = intervention group, C= control group, Sign = Significant NS = No significant, LOS = Length of stay, 6MWT = 6-Minute Walking test, QOL = Quality of life, SF36 = Short-Form 36, SGRQ = St. George's Respiratory Questionnaire, HADS = Hospital and Anxiety Depression Scale

Table 2.6 Studies on outcomes of COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Australia					
Hermiz et al., 2002 (140)	RCT	COPD patients in Health Services aged 30-80 yrs, attended to ED or admitted to the hospitals I: Home visits by community nurse at 1 to 4 weeks after discharge (N=84) C: Usual care (N=93)	3	• QOL: SGRQ • Quality of care: Satisfaction • Health-care utilization: Hospitalization, ED visits • Knowledge, Behaviour, Follow-up	NS Sign. more satisfied with their care NS, NS Sign. greater knowledge of COPD, NS, Sign. more follow-up
Canada					
Bourbeau et al .,2003 (141) Gadoury et al., 2005 (142) Bourbeau et al., 2006 (143)	RCT	COPD patients aged ≥ 50 in 7 hospitals with advanced COPD with at least 1 hospitalisation for exacerbation in the previous year I: Comprehensive patient education specific to COPD, monthly telephone follow-up (N=96) C: Usual care (N=95)	12	• QOL: SGRQ (4 domains) • Symptom: 6MWT, MRC, Sputum, Exacerbations • Health-care utilization: Hospitalization, ED visits, Cost	Sign. better on impact domain, other domains NS NS, NS, NS, sign. more decrease in No. of exacerbations Sign. more reduction in No. of hospitalizations, reduction in ED visits, cost saving
New Zealand					
Rea et al., 2004 (144)	RCT	COPD patients from four general practices I: Intensive pulmonary rehabilitation, home visit (N=83) C: Usual care (N=52)	12	• Lung function: FEV_1 • QOL: SF36; CRQ (4 domains) • Health-care utilization: Hospitalization, LOS	Sign. improvement NS; Sign. improvement in 2 domains (fatigue, mastery) NS, NS
Australia					
Jeffs et al., 2005 (145)	CBA	All patients with COPD in a regional hospital I: Pulmonary rehabilitation, home visit (N=28) C: Usual care (N=25)	12	• Health-care utilization: ED visits, hospitalization, LOS	NS, NS, Sign. higher increase in hospital bed days

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, SGRQ = St. George's Respiratory Questionnaire, 6MWT = 6-Minute Walking test, MRC = Medical Research Council , SF36 = Short-Form 36, CRQ = Chronic Respiratory Questionnaire, LOS = Length of stay

Table 2.6 Studies on outcomes of COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
U.K.					
Sridhar et al., 2008 (146)	RCT	COPD patients previously admitted to community and hospital care in west London I: Pulmonary rehabilitation, home visit and a personalized written COPD action plan, monthly telephone calls (N=61) C: Usual care (N=61)	24	• QOL: CRQ • Symptom: Mortality, Exacerbations • Health-care utilization: Hospitalization, visits • Behaviour	NS Sign. lower No. of COPD related deaths, NS NS, Sign. less unscheduled GP contacts Sign. better self-management of exacerbations
China					
Yumin et al., 2010 (147)	RCT	COPD patients aged 40-89 from two communities in Guangzhou I: Systematic health education, rehabilitation, home visit (N=436) C: Usual care (N=436)	60	• Lung function: FEV1	Sign. lower annual rate of decline in FEV_1 in intervention group
United States					
Chuang et al., 2011 (148)	RCT	COPD patients from HealthCare Partners Medical Group (HCP) in Southern California I: Scheduled education and disease management nurse telephonic outreach (N=40) C: Usual care (N=57)	12	• Health-care utilization: Hospitalization, LOS, ED visits	Sign. Hospital admissions, LOS, and ED visits showed downward trends in the intervention group
Patient education, professional roles; nurse					
Netherland					
Meulepas et al., 2007 (149)	CBA	COPD patients aged ≥ 40 yrs in general practice I: Self-management education, home visit by nurse (N=137) C: Usual care (N=123)	24	• Symptom: Exacerbation • Inhalation technique, compliance	NS Sign. more improvement in correct inhalation technique, NS

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, CRQ = Chronic Respiratory Questionnaire, LOS = Length of stay

Table 2.6 Studies on outcomes of COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
United States					
Aiken et al., 2006 (150)	RCT	COPD patients aged > 18 with an estimated 2 year life-expectancy, Phoenix, Arizona I: Pulmonary rehabilitation, action plan by nurse (N=33) C: Usual care (N=28)	9	• QOL: SF36 (8 domains) • Behaviour, knowledge	Sign. better on 3 domains: physical functioning, general health and vitality Sign. better outcomes on self-management of illness and knowledge on illness
Professional education, patient education, continuity of care (follow-up)					
New Zealand					
Poole et al., 2001 (151)	CBA	All patients who had been admitted to Auckland Hospital for COPD for ≥ 4 in the previous 2 yrs I: Education about COPD disease process, weekly telephone calls (N=16) C: Usual care (N=16)	12	• QOL: CRQ (4 domains) • Health-care utilization: Hospitalization, LOS	Sign. clinically relevant improvement in all CRQ scores NS, Sign. more decrease in LOS
China					
Lee et al., 2002 (152)	RCT	COPD patients aged ≥ 65 yrs, resident of 45 nursing homes in Hong Kong I: Training practice (for nurse), self-management education, home visit (N=48) C: Usual care (N=41)	6	• QOL: GHQ (4 domains); Barthel Index (BI) • Health-care utilization : ED visits, Hosp, LOS	Sign. less anxiety and insomnia and improved overall psychological well-being; NS NS,NS,NS
Spain					
Hernandez et al., 2003 (153)	RCT	COPD patients with exacerbations admitted to ER or two tertiary hospitals I: Integrated care delivered by a specialized nurse for an 8-week follow-up period (N=121) C: Usual care (N=101)	2	• QOL: SGRQ (4 domains) • Quality of care: satisfaction • Health-care utilization: readmission, ED visits, LOS, Costs	Sign. improvement in total score Sign. higher satisfaction NS, Sign. less ED visits, Sign. lower LOS, Sign. lower overall health care cost per patient

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, SF36 = Short-Form 36, CRQ = Chronic Respiratory Questionnaire, LOS = Length of stay, GHQ = General Health Questionnaire

Table 2.6 Studies on outcomes of COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
United States					
Coultas et al., 2005 (154)	RCT	COPD patients in primary care clinics associates with an urban academic health center, aged ≥ 45 yrs cared for by primary care physicians I: Self-management education, home visit (N=72) C: Usual care (N=73)	6	• QOL: SF36, SGRQ, illness intrusiveness scale • Health-care utilization: ED visits, hospitalization	NS, NS, Sign. more improvement in perceived illness intrusiveness NS, NS
Spain and Belgium					
Casas et al., 2006 (4)	RCT	COPD patients recruited in two tertiary hospitals immediately after the patients' hospital discharge for an exacerbation > 48 hours I: Comprehensive assessment of the patients at discharge, self-management education, agreement on an individually tailored care plan following international guidelines, accessibility of the specialised nurse to patients/carers and primary care professionals during the follow-up period (N=65) C: Usual care (N=90)	12	• Health-care utilization: Readmissions	Significantly lower No. of readmissions, rate of readmission, and mean No. of readmissions
Spain					
Garcia-Aymerich et al., 2007 (155)	RCT	COPD patients recruited in a tertiary hospitals immediately after the patients' hospital discharge for an exacerbation > 48 hours I: Self-management education, coordination among levels of care, and home visit (N=44) C: Usual care (N=69)	12	• Lung function: FEV_1 • QOL: SGRQ, EQ-5D • Symptom: Dyspnea • Knowledge, behaviour, compliance	NS NS, NS NS All variables related to knowledge and behaviour were better (mostly sign.), compliance NS

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, SF36 = Short-Form 36, SGRQ = St. George's Respiratory Questionnaire, EQ-5D = Euro-Quol-5D

Table 2.6 Studies on outcomes of COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Netherland					
Vrijhoef et al., 2007 (156)	RCT	Patients with previously documented COPD attending the respiratory outpatient clinic I: Self-management education, integrated of treatment guideline, telephonic follow-up (N=91) C: Usual care (N=83)	9	• Lung function: FEV_1, FVC • QOL: SGRQ • Quality of care: Satisfaction • Health-care utilization: Visits	NS, Sign. more improvement in mean FVC NS Sign. better satisfaction NS
Northern Ireland					
Khdour et al., 2009 (157)	RCT	COPD patients aged > 45 yrs from outpatient COPD clinic at the Mater Hospital, Belfast I: Education on disease state, medications, and breathing technique (N=71) C: Usual care (N=72)	12	• Health-care utilization: ED visits, hospitalization •QOL: SGRQ	Sign. ED visits and hospitalization decreased by 50%, 60% respectively Sign. symptom and impact subscales

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, SGRQ = St. George's Respiratory Questionnaire

Table 2.7 Studies on outcomes of asthma and COPD

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Professional education, patient education, pharmacist intervention					
United States					
Weinberger et al., 2002 (158)	RCT	Asthma and COPD patients aged > 18 yrs with reactive airways disease at 36 community drugstores in Indianapolis I: Pharmaceutical care program (N=447) C: Usual care (N=363)	12	• Lung function: PEFR • QOL: CRQ, AQLQ • Quality of care: Satisfaction • Health-care utilization: Hospitalization, ED visits	NS NS (COPD), NS (asthma) Sign. more satisfied with pharmacist NS, NS

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, CRQ = Chronic Respiratory Questionnaire, AQLQ = Asthma Quality of Life Questionnaire

Table 2.7 Studies on outcomes of asthma and COPD (cont.)

Study	Study design	Participants/interventions	Follow-up (months)	Outcomes measure	Results
Patient education, professional roles; nurse					
Netherlands					
Hesselink et al., 2004 (159)	RCT	Patients aged 16-75 from GP practices in with asthma or COPD I: Self-management education, action plan by nurse (N=139) C: Usual care (N=137)	12	• QOL: QOL-RIQ • Symptom: MRC • Inhalation technique, compliance, behaviour	NS NS Sign. better inhalation technique, NS, NS
Professional education, patient education, continuity of care (follow-up)					
Netherlands					
Steuten et al., 2006 (160)	Quasi-experimental study	Asthma and COPD patients from hospital's outpatient department in the region of Maastricht I: Disease management program (N=975)	12	• Lung function: PEFR • Quality of care: Satisfaction • Health-care costs	NS Sign. better satisfaction Sign. cost savings in asthma patients
Patient education, pharmacist intervention					
Thailand					
Trakarnkitwichit U., 2002 (161)	Quasi-experimental study	Asthma or COPD patients from inpatient department of Samutprakarn Hospital I: Drug counseling (N=40)	8	• Knowledge, patient compliance	Sign. higher percentage of knowledge Sign. higher medication compliance
Thailand					
Phanphao et al., 2005 (162)	Prospective descriptive study	Asthma or COPD patients from outpatient and inpatient department at Buddhachinaraj Hospital, Phitsanulok I: Pharmaceutical care: 1) managing drug related problems 2) evaluate inhalation technique (N=31)	2	• Resolved DRPs, inhalation technique	Sign. manage and resolved DRPs Sign. better inhalation technique

I = intervention group, C= control group, Sign = Significant NS = No significant, QOL = Quality of life, QOL-RIQ = Quality-of-life for Respiratory Illness Questionnaires, MRC = Medical Research Council

Part IV Easy Asthma/COPD clinic in Thailand

1. Easy Asthma/COPD Clinic project

The Easy Asthma Clinic was set up before Easy COPD Clinic, which is mainly due to problems of asthma in Thailand as follow.

1) From a survey of asthma control in Thailand in 2004 (22), it was found that the burden of asthma was high, with 14.8% of asthma patients were admitted to hospital in the past year and 21.7% reported one or more emergency room visit. One-quarter of those surveyed had lost workdays as a result of their asthma, and most patients felt that their lifestyle was limited. Asthma sufferers greatly underestimated the severity of their condition. Only 36.0% used reliever medication, and use of inhaled corticosteroids was low at 6.7%. Understanding of the inflammatory basis of asthma was poor. Few patients underwent lung function tests or took peak flow meter readings.

2) From the results of assessment of quality of care in asthma patients in fiscal year 2007 by National Health Security Office (55), it was found that asthma patients did not received a proper severity assessment because only 1.08% of asthma patients received Peak Flow Meter measuring and physicians prescribed inhaled corticosteroids to patients with only 10.92%.

3) A comparison with Asthma Insights and Reality in Europe (AIRE) and US surveys (20, 21) showed that asthma patients in Thailand suffer a high level of morbidity. Asthma patients in Thailand had more admissions to hospital than patients either in Europe or the USA, more emergency room visits due to asthma than patients in Europe, and a similar number to patients in the USA.

2. Development of Easy Asthma/COPD Clinic project (163)

Easy Asthma Clinic and Easy COPD Clinic project have been developed in 2006 and 2010 respectively (Table 2.8). Principles and working procedure in Easy Asthma and COPD Clinic have the same. Srinagarind Faculty of Medicine, Khon Kaen University and Easy Asthma & COPD Clinic network collaborated on this project. The National Health Security office was also involved. The main responsibilities of National Health Security office in this project were supporting the

budget and determination of the policies. The results of the project were evaluated quickly by using available online information. Easy Asthma/COPD Clinic were expected to improve the treatment and reduce the number of asthma and COPD sufferers.

Table 2.8 Development of Easy Asthma/COPD Clinic project

Year	Development
2006 – 2007	- Clinical audit in quality of care of asthma patients
2008	- Disseminate health service practice guideline in asthma
2008 – 2009	- Pilot project of Easy Asthma Clinic at Khon Kaen area
2008 – 2011	- NSHO support budget based on indicators of quality of care in asthma patients
2010	- Expanding of Easy Asthma Clinic in 500 hospitals
2010	- Disseminate health service practice guideline in COPD
2010	- Develop caring system in COPD patients at Lumpang province
2011	- Pilot project of Easy COPD Clinic at Phitsanulok area - Expanding of Easy Asthma Clinic in all hospitals - NSHO compensate budget for inhaled corticosteroid

3. Principles of Easy Asthma/COPD Clinic (163)

Easy Asthma/COPD Clinic was set up in community hospitals in Thailand in order to make asthma/COPD treatment easier, with the following principles:

a. First, make asthma/COPD treatment easier that physicians in general hospitals or community hospitals can practice and comply.

b. Second, there is a good system that will make physicians spend less time with patient care.

c. Third, increasing the role of nurses and pharmacists to participate in patient care including educate patients about asthma/COPD knowledge and medication, counsel patients about the proper technique for inhaling medications.

d. Fourth, develop asthma/COPD database in Thailand and collect data from online website at http://eac2.dbregistry.com in order to evaluate asthma/COPD control in patients effectively.

4. Condition within compensation in budget of inhaled corticosteroid (163)

Hospitals received budget of inhaled corticosteroid from sending data of asthma/COPD patients to National Health Security Office through the website online of Easy Asthma/COPD Clinic. Compensation rates are 250 baht/visit, provide 4 visit/case/year. National Health Security Office determine condition of compensation of inhaled corticosteroid as follow:

a. Treatment with inhaled corticosteroid,

b. Perform pulmonary function,

c. Patients who receive continuous treatment for at least 2 visits/6 months,

d. Patients who receive instruction and assessment of inhaling medication use.

5. Expected outcome and benefits of Easy Asthma/COPD Clinic (163)

The Easy Asthma/COPD Clinic was expected to be a cost-effective solution to the problem in asthma/COPD management in Thailand. Expected outcome in this project are consist of:

a. Hospitals have standard treatment in patients with asthma and COPD,

b. There are Asthma/COPD database for improving the quality of care in patients,

c. Improve quality of life in Asthma/COPD patients,

d. Reduce acute exacerbation rate,

e. Reduce emergency department visit and admissions and,

f. Reduce workload for physicians.

CHAPTER III
METHODOLOGY

This chapter provides a description of research methodology including study design, ethical approval, study location, study period, data sources, study population, study procedure, data collection, and data analysis.

Study design

This study is a comparative research.

Ethical approval

Study protocol was approved by the Human Research Ethics Committee of Faculty of Dentistry/Faculty of Pharmacy, Mahidol University on March 6, 2012.

Study location

Wangtong Hospital, a 60 – bed community hospital was chosen to be studied location.

Study period

Study period was divided into two phases; before implementing clinic (January 1 to September 30, 2010), and after implementing clinic (October 1, 2010 to December 31, 2011). Because of patients entered the clinic in difference times, pre and post intervention period covered a period of 9 months before and after a patient entered the clinic. For patients who did not enter the clinic, study period covered a period of 9 months before and after implementing clinic.

Data sources

There were two data sources, electronic database and data records in Easy Asthma/COPD Clinic of NHSO website. Economic outcomes were obtained from electronic database, retrieved from hospital's database (Microsoft SQL database) and transformed to Microsoft Excel data format (.xls) and Microsoft Access data format (**.**mdb). Hospital database was separated into outpatient and inpatient department. The database included three major parts: 1) Patient history and hospital utilization data, 2) Dispensing data, and 3) Financial data (Appendix A).

Hospital utilization data

These data are detail of patient's characteristics which are age, gender, marital status, occupation, diagnosis as ICD-10, and date of hospital utilization as outpatient visit or inpatient admission and discharge.

Dispensing data

These data are detail of drug and non-drug dispensing to both outpatient and inpatient. There are patient's hospital number (HN), admission number (AN), date of dispensing, drug and non-drug code, drug and non-drug name, quantity and unit cost (at retail price).

Financial data

These data are the detail of medical expenditure of both outpatient and inpatient services. In addition, there are type of service and type of health insurance.

The data records in Easy Asthma/COPD Clinic of NHSO website were designed to collect clinical outcomes. In this website, clinical data such as smoking habit, % Peak Expiratory Flow Rate, disease control, frequency of daytime and nighttime symptom, reliever drug use, % proper inhalation technique were recorded in record form of first visit (Appendix B) and assessment form of disease control (Appendix C). Data in the record form were obtained from interviewing patients in each visit by the hospital.

Study population

From electronic database, all patients who were given a diagnosis of asthma or COPD as the International Statistics Classification Diagnostics and Health

Problem tenth revision (ICD-10) code at Wangtong Hospital during January 1, 2010 to December 31, 2011 were the population.

ICD-10 code for asthma, they are

- J45 (Asthma);
- J45.0 (Predominantly allergic asthma);
- J45.1 (Nonallergic asthma);
- J45.8 (Mixed asthma);
- J45.9 (Asthma, unspecified); and
- J46 (Status asthmaticus).

And COPD, they are

- J44 (Other chronic obstructive pulmonary disease);
- J44.0 (Chronic obstructive pulmonary disease with acute lower respiratory infection);
- J44.1 (Chronic obstructive pulmonary disease with acute exacerbation, unspecified);
- J44.8 (Other specified chronic obstructive pulmonary disease); and
- J44.9 (Chronic obstructive pulmonary disease, unspecified).

Inclusion criteria :

- Patients who had continuous treatment data 9 months both before and after implementation of Easy Asthma/COPD Clinic.

Exclusion criteria :

- Patients with incomplete medical record.

In addition, sub-group analysis was done for comparison among two groups such as asthma/COPD patients who entered, and did not enter the Easy Asthma/COPD Clinic.

Study procedure

Study procedure divided into two periods: 1) Pre-intervention period (9 months before a patient entered the clinic), 2) Post-intervention period (9 months after a patient entered the clinic)**.** The intervention program started at October 1, 2010. Steps of treatment in each period was shown in Figure 3.1.

Pre-intervention period

Before implementing an Easy Asthma/COPD Clinic at Wangtong Hospital, asthma and COPD patients went through the following procedure:

Step 1, nurse screened and recorded patient personal data and medical history into the hospital's database.

Step 2, physician treated patients and prescribed drug through the hospital's database.

Step 3, pharmacist dispensed drug and counseled inhalation technique for the first use.

Step 4, appointment by nurse.

Post-intervention period

After implementing an Easy Asthma/COPD Clinic at Wangtong Hospital since October 2010, asthma and COPD patients were invited and questioned about their willing to participate in this clinic. Patients who entered the clinic received interventions as the followings.

Step 1, nurse registered and recorded patient history, disease, medication and lifestyle factors such as smoking habits into hospital's database and record form of first visit (Appendix B). After that, patients were assessed for disease control based on assessment form of asthma/COPD control (Appendix C) and performed pulmonary function test by peak flow meter. All data in record form of first visit and assessment form of asthma/COPD control were recorded and sent to online website of Easy Asthma/COPD Clinic of National Health Security Office.

Step 2, the activities during waiting physician were a 15-minute comprehensive self-management education, rehabilitation and exercise capacity test (6-minute walk test) by nurses and physiotherapist. Self-management education included discussion with patients and their carers about treatment plan and action plan tailored to individual patients taking into consideration their symptoms and social and physical environment.

Step 3, physician treated patients based on Easy Asthma/COPD guideline (Appendix D) and educated patients about their disease. Physician prescribed drug through the hospital's database.

Step 4, pharmacist dispensed drug and counseled patients about asthma/COPD medications, checking inhalation technique and monitor medication use. To assess inhalation technique, a 8-items check-list had been developed, which could be used for metered-dose inhaler (MDI) devices (Appendix E). About check-list form, each items had 1 points and total score is 8 points, equivalent to 100%. Thus, the range of scores are 0-100%. Pharmacists assessed inhalation technique for every clinic visits in order to help patients use inhaler medication correctly and remind patient's memory.

Step 5, appointment by nurse

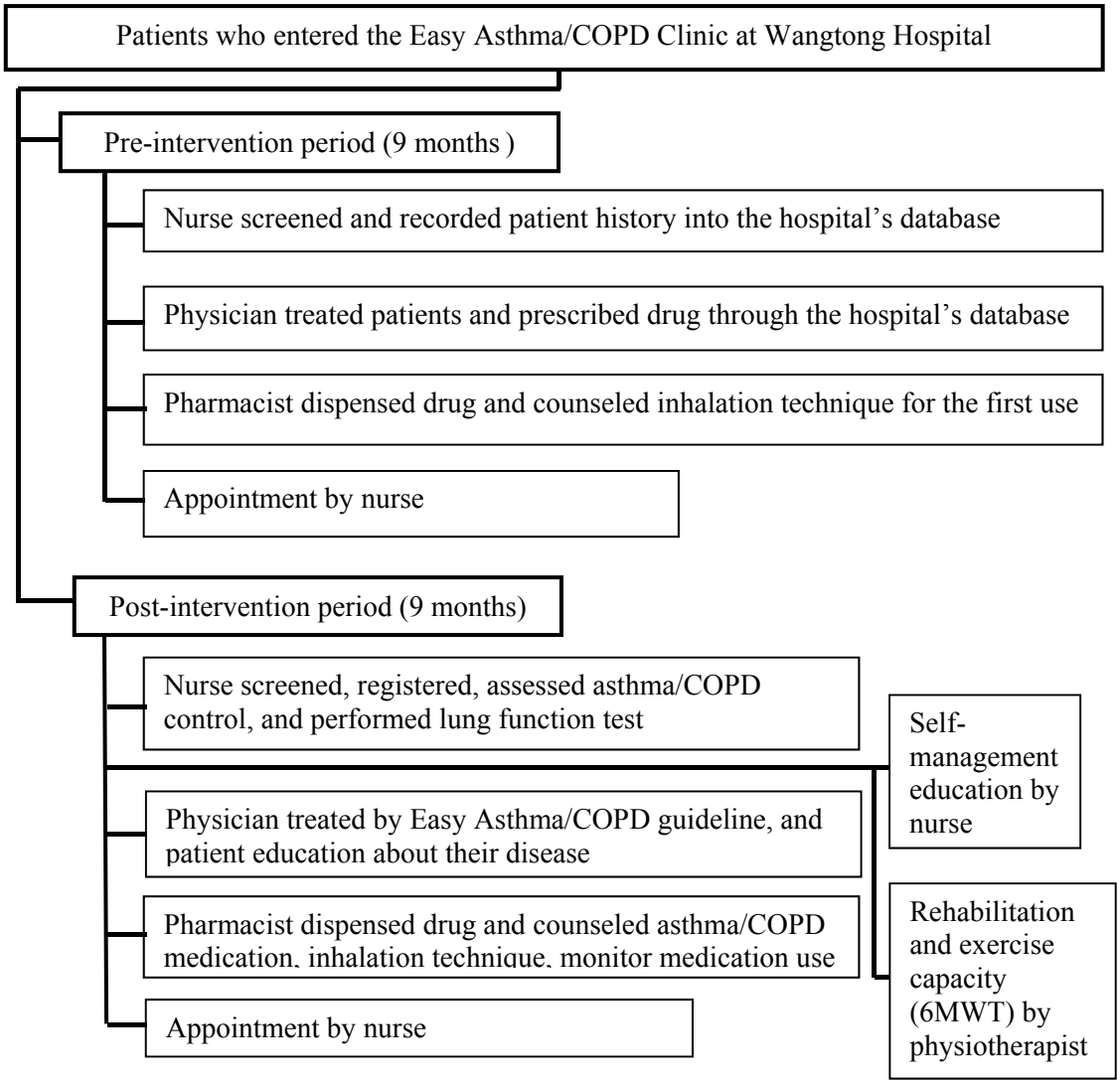

Figure 3.1 Study procedure for asthma/COPD patients who entered the Easy Asthma/COPD Clinic

Data collection

Data were collected in 4 parts: demographic of patients, resource utilization, economic outcomes, and clinical outcomes.

1. Demographic of patients

Demographic of patients such as age, gender, marital status, co-morbidity, and health insurance coverage were collected. Age was year (s). Gender was classified as male and female. Marital status was classified as single and married. Co-morbidities were classified as hypertension, diabetes mellitus, hyperlipidaemia, allergic rhinitis, and other. Types of health insurance were classified as universal coverage (UC), social security scheme (SSS), civil servant medical benefit scheme (CSMBS), and out of pocket. If patients had more than one type, they would be classified according to the latest scheme they have registered during study period.

2. Resource utilization

2.1 Utilization of service

The data of hospital use were separated for outpatient visits, emergency department visits, and inpatient admission. Outpatient visits were identified by hospital number (HN) and date of hospital visit. Emergency department visits were identified by hospital number (HN) and date of hospital visit that have items of nebulizing bronchodilator in emergency department (code 3120014) and observe symptom in emergency department (code 3160539). Inpatients admissions were identified by hospital number (HN), admission number (AN) and date of admission and discharge. Hospital bed-days were determined by difference of discharge date and admission date. Furthermore, number of inhaled corticosteroid and bronchodilator use were collected from file that containing information of drug's quantity which is identified by code of inhaled corticosteroid (1000514 = Budesonide inhaler, 1000527 = Salmeterol+fluticasone inhaler (Seretide®)) and code of inhaled bronchodilator (1000505 = Salbutamol inhaler, 1000515 = Beradual inhaler). The total numbers of outpatient visits, emergency department visits, inpatient admission, hospital bed days, inhaled corticosteroid and inhaled bronchodilator use were determined in each patient.

2.2 Medical expenditure

Medical expenditures which are charge of treatment per capita in outpatient, emergency department, and inpatient were determined for asthma/COPD patients. Medical expenditures were classified into 2 main groups of services: 1) drug, and 2) non drug.

1) Drugs include both drug for asthma/COPD and drug for non asthma/COPD. In addition, Drug for asthma/COPD were collected separately for inhaled corticosteroid and inhaled bronchodilator,

2) Non drug include medical supplies, lab & X-ray, surgery, hospitalization, and other medical service.

Medical expenditures were collected from file that containing information of patient's expense.

3. Economic outcomes

The cost-benefit analysis was performed based on provider and societal perspective. Costs and benefits were collected as follow.

3.1 Costs accounted for the Easy Asthma/COPD Clinic

Costs were collected in both before and after implementation of the Easy Asthma/COPD Clinic. The relevant costs were divided into three categories such as administrative costs, direct medical costs, and direct non-medical costs.

Administrative costs

Administrative costs are comprised of capital costs, labor costs, and material costs.

Capital costs

To calculate the capital cost before and after implementation of the Easy Asthma/COPD Clinic, operating area, durable goods, and cost of education used was considered. Capital cost was calculated employing economic-based approach.

Equivalent annual cost = Current price/ Annuity factor

Current price (in the year of analysis) = Original price x Inflation adjustment factor

Inflation adjustment factor = Customer Price Index of the current year/Customer Price Index the year of first using

Annuity factor = $[1-(1+r)^{-n}]/r$

n = working year or useful year

r = discount rate or real interest rate (3%)

Labor costs

Labor costs were additional labor cost of administrative the clinic which is cost of recording data to National Health Security Office and calculated by multiplying income of personal who recorded data per hours and time used to record data during 1 year.

Material costs

Material cost was the sum of cost of material used in outpatient operation and clinic. In this study, material used was office materials.

Direct medical costs

Direct medical costs were derived from results of outpatient charge which occurred in 9 months period. To adjust data for 1 year, this data would be multiply by 1.33. To adjust charge at the present time (2011), the consumer price index (CPI) was used. In this study, CPI in FY2010, FY 2011 were 108.0, 112.0. Because of charge information does not reflect actually cost of hospital services. In this study, we use cost-to-charge-ratio to convert money into the hospital cost. Ratio of cost-to-charge of community hospital defined by service group was derived from standard unit costs 2011 by Ministry of Public Health (164) (Appendix F).

Direct non-medical costs

Direct non-medical costs consisted of transportation cost, food cost, and time costs while receiving treatment of patient and caregivers. Transportation and food costs were calculated by multiplying number of visit and average transportation and food costs that is derived from Standard Cost Lists for Health Technology Assessment by Health Intervention and Technology Assessment Program (165) (Appendix G). Time costs while receiving treatment was calculated by wages and the time spend in receiving treatment (including waiting and travel time). The

minimum daily wages of Phitsanulok province in 2011 was 163 baht. Time cost of patients who not employed [children (2-12 year), and old person (≥ 60 year)] was assumed to be zero.

3.2 Benefits of Easy Asthma/COPD Clinic

Benefits of Easy Asthma/COPD Clinic was determined in terms of cost saving from emergency visit/hospitalization avoided.

Data used to collect the benefit of the clinic were consisted of direct medical costs (e.g., cost of emergency and inpatient service), direct non-medical costs (e.g., transportation and food costs), and indirect costs of emergency and inpatient service before and after implementation the clinic. For indirect costs, opportunity costs of patients and caregivers were included and estimated using the human capital approach. Opportunity cost was the present value of lost wages of patients or caregivers over the period of illness and calculated by multiplying wages and the sick time (days) of patients.

4. Clinical outcomes

Data to be collected for clinical outcomes such as peak expiratory flow rate, level of disease control, daytime and nighttime symptoms, reliever drug use, and % proper inhalation technique. These data were collected at the start of the intervention period (baseline) and the last follow-up.

Peak Expiratory Flow Rate were collected in 4 groups such as PEFR < 30%, 30% ≤PEFR < 50%, 50% ≤ PEFR < 80%, and PEFR ≥ 80%.

Level of asthma control were collected in 3 groups such as uncontrolled, partly controlled, and controlled. Level of COPD control were collected in 3 groups such as poor, total control, and well.

Daytime and nighttime symptom were collected in 4 groups such as none, less than once a week, more than once a week, and every day.

Reliever drug use were collected in 4 groups such as not use, less than once a week, almost every day, and every day.

% proper inhalation technique were collected in 6 groups such as 0%, 1% - 25%, 26% - 50%, 51% - 75%, 76% - 99%, and 100%.

Data analysis

Data were analyzed by Microsoft Access 2010 and SPSS program version 19.0. For all statistical tests, a p-value of less than 0.05 was considered statistically significant.

1. Demographic of patients

Age, gender, marital status, co-morbidities, and health-insurance coverage were analyzed by descriptive statistics (frequency, mean ± standard deviation, and percentage) for patients who entered and not entered the Easy Asthma/COPD Clinic.

2. Resource utilization

2.1 Utilization of service

The indicators of utilization were outpatient, emergency department, and inpatient utilization rate, which were the number of times a patient comes for treatment in a hospital during a period of pre-intervention and post-intervention. Utilization rate was computed as average outpatient visits per capita, average emergency department visits per capita, average admissions per capita and average hospital bed-day per capita.

Outpatient utilization rate

$$\text{Average OPD visits per capita} = \frac{\text{Total number of OPD visits}}{\text{Total number of patient}}$$

Emergency department utilization rate

$$\text{Average ED visits per capita} = \frac{\text{Total number of ED visits}}{\text{Total number of patient}}$$

Inpatient utilization rates

$$\text{Average admission per capita} = \frac{\text{Total number of admissions}}{\text{Total number of patients}}$$

$$\text{Average hospital bed-day per capita} = \frac{\text{Total number of bed-day}}{\text{Total number of patients}}$$

2.2 Medical expenditure

Total medical expenditures were computed by summation of all service expenditure during treatment in hospital. Total medical expenditure per

capita are determined separately for outpatients, emergency patients, and inpatients. Medical expenditure per capita was calculated by total charge divided by total number of patient.

$$\text{Outpatient expenditure per capita} = \frac{\text{Total charge of OP treatment}}{\text{Total number of patients}}$$

$$\text{Emergency patient expenditure per capita} = \frac{\text{Total charge of ER treatment}}{\text{Total number of patients}}$$

$$\text{Inpatient expenditure per capita} = \frac{\text{Total charge of IP treatment}}{\text{Total number of patients}}$$

2.3 Use of inhaled corticosteroid and inhaled bronchodilator

Number of inhaled corticosteroid and inhaled bronchodilator use and expenditure were analyzed by descriptive statistic (frequency, mean ± standard deviation, and percentage).

Comparison of resource utilization

Resource utilization was compared between before and after implementation the clinic by Wilcoxon sign-rank test. Moreover a sub-group analysis was done for comparison among patients who entered and did not enter the clinic. Relative risk was used to compare the risk of emergency visit and admission before and after implementation the clinic of those patients who entered the clinic.

3. Clinical outcomes

Clinical outcomes were compared in asthma/COPD patient who entered the clinic between start and follow-up period. Paired sample t-test was used to analyze continuous variables such as Peak Expiratory Flow Rate, % proper inhalation technique and Pearson Chi-Square test was used to analyze categorical variables such as disease control, daytime and nighttime symptoms, and reliever drug use.

4. Cost-benefit of Easy Asthma/COPD Clinic

Costs of Easy Asthma/COPD Clinic were incremental costs from implementation the clinic and this costs would be calculated from the difference

between total costs after implementation the clinic and total costs before implementation the clinic.

The benefit of Easy Asthma/COPD Clinic were cost saving from emergency department visit/hospitalization avoided and calculated from the difference of total costs in emergency department and hospitalization before and after implementation the clinic.

Benefit to cost ratio was calculated by dividing cost saving from emergency department visit/hospitalization avoided by the total costs in clinic. Result of the benefit to cost ratio indicated, if a ratio of benefit to cost was more than one that the benefit are worth the cost.

Calculating cost-benefit from societal perspective, administrative costs, direct medical costs, direct non-medical costs, and indirect cost were included for analyzed. While in provider perspective, direct non-medical costs and indirect costs were excluded.

5. Factor affecting disease control in asthma and COPD patients

Binary logistic regression analysis was applied when disease control were dependent variable. Independent variables included demographic factors (e.g., age, gender, smoking habit), payment methods such as capitation (i.e., SSS and UC), and Fee for service (i.e., CSMBS), health care and drug utilization (e.g., emergency patient visit, inpatient visit, inhaled corticosteroid use, and reliever drug use), clinical characteristics (e.g., comorbidity, daytime symptoms, nighttime symptom, and % Peak Expiratory Flow Rate). All variables used in the analysis are presented in Table 3.1.

Table 3.1 Variables included in logistic regression analysis

Variable code	Variable definition	Type of variable	Value labeled
Dependent: Disease_control	Disease control	Dummy	0 = uncontrolled 1 = controlled and partly controlled
Independent: Age	age	Continuous	years
Gender	gender	Dummy	0 = male, 1 = female
Smoking_habit	Smoking habit	Dummy	0 = no smoked 1 = smoked
Payment_method	Payment method	Dummy	0 = Fee for service (i.e., CSMBS) 1 = Capitation (i.e., SSS or UC)
Comor	Asthma/COPD related co-morbidity	Dummy	0 = Asthma/COPD only 1 = Asthma/COPD + comorbidity
Daytime_symp	Daytime asthma/COPD symptoms	Dummy	0 = no 1 = yes
Nighttime_symp	Nighttime asthma/COPD symptoms	Dummy	0 = no 1 = yes
PEFR	% Peak Expiratory Flow Rate	Continuous	percent
ICS_use	Inhaled corticosteroid use	Dummy	0 = no use, 1 = use
Relieverdrug_use	Use of reliever drug	Dummy	0 = no use, 1 = use
ER_vis	Emergency patient visit	Dummy	0 = no, 1 = yes
IPD_adm	Inpatient visit	Dummy	0 = no, 1 = yes

Checking assumptions of logistic regression model have to examine as follows; 1) The dependent variable must be a dichotomy (2 categories), 2) The independent variables need not be interval, nor normally distributed, nor linearly related, nor of equal variance within each group, 3) The categories (groups) must be mutually exclusive and exhaustive; a case can only be in one group and every case must be a member of one of the groups, 4) A minimum of 50 cases per predictor is recommended for logistic regression.

Logistic regression calculates the probability of success over the probability of failure, the results of analysis are in the form of an odds ratio.

$$\text{Log (odds ratio)} = \beta_0 + \beta_1 X_1 + \ldots + \beta_p X_p$$

X = Independent variables

$\beta_0, \beta_1, \ldots, \beta_p$ = Parameter estimate

CHAPTER IV
RESULTS

The following analyses are presented as six parts;

Part I Demographic of study patients,

Part II Determination of resource utilization,

Part III Clinical outcomes of Easy Asthma/COPD Clinic,

Part IV Cost benefit of Easy Asthma/COPD Clinic, and

Part V Factor affecting disease control in asthma/COPD patients who entered the Easy Asthma/COPD Clinic

Part I Demographic of study patients

A total of 362 patients were assessed. Of these, 145 patients were diagnosed with asthma and 217 patients were diagnosed with COPD. Numbers of asthma patients who entered and did not enter the Easy Asthma/COPD Clinic were 105 and 40, respectively. Numbers of COPD patients who entered and did not enter the Easy Asthma/COPD Clinic were 171 and 46, respectively.

Characteristics of asthma patients who entered and did not enter the Easy Asthma/COPD Clinic were summarized in Table 4.1. Demographic data of both groups were similar in age, gender, marital status, comorbidities, and health insurance coverage. The average age was approximately 46 years old, and more than a half of patients were female. Most of patients were married. Slightly more than half of patients had comorbidities. Most of comorbidities in patients who entered and did not enter the clinic were allergic rhinitis (30.88%), and hypertension (39.28%), respectively. In term of health insurance coverage, most of patients were under the Universal Coverage (UC) program.

Characteristics of COPD patients who entered and did not enter the Easy Asthma/COPD Clinic were summarized in Table 4.2. Likewise, demographic data of

both groups were similar. The mean age of those was approximately 67 years old and slightly more than half of patients were more than 60 years old. Over 60% of patients were male. Most of patients were married. Approximately 50% of patients have comorbidities. Most of comorbidities in both groups were hypertension (51.11%, and 47.83% in patients who entered and did not enter the clinic**,** respectively). Almost 90% of patients were under the Universal Coverage (UC) program.

Table 4.1 Characteristics of asthma patients who entered and did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

Characteristics	**Patients entered the clinic (N=105)**	**%**	**Patients did not enter the clinic (N=40)**	**%**
Age group (year)				
0-10	6	5.71	3	7.50
11-20	7	6.67	2	5.00
21-30	4	3.81	2	5.00
31-40	11	10.48	4	10.00
41-50	32	30.48	13	32.50
51-60	27	25.71	9	22.50
61-70	10	9.52	3	7.50
>70	8	7.62	4	10.00
Average (mean ± SD)	46.47 ± 17.71		46.03 ± 18.52	
Gender				
Male	28	26.67	10	25.00
Female	77	73.33	30	75.00
Marital status				
Single	25	23.81	8	20.00
Married	80	76.19	32	80.00
Comorbidities				
None	62	59.05	24	60.00
Have comorbidities	43	40.95	16	40.00
• Hypertension	20	29.41	11	39.28
• Diabetes mellitus	9	13.24	4	14.29
• Hyperlipidaemia	17	25.00	7	25.00
• Congestive heart failure	1	1.47	1	3.57
• Allergic rhinitis	21	30.88	5	17.86
Health insurance coverage				
UC	99	94.29	37	92.50
SSS	1	0.95	2	5.00
CSMBS	5	4.76	1	2.50
Out of pocket	0	0.00	0	0.00

Table 4.2 Characteristics of COPD patients who entered and did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

Characteristics	Patients entered the clinic (N=171)	%	Patients did not enter the clinic (N=46)	%
Age group (year)				
0-10	0	0.00	0	0.00
11-20	0	0.00	0	0.00
21-30	0	0.00	0	0.00
31-40	4	2.34	0	0.00
41-50	12	7.02	4	8.70
51-60	35	20.47	9	19.56
61-70	39	22.81	13	28.26
>70	81	47.37	20	43.48
Average (mean ± SD)	66.80 ± 11.97		67.28 ± 10.83	
Gender				
Male	143	83.63	31	67.39
Female	28	16.37	15	32.61
Marital status				
Single	12	7.02	4	8.70
Married	159	92.98	42	91.30
Comorbidities				
None	87	50.88	20	43.48
Have comorbidities :	84	49.12	26	56.52
• Hypertension	69	51.11	22	47.83
• Diabetes mellitus	21	15.56	7	15.22
• Hyperlipidaemia	40	29.63	16	34.78
• Congestive heart failure	2	1.48	1	2.17
• Allergic rhinitis	3	2.22	0	0.00
Health insurance coverage				
UC	152	88.89	40	86.96
SSS	5	2.92	1	2.17
CSMBS	14	8.19	5	10.87
Out of pocket	0	0.00	0	0.00

Part II Determination of resource utilization

2.1 Asthma

2.1.1 Patients who entered the clinic

From table 4.3, the result of utilization rate in asthma patients who entered the clinic shows that average outpatient visit per patient for asthma was increased 25.76% while, it was decreased 92.98% for non asthma visit after intervention. Average emergency visit per patient for asthma and non asthma visit was decreased 29.54% and 90% after intervention, respectively. Average admission per patient for asthma and non asthma visit was decreased 64.86% and 91.67% after intervention, respectively. Average hospital bed-days per patient for asthma and non asthma visit was decreased 73.19% and 93.10% after intervention, respectively.

Medical expenditure of asthma patients who entered the clinic was presented in table 4.4. The medical expenditure in both asthma visits and non asthma visits of outpatient service, emergency patient service, and inpatient service was approximately 51-83%, 8-11%, and 8-36% of total medical expenditure, respectively. Medical expenditure for asthma visits account more than half of total medical expenditure.

The results after implementation the clinic shows that average outpatient expenditure per capita was increased 85% whereas average emergency and inpatient expenditure per capita was decreasing 22% and 72%, respectively. Overall, average medical expenditure per capita was increased 20% due to increasing of outpatient expenditure.

When considering in proportion of medical expenditure, drug expenditure account the most proportion among total outpatient and emergency expenditure (about 80% and 70%, respectively). For inpatients, the major components of expenditure were non drug (about 70% of total inpatient expenditure). Proportion of drug for asthma was higher than drug for non asthma in all service. Detail of medical expenditure by asthma patients who entered the clinic classified into six group of service (drug, medical supplies, Lab & X-ray, surgery, hospitalization, and other medical service) is shown in appendix H.

2.1.2 Patients who did not enter the clinic

From table 4.3, the result of utilization rate in asthma patients who not enter the clinic shows that utilization rate for outpatient and emergency patient for asthma visit was decreased 22.92% and 3.64% after implementation the clinic, respectively. In contrast, average admission and hospital bed-days per patient for asthma visit was increased 20% and 50% after implementation the clinic, respectively. Utilization rate in all service for non asthma visit was decreased after implementation the clinic.

Table 4.5 presents medical expenditure of asthma patients who did not enter the clinic. Expenditure of asthma patient in both asthma visit and non asthma visit was approximately 63-67% in outpatient service, 7-10% in emergency patient service, and 23-29% in inpatient service. Like patients who entered the clinic, medical expenditure for asthma visit account more than half of total medical expenditure.

The results after implementation the clinic shows that average outpatient and inpatient expenditure per capita was increased 6% and 90%, respectively. In contrast, the average emergency expenditure per capita was decreased 21%. Overall, medical expenditure per capita was increased 16% due to increasing of inpatient expenditure.

The results of proportion of medical expenditure are the same with patients who entered the clinic. Detail of medical expenditure by asthma patients who did not enter the clinic classified into six group of service (drug, medical supplies, Lab & X-ray, surgery, hospitalization, and other medical service) is shown in appendix I.

Table 4.3 Utilization of hospital services before and after implementation the clinic by asthma patients who entered and did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

	Patients entered the clinic (N=105)		**Patients did not enter the clinic (N=40)**	
	Before implementation	**After implementation**	**Before implementation**	**After implementation**
Outpatient services				
Total number of visit for asthma (%) Average number of visit for asthma	310 (72.09) 2.95	390 (97.99) 3.71	101 (55.49) 2.53	78 (70.27) 1.95
Total number of visit for non asthma (%) Average number of visit for non asthma	120 (27.91) 1.14	8 (2.01) 0.08	81 (44.51) 2.03	33 (29.73) 0.83
Emergency patient services				
Total number of visit for asthma (%) Average number of visit for asthma	92 (81.42) 0.88	65 (97.01) 0.62	22 (66.67) 0.55	21 (84.00) 0.53
Total number of visit for non asthma (%) Average number of visit for non asthma	21 (18.58) 0.20	2 (2.99) 0.02	11 (33.33) 0.28	4 (16.00) 0.10
Inpatient services				
Total number of admission for asthma (%) Average number of admission for asthma	39 (75.00) 0.37	14 (93.33) 0.13	6 (50.00) 0.15	7 (70.00) 0.18
Total number of admission for non asthma (%) Average number of admission for non asthma	13 (25.00) 0.12	1 (6.67) 0.01	6 (50.00) 0.15	3 (30.00) 0.08
Total number of bed-days for asthma (%) Average number of bed-days for asthma	145 (70.39) 1.38	39 (90.70) 0.37	16 (41.03) 0.40	24 (64.86) 0.60
Total number of bed-days for non asthma (%) Average number of bed-days for non asthma	61 (29.61) 0.58	4 (9.30) 0.04	23 (58.97) 0.57	13 (35.14) 0.32
Total				
Total outpatient visits (%) Average number of outpatient visit	430 (100.00) 4.10	348 (100.00) 3.31	182 (100.00) 4.55	111 (100.00) 2.78
Total emergency patient visits (%) Average number of emergency visit	113 (100.00) 1.08	67 (100.00) 0.64	33 (100.00) 0.83	25 (100.00) 0.63
Total admission (%) Average number of admission	52 (100.00) 0.50	15 (100.00) 0.14	12 (100.00) 0.30	10 (100.00) 0.25
Total number of bed-days (%) Average number of bed-days	206 (100.00) 1.96	43 (100.00) 0.41	39 (100.00) 0.98	37 (100.00) 0.93

Table 4.4 Expenditure of hospital services (baht) for asthma and non asthma of patients at Easy Asthma/COPD Clinic at Wangtong Hospital

	Pre-intervention (N=105)						Post-intervention (N=105)					
	Asthma	**%**	**Non asthma**	**%**	**Total**	**%**	**Asthma**	**%**	**Non asthma**	**%**	**Total**	**%**
Outpatient services												
Drug : asthma	199,747	69.75	14,800	33.94	214,547	65.02	366,530	69.04	0	0.00	366,530	68.32
non asthma	41,956	14.65	13,847	31.76	55,803	16.91	84,532	15.92	941	16.92	85,473	15.93
Sub total	241,703	84.40	28,647	65.70	270,350	81.93	451,062	84.96	941	16.92	452,003	84.25
Non drug	44,685	15.60	14,955	34.30	59,640	18.07	79,840	15.04	4,620	83.08	84,460	15.74
Total	286,388	100.00	43,602	100.00	329,990	100.00	530,902	100.00	5,561	100.00	536,463	100.00
Average ± SD	2,727.51 ± 2,378.52		415.26 ± 818.70		3,142.76 ± 2,448.68		5,056.21 ± 2,936.74		52.96 ± 422.51		5,109.17 ± 2,962.96	
Emergency patient services												
Drug : asthma	36,508	55.58	973	11.17	37,481	50.38	28,173	54.98	10	0.71	28,183	53.54
non asthma	10,193	15.52	3,442	39.49	13,635	18.33	7,233	14.12	170	12.06	7,403	14.06
Sub total	46,701	71.10	4,415	50.66	51,116	68.71	35,406	69.10	180	12.77	35,586	67.60
Non drug	18,980	28.90	4,300	49.34	23,280	31.29	15,830	30.90	1,230	87.23	17,060	32.40
Total	65,681	100.00	8,715	100.00	74,396	100.00	51,236	100.00	1,410	100.00	52,646	100.00
Average ± SD	625.53 ± 1,701.55		83.00 ± 260.70		708.53 ± 1,716.50		487.96 ± 933.79		13.43 ± 101.32		501.39 ± 951.03	
Inpatient services												
Drug : asthma	46,846	27.40	7,663	11.84	54,509	23.13	15,234	31.58	1,756	25.08	16,990	30.76
non asthma	11,474	6.71	8,888	13.74	20,362	8.64	3,531	7.32	1,437	20.52	4,968	8.99
Sub total	58,320	34.11	16,551	25.58	74,871	31.77	18,765	38.90	3,193	45.60	21,958	39.75
Non drug	112,645	65.89	48,145	74.42	160,790	68.23	29,470	61.10	3,810	54.40	33,280	60.25
Total	170,965	100.00	64,696	100.00	235,661	100.00	48,235	100.00	7,003	100.00	55,238	100.00
Average ± SD	1,628.24 ± 5,068.73		616.15 ± 2,108.81		2,244.39 ± 5,991.71		459.38 ± 1,754.34		66.70 ± 683.42		526.08 ± 2,231.31	
Total												
Drug : asthma	283,101	54.13	23,436	20.03	306,537	47.89	409,937	65.03	1,766	12.64	411,703	63.90
non asthma	63,623	12.16	26,177	22.37	89,800	14.03	95,296	15.12	2,548	18.23	97,844	15.18
Sub total	346,724	66.29	49,613	42.40	396,337	61.92	505,233	80.15	4,314	30.87	509,547	79.08
Non drug	176,310	33.71	67,400	57.60	243,710	38.08	125,140	19.85	9,660	69.13	134,800	20.92
Total	523,034	100.00	117,013	100.00	640,047	100.00	630,373	100.00	13,974	100.00	644,347	100.00
Average ± SD	4,981.28 ± 6,727.65		1,114.41 ± 2,429.15		6,095.69 ± 7,476.64		6,003.55 ± 3,558.02		133.09 ± 828.13		6,136.64 ± 3,920.73	

Table 4.5 Expenditure (baht) from asthma and non asthma of patients who did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

	Before implementation (N = 40)						After implementation (N = 40)					
	Asthma	**%**	**Non asthma**	**%**	**Total**	**%**	**Asthma**	**%**	**Non asthma**	**%**	**Total**	**%**
Outpatient services												
Drug : asthma	51,323	69.85	13,872	31.68	65,195	55.60	54,171	69.38	11,488	41.95	65,659	62.26
non asthma	9,438	12.85	15,203	34.72	24,641	21.01	11,888	15.23	8,625	31.50	20,513	19.45
Sub total	60,761	82.70	29,075	66.40	89,836	76.61	66,059	84.61	20,113	73.45	86,172	81.71
Non drug	12,715	17.30	14,710	33.60	27,425	23.39	12,020	15.39	7,270	26.55	19,290	18.29
Total	73,476	100.00	43,785	100.00	117,261	100.00	78,079	100.00	27,383	100.00	105,462	100.00
Average ± SD	1,836.90 ± 1,779.65		1,094.63 ± 1,793.65		2,931.53 ± 2,055.50		1,951.98 ± 1,829.45		684.58 ± 1,373.62		2,636.55 ± 2,135.90	
Emergency patient services												
Drug : asthma	6,459	49.71	1,254	25.91	7,713	43.26	4,820	46.69	933	49.18	5,753	47.07
non asthma	1,374	10.58	795	16.43	2,169	12.16	1,084	10.50	524	27.63	1,608	13.16
Sub total	7,833	60.29	2,049	42.34	9,882	55.42	5,904	57.19	1,457	76.81	7,361	60.23
Non drug	5,160	39.71	2,790	57.66	7,950	44.58	4,420	42.81	440	23.19	4,860	39.77
Total	12,993	100.00	4,839	100.00	17,832	100.00	10,324	100.00	1,897	100.00	12,221	100.00
Average ± SD	324.83 ± 514.23		120.95 ± 305.49		445.80 ± 600.36		258.10 ± 612.85		47.43 ± 170.57		305.53 ± 737.00	
Inpatient services												
Drug : asthma	6,250	39.71	2,874	11.60	9,124	22.52	5,398	18.08	4,059	21.99	9,457	19.57
non asthma	858	5.45	2,750	11.10	3,608	8.91	1,411	4.73	938	5.08	2,349	4.86
Sub total	7,108	45.16	5,624	22.70	12,732	31.43	6,809	22.81	4,997	27.07	11,806	24.43
Non drug	8,630	54.84	19,145	77.30	27,775	68.57	23,050	77.19	13,465	72.93	36,515	75.57
Total	15,738	100.00	24,769	100.00	40,507	100.00	29,859	100.00	18,462	100.00	48,321	100.00
Average ± SD	393.45 ± 1,209.35		619.23 ± 1,704.04		1,012.68 ± 2,534.21		746.48 ± 1,894.34		461.55 ± 2,274.37		1,208.03 ± 3,690.24	
Total												
Drug : asthma	64,032	62.65	18,000	24.53	82,032	46.72	64,389	54.45	16,480	34.52	80,869	48.72
non asthma	11,670	11.42	18,748	25.54	30,418	17.32	14,383	12.16	10,087	21.13	24,470	14.74
Sub total	75,702	74.07	36,748	50.07	112,450	64.04	78,772	66.61	26,567	55.65	105,339	63.46
Non drug	26,505	25.93	36,645	49.93	63,150	35.96	39,490	33.39	21,175	44.35	60,665	36.54
Total	102,207	100.00	73,393	100.00	175,600	100.00	118,262	100.00	47,742	100.00	166,004	100.00
Average ± SD	2,555.18 ± 2,126.06		1,834.83 ± 2,652.25		4,390.00 ± 3,104.97		2,956.55 ± 3,239.97		1,193.55 ± 2,581.74		4,150.10 ± 4,706.98	

2.2 COPD

2.2.1 Patients who entered the clinic

From table 4.6, the result of utilization rate in COPD patients who entered the clinic shows that average outpatient visit per patient for COPD visit was increased 18.90% while, it was decreased 85.83% for non COPD visit after intervention. Average emergency visit per patient for COPD and non COPD visit was decreased 6% and 92.96% after intervention, respectively. Average admission per patient for COPD and non COPD visit was decreased 37.68% and 100% after intervention, respectively. Average hospital bed-days per patient for COPD and non COPD visit was decreased 32.68% and 100% after intervention, respectively.

Medical expenditure of COPD patients who entered the clinic was presented in table 4.7. The medical expenditure in both COPD visits and non COPD visits of outpatient service, emergency patient service, and inpatient service was approximately 47-60%, 14-15%, and 24-38% of total medical expenditure, respectively. Medical expenditure for COPD visit account more than half of total medical expenditure.

The results after implementation the clinic shows that average outpatient and emergency expenditure per capita was increased 32% and 3%, respectively. For inpatients, average inpatient expenditure per capita was decreased 24%. Overall, average medical expenditure per capita was increased 11% due to increasing of outpatient expenditure.

When considering in proportion of medical expenditure, drug expenditure account the most proportion among total outpatient and emergency expenditure (about 80% and 70%, respectively). For inpatients, the major components of expenditure were non drug (about 60% of total inpatient expenditure). Proportion of drug for COPD was higher than drug for non COPD in all service. Detail of medical expenditure by COPD patients who entered the clinic classified into six group of service (drug, medical supplies, Lab & X-ray, surgery, hospitalization, and other medical service) is shown in appendix J.

2.2.2 Patients who did not enter the clinic

From table 4.6, the result of utilization rate in COPD patients who did not enter the clinic shows that average outpatient visit per patient for COPD and non COPD visit after implementation the clinic was decreased 38% and 61%, respectively. Average emergency visit per patient for COPD visit was increased 9% while, it was decreased 43% for non COPD visit after implementation the clinic. Average admission per patient for COPD visit was increased 5% while, it was decreased 92% for non COPD visit after implementation the clinic. Average hospital bed-days per patient for COPD visit was increased 86% while, it was decreased 99% for non COPD visit after implementation the clinic.

Table 4.8 presents medical expenditure of COPD patients who did not enter the clinic. The medical expenditure in both COPD visits and non COPD visits of outpatient service, emergency patient service, and inpatient service was approximately 34-53%, 6-12%, and 40-54% of total medical expenditure, respectively. Like patients who entered the clinic, medical expenditure for COPD visit account more than half of total medical expenditure.

The results after implementation the clinic shows that average outpatient expenditure per capita was decreased 37%. Average emergency and inpatient expenditure per capita was increased 48% and 64%, respectively. Overall, average medical expenditure per capita was increased 3% due to increasing of emergency and inpatient expenditure.

The results of proportion of medical expenditure are the same with patients who entered the clinic. Detail of medical expenditure by COPD patients who did not enter the clinic classified into six group of service (drug, medical supplies, Lab & X-ray, surgery, hospitalization, and other medical service) is shown in appendix K.

Table 4.6 Utilization of hospital services before and after implementation the clinic by COPD patients who entered and did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

	Patients entered the clinic (N=171)		Patients did not enter the clinic (N=46)	
	Before implementation	**After implementation**	**Before implementation**	**After implementation**
Outpatient services				
Total number of visit for COPD (%) Average number of visit for COPD	624 (75.27) 3.65	742 (96.11) 4.34	91(44.39) 1.98	56 (56.00) 1.22
Total number of visit for non COPD (%) Average number of visit for non COPD	205 (24.73) 1.20	30 (3.89) 0.17	114 (55.61) 2.48	44 (44.00) 0.96
Emergency patient services				
Total number visit for COPD (%) Average number of visit for COPD	256 (67.73) 1.50	241 (96.40) 1.41	20 (58.82) 0.44	22 (73.33) 0.48
Total number of visit for non COPD (%) Average number of visit for non COPD	122 (32.27) 0.71	9 (3.60) 0.05	14 (41.18) 0.30	8 (26.67) 0.17
Inpatient services				
Total number of admission for COPD (%) Average number of admission for COPD	118 (64.84) 0.69	74 (100.00) 0.43	18 (62.07) 0.39	19 (95.00) 0.41
Total number of admission for non COPD (%) Average number of admission for non COPD	64 (35.17) 0.37	0 (0.00) 0.00	11 (37.93) 0.24	1 (5.00) 0.02
Total number of bed-days for COPD (%) Average number of bed-days for COPD	435 (61.18) 2.54	293 (80.49) 1.71	58 (41.73) 1.26	108 (99.08) 2.35
Total number of bed-days for non COPD (%) Average number of bed-days for non COPD	276 (38.82) 1.61	0 (0.00) 0.00	81 (58.27) 1.76	1 (0.92) 0.02
Total				
Total outpatient visits (%) Average number of outpatient visit	829 (100.00) 4.85	772 (100.00) 4.52	205 (100.00) 4.46	100 (100.00) 2.17
Total emergency patient visits (%) Average number of emergency visit	378 (100.00) 2.21	250 (100.00) 1.46	34 (100.00) 0.74	30 (100.00) 0.65
Total admission (%) Average number of admission	182 (100.00) 1.06	74 (100.00) 0.43	29 (100.00) 0.63	20 (100.00) 0.43
Total number of bed-days (%) Average number of bed-days	711 (100.00) 4.16	293 (100.00) 1.71	139 (100.00) 3.02	109 (100.00) 2.37

Table 4.7 Expenditure of hospital services (baht) for COPD and non COPD of patients at Easy Asthma/COPD Clinic at Wangtong Hospital

	Pre-intervention (N=171)						Post-intervention (N=171)					
	COPD	**%**	**Non COPD**	**%**	**Total**	**%**	**COPD**	**%**	**Non COPD**	**%**	**Total**	**%**
Outpatient services												
Drug : COPD	666,086	67.19	63,003	42.54	729,089	63.99	976,231	74.43	13,155	49.46	989,386	73.93
non COPD	192,987	19.47	40,852	27.59	233,839	20.52	165,410	12.61	5,605	21.07	171,015	12.78
Sub total	859,073	86.66	103,855	70.13	962,928	84.51	1,141,641	87.04	18,760	70.53	1,160,401	86.71
Non drug	132,238	13.34	44,230	29.87	176,468	15.48	169,940	12.96	7,840	29.48	177,780	13.29
Total	991,311	100.00	148,085	100.00	1,139,396	100.00	1,311,581	100.00	26,600	100.00	1,338,181	100.00
Average ± SD	5,797.14 ± 4,000.86		865.99 ± 2,072.40		6,663.13 ± 4,062.86		7,670.06 ± 4,752.82		155.56 ± 622.52		7,825.62 ± 4,711.59	
Emergency patient services												
Drug : COPD	186,823	60.01	14,028	25.87	200,851	54.95	221,282	68.83	3,671	45.49	224,953	68.26
non COPD	24,066	7.73	6,290	11.60	30,356	8.30	35,576	11.07	539	6.68	36,115	10.96
Sub total	210,889	67.74	20,318	37.47	231,207	63.25	256,858	79.90	4,210	52.17	261,068	79.22
Non drug	100,440	32.26	33,898	62.53	134,338	36.75	64,635	20.10	3,860	47.83	68,495	20.78
Total	311,329	100.00	54,216	100.00	365,545	100.00	321,493	100.00	8,070	100.00	329,563	100.00
Average ± SD	1,820.64 ± 5,065.49		317.05 ± 1,025.93		2,137.69 ± 5,343.41		1,880.08 ± 4,083.94		47.19 ± 283.26		1,927.27 ± 4,085.36	
Inpatient services												
Drug : COPD	215,991	38.16	76,752	22.05	292,743	32.02	144,508	33.42	27,282	26.31	171,790	32.04
non COPD	42,602	7.52	47,320	13.60	89,922	9.84	19,591	4.53	6,682	6.45	26,273	4.90
Sub total	258,593	45.68	124,072	35.65	382,665	41.86	164,099	37.95	33,964	32.76	198,063	36.94
Non drug	307,475	54.32	223,963	64.36	531,438	58.14	268,345	62.05	69,710	67.24	338,055	63.06
Total	566,068	100.00	348,035	100.00	914,103	100.00	432,444	100.00	103,674	100.00	536,118	100.00
Average ± SD	3,310.34 ± 8,075.78		2,035.29 ± 4,801.45		5,345.63 ± 10,815.17		2,528.91 ± 6,940.40		606.28 ± 3,160.40		3,135.19 ± 7,936.91	
Total												
Drug : COPD	1,068,900	57.20	153,783	27.94	1,222,683	50.54	1,342,021	64.97	44,108	31.88	1,386,129	62.89
non COPD	259,655	13.89	94,462	17.17	354,117	14.64	220,577	10.68	12,826	9.27	233,403	10.60
Sub total	1,328,555	71.09	248,245	45.11	1,576,800	65.18	1,562,598	75.65	56,934	41.15	1,619,532	73.49
Non drug	540,153	28.91	302,091	54.89	842,244	34.82	502,920	24.35	81,410	58.85	584,330	26.51
Total	1,868,708	100.00	550,336	100.00	2,419,044	100.00	2,065,518	100.00	138,344	100.00	2,203,862	100.00
Average ± SD	10,928.12 ± 10,954.67		3,218.34 ± 5,532.10		14,146.46 ± 13,009.77		12,079.05 ± 10,408.82		809.03 ± 3,237.81		12,888.08 ± 11,363.35	

Table 4.8 Expenditure of hospital services (baht) from COPD and non COPD of patients who did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

	Before implementation (N=46)						After implementation (N=46)					
	COPD	**%**	**Non COPD**	**%**	**Total**	**%**	**COPD**	**%**	**Non COPD**	**%**	**Total**	**%**
Outpatient services												
Drug : COPD	91,360	70.49	41,216	37.48	132,576	55.34	56,252	69.34	16,773	37.01	73,025	57.75
non COPD	17,963	13.86	38,980	35.45	56,943	23.77	10,550	13.00	15,914	35.12	26,464	20.93
Sub total	109,323	84.35	80,196	72.93	189,519	79.11	66,802	82.34	32,687	72.13	99,489	78.68
Non drug	20,280	15.65	29,760	27.07	50,040	20.89	14,325	17.66	12,628	27.87	26,953	21.32
Total	129,603	100.00	109,956	100.00	239,559	100.00	81,127	100.00	45,315	100.00	126,442	100.00
Average ± SD	2,817.46 ± 3,473.11		2,390.35 ± 3,466.80		5,207.80 ± 3,642.53		1,763.63 ± 2,591.06		985.11 ± 1,377.60		2,748.74 ± 2,848.49	
Emergency patient services												
Drug : COPD	10,522	54.62	975	10.93	11,497	40.79	19,275	67.74	7,005	45.87	26,280	60.10
non COPD	1,843	9.56	2,167	24.29	4,010	14.23	2,609	9.17	1,493	9.77	4,102	9.38
Sub total	12,365	64.18	3,142	35.22	15,507	55.02	21,884	76.91	8,498	55.64	30,382	69.48
Non drug	6,900	35.82	5,780	64.78	12,680	44.98	6,570	23.09	6,775	44.36	13,345	30.52
Total	19,265	100.00	8,922	100.00	28,187	100.00	28,454	100.00	15,273	100.00	43,727	100.00
Average ± SD	418.80 ± 925.23		193.96 ± 482.02		612.76 ± 984.37		618.56 ± 1,261.55		332.02 ± 861.48		950.59 ± 1,830.09	
Inpatient services												
Drug : COPD	22,226	30.97	6,675	6.02	28,901	15.82	31,707	26.92	14,071	16.48	45,778	22.54
non COPD	9,432	13.14	33,837	30.51	43,269	23.69	10,153	8.62	6,583	7.72	16,736	8.24
Sub total	31,658	44.12	40,512	36.53	72,170	39.51	41,860	35.54	20,654	24.20	62,514	30.78
Non drug	40,105	55.88	70,400	63.47	110,505	60.49	75,910	64.46	64,700	75.80	140,610	69.22
Total	71,763	100.00	110,912	100.00	182,675	100.00	117,770	100.00	85,354	100.00	203,124	100.00
Average ± SD	1,560.07 ± 3,874.81		2,411.13 ± 8,475.31		3,971.20 ± 8,954.36		2,560.22 ± 7,002.10		1,855.52 ± 6,460.10		4,415.74 ± 11,651.08	
Total												
Drug : COPD	124,108	56.25	48,866	21.26	172,974	38.40	107,234	47.17	37,849	25.93	145,083	38.87
non COPD	29,238	13.25	74,984	32.64	104,222	23.14	23,312	10.25	23,990	16.44	47,302	12.67
Sub total	153,346	69.50	123,850	53.90	277,196	61.54	130,546	57.42	61,839	42.37	192,385	51.54
Non drug	67,285	30.50	105,940	46.10	173,225	38.46	96,805	42.58	84,103	57.63	180,908	48.46
Total	220,631	100.00	229,790	100.00	450,421	100.00	227,351	100.00	145,942	100.00	373,293	100.00
Average ± SD	4,796.33 ± 6,362.79		4,995.43 ± 8,927.36		9,791.76 ± 9,959.25		4,942.41 ± 8,453.64		3,172.65 ± 6,872.37		8,115.06 ± 12,602.00	

2.3 Relative risk of emergency visit and admission after implementation of the Easy Asthma/COPD Clinic at Wangtong Hospital

From table 4.9, in patients who entered the clinic, asthma patients have the risk of emergency visit and admission less than 15% and 55% after implementation, respectively. In COPD patients, the risk of emergency visit and admission are less than 8% and 26% after implementation, respectively. In contrast, in patients who did not enter the clinic, asthma patients have the risk of emergency visit and admission more than 1.33 and 1.20 times after implementation, respectively. In COPD patients, the risk of emergency visit and admission are more than 1.36 and 1.64 times after implementation, respectively. However, most of relative risks are not statistically significant except the risk of admission in asthma patients who entered the clinic.

Table 4.9 Relative risk of emergency visit and admission in patients who entered and did not enter the clinic

	Before implementation [n, (%)]	**After implementation [n, (%)]**	**Relative Risk (95% CI)**	**P-value[a]**
Patients who entered the clinic				
Asthma (N=105)				
Emergency visit	41 (39.05)	35 (33.33)	0.85 (0.59-1.22)	0.389
Admission	22 (20.95)	10 (9.52)	0.45 (0.23-0.91)	0.000*
COPD (N=171)				
Emergency visit	78 (45.61)	72 (42.10)	0.92 (0.85-1.17)	0.513
Admission	47 (27.48)	35 (20.47)	0.74 (0.51-1.09)	0.129
Patients who did not enter the clinic				
Asthma (N=40)				
Emergency visit	15 (37.50)	20 (50.00)	1.33 (0.79-2.22)	0.260
Admission	5 (12.50)	6 (15.00)	1.20 (0.40-3.64)	0.745
COPD (N=46)				
Emergency visit	11 (23.91)	15 (32.61)	1.36 (0.70-2.66)	0.354
Admission	11 (23.91)	18 (39.13)	1.64 (0.88-3.03)	0.116

[a]Tested by Pearson Chi-Square test. (*Statistic significant different at p-value<0.05)

2.4 Comparison means of resource utilization from asthma/COPD visit

Table 4.10 summarizes the average of resource utilization incurred per asthma/COPD patients who entered the clinic in pre and post intervention period. The mean results of asthma patients shows that there are statistical significant difference ($p<0.05$) in most of resource utilization outcomes between pre and post intervention

period, except for comparing in emergency visits and emergency expenditure per patient were not statistically significant different (p=0.082 and p=0.449, respectively). In COPD patients, it had statistically different in outpatient visit, inpatient visits, number of bed-days, outpatient expenditure, and total expenditure except for comparing in emergency visits, emergency expenditure, and inpatient expenditure were not statistically significant different (p=0.461, p=0.232, and p=0.054, respectively). Overall, most of resource utilization had the same trend between asthma and COPD patients.

In contrast, there are not statistically significant different in most of resource utilization outcomes in patient who did not enter the clinic (Table 4.11). In asthma patients, average outpatient visits decreased significantly from 2.53 (SD = 2.30) per patient before implementation the clinic to 1.95 (SD = 1.57) per patient after implementation the clinic (p = 0.048), whereas the rest outcomes were not statistically significant different. In COPD patients, average outpatient visits decreased significantly from 1.98 (SD = 2.09) per patient before implementation the clinic to 1.22 (SD = 1.52) per patient after implementation the clinic (p = 0.022) and average outpatient expenditure decreased significantly from 2,817.46 (SD = 3,473.11) per patient before implementation the clinic to 1,763.63 (SD = 2,591.06) per patient after implementation the clinic (p =0.038), whereas the rest outcomes were not statistically significant different. Similarly, most of resource utilization had the same trend between asthma and COPD patients.

Table 4.10 Comparison means of resource utilization from asthma/COPD visits by asthma/COPD patients who entered the Easy Asthma/COPD Clinic at Wangtong Hospital between pre and post intervention period

	Resource utilization	Pre-intervention	Post-intervention	Mean difference (95% CI)	P-value[a]
Asthma patients	**Utilization of service**				
	Outpatient visits	2.95 ± 1.88	3.71 ± 1.56	+0.76 (0.29 to 1.23)	0.000*
	Emergency patient visits	0.88 ± 1.79	0.62 ± 1.16	-0.26 (-3.23 to 2.71)	0.082
	Inpatient visits	0.37 ± 0.89	0.13 ± 0.46	-0.24 (-0.43 to -0.05)	0.005*
	Number of bed-days (days)	1.38 ± 4.11	0.37 ± 1.40	-1.01 (-1.84 to -0.18)	0.003*
	Medical expenditure				
	Outpatient expenditure	2,727.51 ± 2,378.52	5,056.21 ± 2,936.74	+2,328.70 (1,606.75 to 3,050.65)	0.000*
	Emergency patient expenditure	625.53 ± 1,701.55	487.96 ± 933.79	-137.57 (-508.36 to 233.22)	0.449
	Inpatient expenditure	1,628.24 ± 5,068.73	459.38 ± 1,754.34	-1,168.86 (-2,193.53 to -144.19)	0.003*
	Total expenditure	4,981.28 ± 6,727.65	6,003.55 ± 3,558.02	+1,022.27 (-431.63 to 2,476.17)	0.000*
COPD patients	**Utilization of service**				
	Outpatient visits	3.65 ± 2.41	4.34 ± 2.45	+0.69 (0.18 to1.20)	0.000*
	Emergency patient visits	1.50 ± 3.37	1.41 ± 2.78	-0.09 (-0.74 to 0.56)	0.461
	Inpatient visits	0.69 ± 1.68	0.43 ± 1.07	-0.26 (-0.56 to 0.04)	0.012*
	Number of bed-days (days)	2.54 ± 6.20	1.71 ± 4.56	-0.83 (-1.97 to 0.31)	0.021*
	Medical expenditure				
	Outpatient expenditure	5,797.14 ± 4,000.86	7,670.06 ± 4,752.82	+1,872.92 (945.57 to 2,800.27)	0.000*
	Emergency patient expenditure	1,820.64 ± 5,065.49	1,880.08 ± 4,083.94	+59.44 (-911.82 to 1,030.70)	0.232
	Inpatient expenditure	3,310.34 ± 8,075.78	2,528.91 ± 6,940.40	-781.43 (-2,371.43 to 808.57)	0.054
	Total expenditure	10,928.12 ± 10,954.67	12,079.05 ± 10,408.82	+1,150.93 (-1,104.15 to 3,406.01)	0.009*

[a]Tested by Wilcoxon sign-rank test. (* Statistic significant different at p-value<0.05)

Table 4.11 Comparison means of resource utilization from asthma/COPD visits by asthma/COPD patients who did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital between before and after implementation the clinic

	Resource utilization	Before implementation	After implementation	Mean difference (95% CI)	P-value[a]
Asthma patients	**Utilization of service**				
	Outpatient visits	2.53 ± 2.30	1.95 ± 1.57	-0.58 (-1.44 to 0.28)	0.048*
	Emergency patient visits	0.55 ± 0.82	0.53 ± 1.11	-0.02 (-0.45 to 0.41)	0.314
	Inpatient visits	0.15 ± 0.43	0.18 ± 0.45	+0.03 (-0.31 to 0.37)	0.369
	Length of stay (days)	0.40 ± 1.15	0.60 ± 1.53	+0.20 (-0.32 to 0.72)	0.201
	Medical expenditure				
	Outpatient expenditure	1,836.90 ± 1,779.65	1,951.98 ± 1,829.45	+115.08 (31.81 to 198.35)	0.422
	Emergency patient expenditure	324.83 ± 514.23	258.10 ± 612.85	-66.73 (-112.62 to -20.11)	0.115
	Inpatient expenditure	393.45 ± 1,209.35	746.48 ± 1,894.34	+353.03 (181.37 to 524.69)	0.172
	Total expenditure	2,555.18 ± 2,126.06	2,956.55 ± 3,239.97	+401.37 (298.77 to 503.97)	0.347
COPD patients	**Utilization of service**				
	Outpatient visits	1.98 ± 2.09	1.22 ± 1.52	-0.76 (-3.41 to 1.89)	0.022*
	Emergency patient visits	0.43 ± 0.96	0.48 ± 0.84	+0.05 (-0.30 to 0.40)	0.458
	Inpatient visits	0.39 ± 0.83	0.41 ± 1.04	+0.02 (-0.36 to 0.40)	0.374
	Length of stay (days)	1.26 ± 2.82	2.35 ± 6.19	+1.26 (-0.63 to 3.17)	0.174
	Medical expenditure				
	Outpatient expenditure	2,817.46 ± 3,473.11	1,763.63 ± 2,591.06	-1,053.00 (-1,162.32 to -945.34)	0.038*
	Emergency patient expenditure	418.80 ± 925.23	618.56 ± 1,261.55	+199.76 (-233.89 to 633.41)	0.327
	Inpatient expenditure	1,560.07 ± 3,874.81	2,560.22 ± 7,002.10	+1,000.15 (-1,218.09 to 3,223.39)	0.345
	Total expenditure	4,796.33 ± 6,362.79	4,942.41 ± 8,453.64	+146.08 (-2,786.71 to 3,078.87)	0.356

[a]Tested by Wilcoxon sign-rank test. (* Statistic significant different at p-value<0.05)

2.5 Inhaled corticosteroid and inhaled bronchodilator utilization

According to Easy Asthma/COPD guideline, the first-line maintenance therapy for most patients with asthma is an inhaled corticosteroid, with the addition of a bronchodilator if needed to control symptoms. However, the reverse is true for the treatment of COPD. Bronchodilators are the first-line maintenance treatment for COPD. Treatment with inhaled corticosteroids is reserved only for selected patients whose COPD is not adequately managed with bronchodilators. To evaluate results of those guideline and compare utilization of these drug in patients who entered and did not entered the clinic, the results were divided into two sections. First, a comparison of inhaled corticosteroid and inhaled bronchodilator use and expenditure between before and after implementation the Easy Asthma/COPD Clinic. And second, a comparison of number of inhaled corticosteroid use more than or equal 4 packs between before and after implementation the Easy Asthma/COPD Clinic.

2.5.1 Comparison of inhaled corticosteroid and inhaled bronchodilator use and expenditure between before and after implementation the Easy Asthma/COPD Clinic

Table 4.12-4.13 presents detail of inhaled corticosteroid and inhaled bronchodilator use and expenditure in patient who entered and did not enter the clinic.

From table 4.12 displays patients who entered the clinic, for inhaled corticosteroid, there was increased significantly between pre and post intervention period in average number of use and expenditure in asthma patients, while it was increased not significantly in COPD patients. Average number of ICS use and expenditure per patient in asthma patients was higher than COPD patients in post intervention period. For inhaled bronchodilator, there was increased significantly between pre and post intervention period in average number of use and expenditure in asthma and COPD patients. Average number of inhaled bronchodilator use and expenditure per patient in COPD patients was higher than asthma patients in post intervention period.

From table 4.13 displays patients who did not enter the clinic, for inhaled corticosteroid, there was increased not significantly between before and

after implementation the clinic in average number of use and expenditure in asthma patients, while it was decreased significantly in COPD patients. Similarly, average number of ICS use and expenditure per patient in asthma patients was higher than COPD patients after implementation the clinic. For inhaled bronchodilator, in asthma patients, there was decreased significantly between before and after implementation the clinic in average expenditure per patient but decreased not significantly in average number of use per patient, while in COPD patients, there was decreased significantly between before and after implementation clinic in both average number of use and expenditure. Average expenditure of inhaled bronchodilator per patient in COPD patients was higher than asthma patients after implementation the clinic.

Table 4.12 Use and expenditure of inhaled corticosteroid and inhaled bronchodilator pre and post intervention period by patients who entered the Easy Asthma/COPD Clinic at Wangtong Hospital

	Asthma (N=105)			**COPD (N=171)**		
	Pre	**Post**	**P-value[a]**	**Pre**	**Post**	**P-value[a]**
Inhaled corticosteroid						
Total package	374	581	0.000*	771	815	0.206
Average ± SD	3.56 ± 3.38	5.53 ± 3.30		4.51 ± 4.21	4.77 ± 4.40	
Total expenditure (baht)	144,984	222,928	0.000*	305,152	349,796	0.123
Average ± SD	1,380.80 ± 1,380.86	2,123.12 ± 1,254.32		1,784.51 ± 1,972.02	2,045.59 ± 2,387.85	
Inhaled bronchodilator						
Total package	607	788	0.000*	1,082	1,897	0.000*
Average ± SD	5.78 ± 4.74	7.50 ± 4.57		6.33 ± 5.91	11.09 ± 8.01	
Total expenditure (baht)	74,093	103,545	0.000*	375,398	647,005	0.000*
Average ± SD	705.65 ± 1,038.93	986.14 ± 1,168.42		2,195.31 ± 2,023.36	3,783.65 ± 2,861.26	

[a]Tested by Wilcoxon sign-rank test. (* Statistic significant different at p-value<0.05)

Table 4.13 Use and expenditure of inhaled corticosteroid and inhaled bronchodilator before and after implementation by patients who did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

	Asthma (N=40)			COPD (N=46)		
	Before	**After**	**P-value[a]**	**Before**	**After**	**P-value[a]**
Inhaled corticosteroid						
Total package	92	112	0.113	108	69	0.020*
Average ± SD	2.30 ± 2.85	2.80 ± 2.60		2.35 ± 2.81	1.50 ± 2.19	
Total expenditure (baht)	34,960	43,992	0.092	43,904	28,368	0.016*
Average ± SD	874.00 ± 1,082.35	1,099.80 ± 1,003.94		954.43 ± 1,181.34	616.70 ± 919.91	
Inhaled bronchodilator						
Total package	221	177	0.109	278	182	0.011*
Average ± SD	5.53 ± 4.95	4.43 ± 4.01		6.04 ± 5.55	3.96 ± 4.18	
Total expenditure (baht)	22,844	17,059	0.040*	81,766	53,819	0.019*
Average ± SD	571.10 ± 767.23	426.48 ± 451.87		1,777.52 ± 1,951.61	1,169.98 ± 1,421.70	

[a]Tested by Wilcoxon sign-rank test. (* Statistic significant different at p-value<0.05)

2.5.2 Comparison of number of inhaled corticosteroid use more than or equal 4 packs between before and after implementation Easy Asthma/COPD Clinic

Quality of prescribing inhaled corticosteroid in Easy Asthma/COPD Clinic program could be evaluated from the continuity and collaboration of inhaled corticosteroid use in patients which is used at least 4 pack/year. Results from table 4.14-4.15 shows that asthma patients who entered the clinic used inhaled corticosteroid ≥ 4 pack increased from 44.76% in pre intervention period to 72.38% in post intervention period, and increased from 50.29% in pre intervention period to 56.14% in post intervention period in COPD patients who entered the clinic. On the other hand, in patients who did not enter the clinic, inhaled corticosteroid use ≥ 4 pack in asthma patients increased slightly from 30% before implementation the clinic to 35% after implementation the clinic, and decreased from 34.78% before implementation the clinic to 15.22% after implementation the clinic in COPD patients.

Table 4.14 Number of inhaled corticosteroid use pre and post intervention period by patients who entered the Easy Asthma/COPD Clinic at Wangtong Hospital

Number of use (pack)	Asthma				COPD			
	Pre (n)	%	Post (n)	%	Pre (n)	%	Post (n)	%
0	26	24.76	13	12.38	47	27.48	52	30.41
1	15	14.29	5	4.76	10	5.85	11	6.43
2	11	10.48	6	5.72	10	5.85	6	3.51
3	6	5.71	5	4.76	18	10.53	6	3.51
4	6	5.71	10	9.52	7	4.09	9	5.26
>4	41	39.05	66	62.86	79	46.20	87	50.88

Table 4.15 Number of inhaled corticosteroid use before and after implementation the clinic by patients who did not enter the Easy Asthma/COPD Clinic at Wangtong Hospital

Number of use (pack)	Asthma				COPD			
	Before (n)	%	After (n)	%	Before (n)	%	After (n)	%
0	17	42.50	10	25.00	23	50.00	26	56.52
1	4	10.00	5	12.50	2	4.35	4	8.69
2	6	15.00	6	15.00	1	2.17	2	4.35
3	1	2.50	5	12.50	4	8.70	7	15.22
4	4	10.00	6	15.00	5	10.87	2	4.35
>4	8	20.00	8	20.00	11	23.91	5	10.87

Part III Clinical outcomes of Easy Asthma/COPD Clinic

Table 4.16 summarizes the change in clinical outcomes from baseline (at start) to the last follow-up of asthma/COPD patients who entered the Easy Asthma/COPD Clinic.

Lung function

No significant changes were found for asthma and COPD patients in each group of lung function. However, there was statistically significant difference in average % PEFR per patient in asthma and COPD patients. Average % PEFR of asthma patients increased from 62.93 per patient at baseline to 70.05 per patient after intervention ($p = 0.000$). Average % PEFR of COPD patients increased from 49.46 per

patient at baseline to 52.65 per patient after intervention (p = 0.002). Additionally, % PEFR of asthma patients was higher than COPD patients.

Disease control

Disease control of asthma and COPD patients was improved significantly (p = 0.000). In asthma patients, there was increased in controlled and partly controlled stage 12.38% and 15.24%, respectively, while decreased in uncontrolled stage 27.62% after intervention. Similarly, in COPD patients, there was increased in well and total control stage 2.93% and 14.04%, respectively, while decreased in poor stage 16.97% after intervention.

Daytime symptoms

There are low frequency significantly of daytime symptom after intervention in asthma and COPD patients (p = 0.002 in asthma and p = 0.048 in COPD). At baseline 42.86% and 49.71% of asthma and COPD patients, respectively indicated a high frequency of daytime symptom (> once a week or everyday). This decreased to 26.66% and 40.35% of asthma and COPD patients, respectively after intervention. At baseline 60% and 50.29% in asthma and COPD patients, respectively indicated a low frequency of daytime symptom (none or < once a week). This increased to 73.34% and 59.65% of asthma and COPD patients, respectively after intervention.

Nighttime symptoms

Likewise, there are low frequency significantly of nighttime symptom after intervention in asthma and COPD patients (p = 0.003 in asthma and p = 0.000 in COPD). At baseline 47.62% and 33.33% of asthma and COPD patients, respectively indicated high frequency of nighttime symptom (> once a week or everyday). This decreased to 33.33% and 27.48% of asthma and COPD patients, respectively after intervention. At baseline 52.38% and 66.67% in asthma and COPD patients, respectively indicated a low frequency of nighttime symptoms (none or < once a week). This increased to 66.67% and 72.52% of asthma and COPD patients, respectively after intervention.

Reliever drug use

Using reliever drug when asthma/COPD attack decreased significantly after program intervention in asthma and COPD patients ($p = 0.000$ in asthma and $p = 0.005$ in COPD). At baseline 60% and 78.95% of asthma and COPD patients, respectively indicated a high frequency of reliever drug use (almost everyday or everyday). This decreased to 40% and 64.91% of asthma and COPD patients, respectively after intervention. At baseline 40% and 21.05% in asthma and COPD patients, respectively indicated a low frequency of reliever drug use (not use or < once a week). This increased to 60% and 35.09% of asthma and COPD patients, respectively after intervention.

% Proper inhalation technique

In asthma patients, the number of patients who used the inhaler correctly (100%) increased significantly from 15.24% at baseline to 54.29% after intervention. In COPD patients, the number of patients who used the inhaler correctly (100%) increased significantly from 8.77% at baseline to 49.71% after intervention. Moreover, average % proper inhalation technique increased significantly after intervention in both patients.

Table 4.16 Clinical outcomes at baseline and follow-up period of patients who entered the Easy Asthma/COPD Clinic at Wangtong Hospital

Clinical outcomes	Asthma (N=105)					COPD (N=171)				
	baseline		follow-up		P-value	baseline		follow-up		P-value
	N	%	N	%		N	%	N	%	
1.Lung function[a] (PEFR)										
1) PEF<30%	5	4.76	1	0.95	0.165	17	9.94	18	10.53	0.855
2) 30% ≤ PEF<50%	26	24.76	18	17.14		78	45.61	72	42.10	
3) 50% ≤ PEF<80%	48	45.72	54	51.43		62	36.26	63	36.84	
4) PEF≥80%	26	24.76	32	30.48		14	8.19	18	10.53	
Average % PEFR ± SD[b]	62.93 ± 20.80		70.05 ± 21.51		0.000*	49.46 ± 18.61		52.65 ± 21.55		0.002*
2. Disease control[a]										
Asthma										
1) Uncontrolled	67	63.81	38	36.19	0.000*					
2) Partly controlled	38	36.19	54	51.43						
3) Controlled	0	0.00	13	12.38						
COPD										
1) Poor						145	84.80	116	67.83	0.000*
2) Total control						23	13.45	47	27.49	
3) Well						3	1.75	8	4.68	
3. Daytime symptoms[a]										
1) None	42	40.00	68	64.76	0.002*	40	23.39	57	33.33	0.048*
2) < once a week	18	17.14	9	8.58		46	26.90	45	26.32	
3) > once a week	35	33.34	23	21.90		40	23.39	31	18.13	
4) Everyday	10	9.52	5	4.76		45	26.32	38	22.22	
4. Nighttime symptoms[a]										
1) None	29	27.62	50	47.62	0.003*	60	35.09	79	46.20	0.000*
2) < once a week	26	24.76	20	19.05		54	31.58	45	26.32	
3) > once a week	27	25.71	19	18.09		36	21.05	31	18.13	
4) Everyday	23	21.91	16	15.24		21	12.28	16	9.35	
5. Use of reliever drug[a]										
1) Not use	15	14.29	43	40.95	0.000*	26	15.20	47	27.49	0.005*
2) < once a week	27	25.71	20	19.05		10	5.85	13	7.60	
3) Almost everyday	33	31.43	18	17.14		29	16.96	15	8.77	
4) Everyday	30	28.57	24	22.86		106	61.99	96	56.14	
6. % proper inhalation technique[a]										
1) 0%	3	2.86	0	0.00	0.000*	2	1.17	0	0.00	0.000*
2) 1% - 25%	24	22.86	9	8.57		42	24.56	19	11.11	
3) 26% - 50%	24	22.86	6	5.71		59	34.50	20	11.70	
4) 51% - 75%	27	25.71	12	11.43		31	18.13	24	14.03	
5) 76% - 99%	11	10.48	21	20.00		22	12.87	23	13.45	
6) 100%	16	15.24	57	54.29		15	8.77	85	49.71	
Average % inhalation technique ± SD[b]	55.99 ± 29.65		84.77 ± 23.89		0.000*	51.42 ± 27.23		78.29 ± 27.82		0.000*

Note: PEFR = Peak Expiratory Flow Rate

[a]Tested by Pearson Chi-Square test. (*Statistic significant different at p-value<0.05)

[b]Tested by Paired sample t- test. (*Statistic significant different at p-value<0.05)

Part IV Cost benefit of Easy Asthma/COPD Clinic

Result of costs, outcomes, and benefit to cost ratio of Easy Asthma/COPD Clinic was shown in Table 4.17.

4.1 Costs of Easy Asthma/COPD Clinic

Additional costs of Easy Asthma/COPD Clinic is calculated from difference of costs before and after implementation. Costs of Easy Asthma/COPD Clinic was divided into 3 parts.

4.1.1 Administrative costs

Administrative costs were divided into 3 parts including capital costs, labor costs, material costs and details of these costs was shown in appendix L. Administrative cost before and after implementation were 47,217.75 THB and 64,589.05 THB, respectively. Therefore, additional cost of administrative cost was 17,371.30 THB.

4.1.2 Direct medical costs

Direct medical costs were costs of outpatient service. This costs before and after implementation were 1,638,470.37 THB and 2,245,030.67 THB, respectively. Therefore, additional cost of direct medical cost was 606,560.30 THB.

4.1.3 Direct non-medical costs

Direct non-medical costs were transportation costs, food costs, and time costs while receiving treatment of patient and caregivers. This costs before and after implementation were 412,451.20 THB and 499,570.62 THB, respectively. Additional cost of direct non-medical cost was 87,119.42 THB.

Total cost of Easy Asthma/COPD Clinic in health care provider perspective was determined from summation of additional costs of administrative costs and direct medical costs. From additional costs calculation, cost of Easy Asthma/COPD Clinic in provider perspective was 671,149.35 THB.

Total cost of Easy Asthma/COPD Clinic in societal perspective was determined from summation of additional costs of administrative costs, direct medical costs, and direct non-medical costs. From additional costs calculation, cost of Easy Asthma/COPD Clinic in societal perspective was 758,268.77 THB.

4.2 Benefits of Easy Asthma/COPD Clinic

The benefit of Easy Asthma/COPD Clinic was determined in terms of the cost savings from emergency department visits and hospitalization avoided.

Considering these cost saved by provider perspective, it was the difference costs between costs of emergency service and admission before implementation with a 2,461,616.32 THB and costs of emergency service and admission after implementation with a 1,587,268.32 THB. The cost of emergency visits and hospitalization is subsequent savings was annualized at 874,348.00 THB after implementation of the clinic.

When considered these cost saved by societal perspective, costs of emergency service, costs of admission, direct non-medical costs, and indirect costs were included for calculation. From calculation the cost saved from emergency visits and hospitalization avoided was 1,235,028.82 THB annually after implementation of the clinic.

4.3 Benefit to costs ratio of the Easy Asthma/COPD Clinic

As a result, the annual costs of Easy Asthma/COPD Clinic program in provider and societal perspective were 671,149.35 THB and 758,268.77 THB, respectively.

The benefits of the Easy Asthma/COPD Clinic, this program is subsequent cost savings from emergency visit and hospitalization avoided in provider and societal perspective were annualized at 874,348.00 THB, and 1,235,028.82 THB, respectively.

If only administrative costs and direct medical costs are used to calculate the benefit to cost ratio, the ratio is 1.30:1, which indicates that the program is cost beneficial from provider perspective. If direct non-medical costs and indirect costs are included in the benefit to cost ratio, the result is 1.63:1, which indicates that the program is cost beneficial from societal perspective.

Table 4.17 Costs, outcomes, and benefit to cost ratio of Easy Asthma/COPD Clinic at Wangtong Hospital

	Before implementation	**After implementation**	**Difference**
Costs			
1. Administrative cost			
1.1 Capital cost	47,217.75	87,806.80	40,589.05
1.2 Labor cost	-	14,400.00	14,400.00
1.3 Material cost	-	9,600.00	9,600.00
2. Direct medical cost: outpatient service	1,638,470.37	2,245,030.67	606,560.30
3. Direct non-medical cost			
3.1 Travel and food cost of patients and caregivers	336,311.52	407,857.46	71,545.94
3.2 Time cost of patients and caregivers while receiving treatment	76,139.68	91,713.16	15,573.48
• Total cost (provider perspective) (1+2)			**671,149.35**
• Total cost (societal perspective) (1+2+3)			**758,268.77**
Benefits			
1.Number of ER visits/hospitalization avoided	943	528	415 visits
2. Cost of ER visits and hospitalization			
2.1 Direct medical cost			
2.1.1 Emergency service	938,071.65	479,387.25	458,684.40
2.1.2 Hospitalization	1,523,544.67	1,107,881.07	415,663.60
2.2 Direct non-medical cost			
2.2.1 Travel and food cost of patients and caregivers	410,231.53	221,494.10	188,737.43
2.3 Indirect cost	315,989.57	144,046.18	171,943.39
• Cost saving from ER visits/hospitalization avoided (provider perspective) (2.1)			**874,348.00**
• Cost saving from ER visits/hospitalization avoided (societal perspective) (2.1+2.2+2.3)			**1,235,028.82**
Benefit to Cost Ratio: Provider perspective	**874,348/671,149.35 = 1.30**		
Benefit to Cost Ratio: Societal perspective	**1,235,028.82/758,268.77 = 1.63**		

Part V Factor affecting disease control in asthma/COPD patients who entered the Easy Asthma/COPD Clinic

Table 4.18 shows the results of logistic regression analyses in asthma patients. Three variables such as daytime symptom, nighttime symptom, and % Peak Expiratory Flow Rate were significant associated with disease control ($p < 0.05$). But age, gender, smoking habit, payment method, comorbidity, inhaled corticosteroid use, reliever drug use, ER visit, and IPD visit were not significantly explanatory variables.

As the results, there was a significantly higher proportion of controlled among asthma patients who have elevation of % Peak Expiratory Flow Rate. In contrast, there was a significantly lower proportion of controlled among asthma patients who have daytimes and nighttime symptom.

Table 4.18 Results of logistic regression analysis in asthma patients

Dependent variables = Disease control (controlled = 1)			
Independent variables	**Parameter estimates**	**Odds ratio**	**P-value**
Constant	-6.073	0.002	0.041*
Age	-0.002	0.998	0.939
Gender	-0.525	0.591	0.228
Smoking habit	-1.918	0.147	0.067
Payment method	-0.215	0.806	0.886
Comorbidity	-0.406	0.666	0.558
Daytime symptom	-1.329	0.265	0.004*
Nighttime symptom	-1.565	0.209	0.001*
% PEFR	0.088	1.092	0.002*
ICS use	0.924	2.519	0.474
Reliever drug use	-0.737	0.479	0.144
ER visit	-0.469	0.626	0.228
IPD visit	-0.223	0.800	0.739

*Statistical significant at p-value<0.05

Table 4.19 shows the results of logistic regression analyses in COPD patients. Three variables such as payment method, daytime symptom, and reliever drug use were significant associated with disease control ($p < 0.05$). But age, gender, smoking habit, comorbidity, nighttime symptom, % PEFR, inhaled corticosteroid use, ER visit, IPD visit were not significantly explanatory variables.

As the results, there was a significantly lower proportion of controlled among COPD patients who under capitation, have daytimes symptom, and use of reliever drug.

Table 4.19 Results of logistic regression analysis in COPD patients

Dependent variables = (Disease control (controlled = 1)			
Independent variables	**Parameter estimates**	**Odds ratio**	**P-value**
Constant	8.214	3691.475	0.035*
Age	-0.007	0.993	0.833
Gender	0.907	2.478	0.070
Smoking habit	-0.507	0.602	0.677
Payment method	-2.733	0.065	0.038*
Comorbidity	-0.625	0.535	0.454
Daytime symptom	-2.670	0.069	0.007*
Nighttime symptom	-0.937	0.392	0.329
% PEFR	0.019	1.019	0.383
ICS use	1.106	3.022	0.182
Reliever drug use	-4.521	0.011	0.003*
ER visit	-0.973	0.378	0.318
IPD visit	-0.717	0.488	0.596

*Statistical significant at p-value<0.05

CHAPTER V
DISCUSSIONS

The present study was performed to evaluate economic and clinical outcomes after implementation of Easy Asthma/COPD Clinic. The topic of discussion in this study were consisted of 2 parts as followed:

Part I Patient's selection
Part II Economic and clinical outcomes

Part I Patient's selection

Because of study design was a pre-post study, the subjects are not randomized and use of each participant as self-control. Thus, it may be have time-dependent confounding factor such as season to affect the outcomes of the study which is explained that the seasonal especially rainfall and winter are the temperature change that have direct effects on inflammation pathways or airways hyper-responsiveness causing of provoking of acute exacerbation that impact on increasing of healthcare resource of emergency and inpatient department and decline of clinical outcomes (166). However, the study participants were recruited over different seasons throughout the year thus the effects of seasons on outcomes might be limited. The potential of selection bias existed because intervention group patients comprised respondents who volunteered themselves for participation in this clinic and not randomly assigned to the intervention or control group. In addition, it is anticipated that increased disease severity could influence a patient's willingness to participate in this clinic in an attempt to minimize their disease-related problems. This hypothesis could explain that the intervention group have disease severity more than control group.

Part II Economic and clinical outcomes

1. Determination of resource utilization

The results of this study are consistent with the resultant cost savings of an intervention program, demonstrating that intervention program can reduce treatment costs by reducing hospitalization and emergency room visits as previous studies (110, 133, 141, 160). Reduction of the number and frequency of emergency room visits and hospitalizations for asthma or COPD is meaningful to patients and providers because these events are clinically burdensome and also to payers, because they are expensive and present an economic burden to the healthcare system.

When compared resource utilization between asthma and COPD patients, COPD patients have higher rate of utilization of service and expenditure than asthma patients because pathophysiology of COPD are more severe and some drug use are more expensive than asthma. For example, in case of exacerbation, there are using of beradual nebulizing solution (40 baht/tube) in COPD patients, while in asthma patients, there are using of salbutamol nebulizing solution (20 baht/tube) etc.

The results also revealed that drug expenditure constituted the largest proportion of total asthma/COPD treatment expenditures and increased after intervention (61.92-65.18% of total treatment expenditure before intervention, and 73.49-79.08% after intervention in patients who entered the clinic). Because healthcare providers were encouraged to prescribed inhaled corticosteroid as part of the intervention program, patient adherence to this intervention may have contributed to the increase in asthma/COPD drug cost per user.

Regarding result of relative risk in patients who entered the clinic, the risk of emergency visit and admission decreased after implementation the clinic. It illustrates that interventions and increasing of inhaled corticosteroid use can improve health status that contribute to reduce emergency visit and admission.

2. Inhaled corticosteroid and inhaled bronchodilator utilization

Use of inhaled corticosteroid and inhaled bronchodilator increased after intervention. Nevertheless, there were patients who did not use inhaled corticosteroid after intervention. From interviewing patients, the common reason for non adherence

to inhaled corticosteroid were misperceptions about the role of inhaled corticosteroid, and worried about the adverse effects of the inhaled corticosteroid. Poor adherence to inhaled corticosteroid is linked particularly to poor outcomes including increased hospitalization and mortality rates (167). There have been many interventions to improve inhaled corticosteroid adherence. A Norwegian study showed improvements in adherence to inhaled corticosteroid by group educational sessions and an individualized intervention (168). A British study showed that personal action plans, developed by hospital-based nurses, resulted in improvements in inhaled corticosteroid adherence, time off work, and health service contact use (169). Another study in UK, community pharmacists have also been shown to improve inhaled corticosteroid adherence and symptom scores through the use of self-management plan (126). As study above, non-adherence to inhaled corticosteroid can be resolved by healthcare providers especially pharmacist in Easy asthma/COPD Clinic, who adapt effective interventions and take a role in patient counseling in order to improve adherence.

Considering prescribing of inhaled corticosteroid between UC and CSMBS patients from table 5.1 shows that there are difference in prescribing of this drug after intervention. All of UC patients were prescribed with inhaled corticosteroid alone that is essential drug, while most of CSMBS patients were prescribed with combination therapy [inhaled corticosteroid plus long acting β_2-agonist (seretide®)] that is non- essential drug and expensive than inhaled corticosteroid alone 3 folds (ICS alone = 308 THB, seretide® = 1,096 THB) but more effective in significantly fewer exacerbation and hospitalization (170, 171). This indicated that UC patients had lower accessibility to more effective drug than CSMBS patients. To access this drug in UC patients, NHSO should support more budget for combination therapy in case of patients who had frequent of exacerbation and hospitalization and not effective in using inhaled corticosteroid alone.

Table 5.1 Proportion of inhaled corticosteroid use in UC and CSMBS patients after intervention

	Asthma		COPD	
	UC (N = 99)	**CSMBS (N = 5)**	**UC (N = 152)**	**CSMBS (N = 14)**
• Budesonide inhaler	88.89%	40%	67.76%	14.29%
• Salmeterol + fluticasone (Seretide®) inhaler	0%	60%	0%	85.71%

3. Clinical outcomes of Easy Asthma/COPD Clinic

After 9 months, this Easy Asthma/COPD Clinic program resulted in improvements of clinical outcomes within patients who entered the clinic. However, in comparison of % Peak Expiratory Flow Rate (PEFR), it only found significantly difference on the mean PEFR but no significantly difference between % PEFR in each degree. It might be explained that the lung function was measured in a short time period because of Peak Flow meter are brought after 6 months of setting up clinic. For this reason, PEFR record might have been too short to provide difference of degree of lung function in each patients.

For disease control, proportion of patients who had achieved control stage in asthma and well stage in COPD after intervention increased 12.38%, and 2.93%, respectively. Result in asthma patients were the same way to other studies in outcomes of Easy Asthma Clinic, the study by Duangdee A. assessed the outcomes of Easy asthma clinic at Banphai Hospital, Khon Kaen from January 2004 to December 2006 showed that proportion of asthma patients who achieved control stage increased from 5.88% to 8.94% (118). Another study in Nongsaeng Hospital, Udon Thani in June 2009 to May 2010 showed that proportion of patients who had achieved total control asthma stage increased from 19.7% in 2009 to 28.5% in 2010 (172).

For daytimes and nighttime symptoms, there are decreased significantly after intervention. The result of asthma patients are similar to study of Bunting BA et al that used claims data from January 1, 1999 to December 31, 2003 to assess clinical, humanistic, and economic outcomes of a community-based medication therapy management (MTM) program showed that daytime and nighttime symptoms after being in the program for 1 year decreased 16% and 12%, respectively (110).

For reliever drug use, there are decreased significantly after intervention. The result of asthma patients are similar to study in Easy Asthma Clinic at Nongsonghong Hospital showed that using of reliever drug decreased from 84.4% before intervention to 68.7% after intervention (121).

For % proper inhalation technique, the number of patients who used the inhaler correctly increased significantly after intervention. The result of asthma patients are similar to study in Easy Asthma Clinic at Yangtalad Hospital showed that the number of patients who used the inhaler correctly increased from 27.2% before intervention to 94.2% after intervention (119).

4. Cost benefit of Easy Asthma/COPD Clinic

The main measures of this part concerned the costs and benefits of Easy Asthma/COPD Clinic Program. From provider and societal perspective, the benefits to costs ratio of the Easy Asthma/COPD Clinic was 1.30 and 1.63, respectively, which indicates that this clinic is effective. The outcomes of this study indicate that the Easy Asthma/COPD Clinic is beneficial in terms of cost savings from emergency patient visit and hospitalization avoided at Wangtong Hospital from provider and societal point of view. In addition, the benefits to costs ratio of this program ensures that the success of the Easy Asthma/COPD Clinic, it is necessary to maintain this clinic in community hospital.

However, there is one issue for consideration. The main effect of total costs and cost savings were drug costs because proportion of drug costs was the highest in direct medical costs, approximately 80% of outpatient cost, 70% of emergency costs, 30% of inpatient costs. If drug cost was reduced, this program might be more effective. Unlike studies in foreign countries, drug costs are small portion of the total costs. For example, study of Karnick P. et al compared cost-benefit of three pediatric asthma interventions from provider perspective, it was found that proportion of drug costs was only 30% of total costs and benefit to costs ratio are more than one in all three interventions etc (173).

5. Factor affecting disease control in asthma/COPD patients who entered the Easy Asthma/COPD Clinic

Logistic regression analysis had been employed for determining explanatory variables influencing disease control after intervention in asthma and COPD patient. In asthma patients, disease control was positively associated with % Peak Expiratory Flow Rate. In contrast, daytime and nighttime symptoms show negative associated. In COPD patients, disease control was negatively associated with payment method, daytime symptoms, and reliever drug use.

It was difficult to compare the result of this study with other studies because of the difference in population and methodology of studies and most of studies conducted in asthma patients. However, it could be roughly performed as follow.

Payment method

COPD patients under capitation (i.e., SSS or UC) has significantly lower disease control than under FFS (i.e., CSMBS). It might be explained that most of patients under capitation were elderly and low education, so that they tended to non - compliance and less caring themselves.

% Peak Expiratory Flow Rate

Increasing of % Peak Expiratory Flow Rate is significantly associated with higher control in asthma patients. There is the same result by the study of Dalcin P.T.R. et al which identify factor associated with uncontrolled asthma at the outpatient asthma Clinic of HCPA at Brazil, the resulted showed that % Peak Expiratory Flow Rate was significantly higher in controlled group than uncontrolled group (71.2 ±21.6 and 58.2 ± 20.8 %, respectively; $P < 0.05$) (174).

Daytime and nighttime symptoms

Result in asthma patients showed that there was a significantly lower proportion of controlled among patients who have daytime symptoms and nighttime symptoms. And result in COPD patients showed that there was a significantly lower proportion of controlled among patients who have daytime symptoms. There was no

study that entered daytime and nighttime symptoms in the list of explanatory variables in COPD patients but there are two studies in asthma patients that have result in the same way in this study. The study by Wei HH et al which explore the association between current asthma control and future risk of asthma exacerbation during a 12-month follow-up at West China Hospital, the resulted showed that the lower asthma control associated with an increased probability of daytimes symptoms (OR 3.65, 95% CI 2.20-6.04) and nighttime symptoms (OR 5.75, 95% CI 2.91-11.38) (175). Another study in United State of America assess asthma control status among adult and pediatric patients with asthma, the resulted illustrated that the predictor of uncontrolled asthma seen only in children were a history of daytime symptoms (OR = 1.49, 95% CI 1.20-1.85) (176).

Reliever drug use

There was no study about reliever drug use in the list of explanatory variables. However, study by Wang indicated that use of reliever drug when acute exacerbation are very common in poorly control COPD (177).

Limitation of the study

1. Data were obtained from electronic database that might be underestimated because of inaccuracies and incomplete in recording data or missing data in case of patients received treatment in other hospital.

2. Some data that indicated quality of care such as cause of death may be lost because it is not recorded in electronic database.

3. About analysis of factor associated to disease control of asthma and COPD patients by logistic regression analysis, it is not perfect prediction because small sample and some variables are not inputted but it can be used as a tool for healthcare worker to improve interventions for disease control.

CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

This chapter provides the conclusions, recommendations of the study. The study was a comparative research analysis of economic and clinical outcomes before and after implementation of Easy Asthma/COPD Clinic at Wangtong Hospital during January 1, 2010 to December 31, 2011. Study populations are asthma and COPD patients who entered and did not enter the clinic for 9 months. Data were collected from hospital's database and data records in Easy Asthma/COPD Clinic of NHSO website and analyzed with Microsoft Access 2010 and SPSS version 19.

Conclusions

Characteristics of patients

A total of 145 asthma and 217 COPD patients were recruited for the study. Among these, there are 105 and 40 patients with asthma patients who entered and did not enter the clinic, whereas COPD patients who entered and did not enter the clinic were 171 and 46 patients, respectively.

Most of asthma and COPD patients are elderly and had comorbidity. COPD patients are older than asthma patients. Over 70% of asthma patients were female, while in COPD patients were male. Main of health insurance of both patients were UC program.

Resource utilization

Trend of utilization rate and expenditure are the same in asthma and COPD patients. Average outpatient visit and expenditure increased 18.90-25.76% and 32.31-85.38%, respectively after intervention. On the other hand, the average use and expenditure per patient associated with emergency services, hospitalization and

number of bed days decreased 3.26-29.54%, 23.60-71.79%, and 32.68-73.17%, respectively.

Drug expenditure was the highest proportion of asthma/COPD outpatients and emergency patient expenditure (about 80% of total outpatient expenditure and 70% of total emergency patient expenditure). Majority of drug expenditure were inhaled therapy. Regarding inpatient, the highest proportion expenditure were non drug (about 70% of total inpatient expenditure).

Relative risk of emergency visit and admission

The risk of emergency visits and admission are declined after implementation.

Inhaled corticosteroid and inhaled bronchodilator utilization

Use of inhaled corticosteroid and inhaled bronchodilator increased after intervention. In addition, the number of patients who used inhaled corticosteroid ≥ 4 pack was also increased.

Clinical outcomes

All outcomes such as lung function, disease control, daytime and nighttime symptoms, reliever drug use, and % proper inhalation technique was improved significantly after intervention.

Cost benefit of Easy Asthma/COPD Clinic

The Easy Asthma/COPD Clinic program is cost beneficial from provider and societal perspective (the benefit to cost ratio is 1.30:1 and 1.63:1, respectively).

Factor affecting disease control in asthma/COPD patients

In asthma patients, disease control was positively associated with % Peak Expiratory Flow Rate but negatively associated with daytime and nighttime

symptom. For COPD patients, disease control was negatively associated with payment method, daytime symptoms, and reliever drug use.

Recommendations

There are some recommendations occur from the study.

1. The interventions in Easy Asthma/COPD Clinic are effective. Therefore, it should encourage all asthma/COPD patients to participate in this clinic and promoted this program in all community hospital.

2. The information from the outcomes of Easy Asthma/COPD Clinic can help policy maker to determine the appropriated budget for hospitals.

Suggestion for future studies

1. To confirm the results of this study. It should be used more than one hospital for comparison.

2. The future studies should explore resource utilization under difference health insurance to provide more information for budget allocation.

3. To detect irrational of inhaled corticosteroid use; drug use per day and next appointment date should be included for further analysis.

4. Because of asthma and COPD are chronic diseases that impact on quality of life. Further research should be evaluated this outcomes.

5. Other factors that affected disease control such as education level, occupation, or medication adherence were not studied. The further research should be concerned of these factors.

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APPENDICES

APPENDIX A
DATA STRUCTURE OF HOSPITAL DATABASE

1. Outpatient department

- HN (Hospital number)
- VN (Visit number)
- VSTDATE (Visit date)
- DATE (Date of dispensing)
- PTNAME (Name of patient)
- SEX (male or female)
- AGE_Y (Age of patient)
- STATUS (Marriage status)
- OCCUPATION (Patient's occupation)
- TYPE (Patient's type of health insurance coverage)
- ICODE (Drug, non-drug code)
- DRUG (Drug name)
- NON-DRUG (Non-drug name)
- STRENGTH (Drug strength)
- UNITS (Sale unit)
- UNIT PRICE (Unit price)
- QTY (Quantity of service)
- SUM_PRICE (Total price)
- PDX (Principle diagnosis)
- $PD_{0,1,2}$ (Other diagnosis)

2. Inpatient department

- HN (Hospital number)
- AN (Admission number)
- REGDATE (Date of admission)
- DCHDATE (Date of discharge)
- DATE (Date of dispensing)
- PTNAME (Name of patient)
- SEX (male or female)
- AGE_Y (Age of patient)
- STATUS (Marriage status)
- OCCUPATION (Patient's occupation)
- TYPE (Patient's type of health insurance coverage)
- ICODE (Drug, non-drug code)
- DRUG (Drug name)
- NON-DRUG (Non-drug name)
- STRENGTH (Drug strength)
- UNITS (Sale unit)
- UNIT PRICE (Unit price)
- QTY (Quantity of service)
- SUM_PRICE (Total price)
- PDX (Principle diagnosis)
- $PD_{0,1,2}$ (Other diagnosis

APPENDIX B

แบบฟอร์มบันทึกประวัติผู้ป่วย Asthma/COPD เมื่อเริ่มการรักษา (first visit)

ข้อมูลประวัติผู้ป่วยเมื่อเริ่มการรักษา (first visit) **โรงพยาบาล……**

1) HN……เลขที่บัตรประชาชน……Asthma/COPD No……..

2) ชื่อ……นามสกุล…….

3) เพศ M) ชาย F) หญิง

4) ที่อยู่……..เบอร์โทรศัพท์……

5) อายุ……..ปี น้ำหนัก……..กก. ส่วนสูง…….ซ.ม.

6) วัน/เดือน/ปีเกิด ☐☐ / ☐☐ / ☐☐☐☐

7) เริ่มหอบอายุ……..ปี หอบมานาน……ปี

8) รักษาโรคหืดที่โรงพยาบาลนี้มากี่ปีแล้ว……ปี

9) ในระยะเวลา 12 เดือนที่ผ่านมา คุณเคยนอนรักษาในโรงพยาบาลด้วยอาการหอบมากหรือไม่

0) ไม่เคย 1) เคย……..ครั้ง (ทั้งหมดกี่คืน……..)

10) ในระยะเวลา 12 เดือนที่ผ่านมา คุณเคยหอบมากจนต้องไปพ่นยาที่ห้องฉุกเฉินหรือไม่

0) ไม่เคย 1) เคย……..ครั้ง

11) การรักษาในปัจจุบัน

* β_2 agonist inhaler	☐ No	☐ Yes…….
* β_2 agonist Tab	☐ No	☐ Yes…….
* Theophylline	☐ No	☐ Yes…….
* Steroid inhaler	☐ No	☐ Yes…….
* Oral steroid	☐ No	☐ Yes…….
* β_2 + Ipratropium inhaler	☐ No	☐ Yes…….
* β_2 + ICS inhaler	☐ No	☐ Yes…….
* ICS + LABA	☐ No	☐ Yes…….
* Anti – Leukotriene	☐ No	☐ Yes…….

12) เคยตรวจสมรรถภาพปอดมาก่อนหรือไม่ 0) ไม่เคย 1) เคย

13) คุณเคยสูบบุหรี่หรือเปล่า 0) ไม่เคย 1) เคย

(ไม่เคย หมายความว่าสูบน้อยกว่า 1 มวนต่อวันเป็นเวลา 1 ปี หรือสูบน้อยกว่า 20 ซอง)

ถ้าเคย 1. ปัจจุบันนี้คุณยังสูบบุหรี่อยู่ 0) ไม่ใช่ 1) ใช่

2. คุณเริ่มสูบบุหรี่เมื่ออายุเท่าไหร่……ปี

3. ถ้าคุณหยุดสูบบุหรี่แล้วคุณหยุดสูบเมื่ออายุเท่าไหร่……..ปี

4. โดยเฉลี่ยคุณสูบบุหรี่กี่มวนต่อวัน……มวน/วัน

14) วันที่สัมภาษณ์ วัน/เดือน/ปี ☐☐ / ☐☐ / ☐☐☐☐

15) ในช่วงหนึ่งปีที่ผ่านมานี้ คุณเคยไปรักษาโรคหืด/ปอดอุดกั้นเรื้อรัง ที่โรงพยาบาลใดนอกจากโรงพยาบาลนี้

……

APPENDIX C

แบบฟอร์มบันทึกการประเมินผลการรักษาผู้ป่วย Asthma/COPD

แบบประเมินผลการรักษาผู้ป่วย ASTHMA/COPD โรงพยาบาล……

วันที่……HN……Asthma/COPD No…….Predicted PEFR……L/min

น้ำหนัก……..ส่วนสูง……

1. **ในช่วง 4 สัปดาห์ที่ผ่านมา** คุณมีอาการไอ หายใจไม่อิ่ม หรือหายใจมีเสียงวี้ด **ในช่วงกลางวัน**หรือไม่

0) ไม่มี 1) มีอาการน้อยกว่า 1 ครั้ง/สัปดาห์

2) มีอาการมากกว่าหรือเท่ากับ 1 ครั้ง/สัปดาห์ 3) มีอาการทุกวัน

4) มีอาการเกือบตลอดเวลาทำให้มีปัญหากับการทำกิจวัตรประจำวัน

2. **ในช่วง 4 สัปดาห์ที่ผ่านมา** คุณต้องลุกขึ้นมาไอ หายใจฝืด แน่นหน้าอก หายใจมีเสียงวี้ด **ในช่วงกลางคืน**หรือไม่

0) ไม่มี 1) มีน้อยกว่าหรือเท่ากับ 2 ครั้ง/เดือน 2) มีมากกว่า 2 ครั้ง/เดือน

3) มีมากกว่า 1 ครั้ง/สัปดาห์ 4) มีเกือบทุกวัน

3. **ในช่วง 4 สัปดาห์ที่ผ่านมา** คุณใช้ยาบรรเทาอาการหอบ (ยาขยายหลอดลม) บ้างหรือไม่

0) ไม่มี 1) ใช้น้อยกว่า 1 ครั้ง/สัปดาห์ 2) ใช้เกือบทุกวัน

3) ใช้ทุกวัน 4) ใช้มากกว่า 4 ครั้ง/วัน ติดต่อกันตั้งแต่ 2 วันขึ้นไป

4. **ในช่วง 4 สัปดาห์ที่ผ่านมา** คุณเคยหอบมากจนต้องไปรับการรักษาที่ห้องฉุกเฉินหรือคลินิกบ้างหรือไม่

0) ไม่เคย 1) เคย (จำนวน…….ครั้ง)

5. **ในช่วง 4 สัปดาห์ที่ผ่านมา** คุณเคยหอบมากจนต้องเข้ารับการรักษาในโรงพยาบาลบ้างหรือไม่

0) ไม่เคย 1) เคย (จำนวน…….ครั้ง) ที่โรงพยาบาล……..

6. คุณมีผลข้างเคียงจากการใช้ยาหรือไม่

0) ไม่มี 1) เชื้อราในปาก 2) เสียงแหบ 3) อื่นๆ โปรดระบุ……..

7. **PRE** PEFR……L/min Predicted PEF……L/min % Predicted……

FVC……..L Predicted FVC……L % Predicted……....

FEV_1…….L Predicted PEV_1……L % Predicted……

PD_{20}…….

POST PEFR…….L/min……% Predicted

FVC…….L……% Predicted

FEV_1……L……..% Predicted

8. ยาที่ผู้ป่วยใช้ในขณะนี้ และขนาดที่ใช้ (ในช่วง 4 สัปดาห์ที่ผ่านมา)

1. …….

2. ……...

3. …….

9. ยาที่แพทย์สั่งให้ใหม่

1. ……

2. ……

3. ……....

10. วันนัดพบแพทย์ครั้งต่อไป วันที่……เดือน……พ.ศ……

11. ปัจจุบันคุณสูบบุหรี่ หรือไม่ 0) ไม่ 1) ใช่

12. (สำหรับผู้ป่วย COPD) คุณมีเสมหะเหลืองหลังจากพบแพทย์ครั้งที่แล้ว หรือไม่ 0) ไม่ใช่ 1) ใช่

13. (สำหรับผู้ป่วย COPD) ขณะนี้ อาการเหนื่อยหอบของคุณเป็นอย่างไรบ้าง

( ) คุณไม่สามารถเดินได้ เนื่องจากสาเหตุอื่น

0) ไม่มีอาการเหนื่อย เพียงแค่รู้สึกหายใจหอบ ขณะออกกำลังกายอย่างหนักเท่านั้น

1) หายใจหอบ เมื่อเดินอย่างเร่งรีบบนพื้นราบ หรือเมื่อเดินขึ้นที่สูงชัน

2) เดินบนพื้นราบได้ช้ากว่าคนอื่นที่อยู่ในวันเดียวกัน เพราะหายใจหอบ หรือต้องหยุดเพื่อหายใจเมื่อเดินปกติบนพื้นราบ

3) ต้องหยุดเพื่อหายใจหลังจากเดินได้ประมาณ 100 เมตร หรือหลังจากเดินได้สักพักบนพื้นราบ

4) หายใจหอบมากเกินกว่าที่จะออกจากบ้าน หรือหอบมากขณะแต่งตัว หรือเปลี่ยนเครื่องแต่งตัว

14. (สำหรับผู้ป่วย COPD) SIX minute walk เดินได้……เมตร

<u>บทบาทของเภสัชกร</u>

15. ได้สอนผู้ป่วยเรื่องความรู้เกี่ยวกับโรคหืด/ปอดอุดกั้นเรื้อรัง ☐ ไม่ใช่ ☐ ใช่

16. ได้สอนการพ่นยาแก่ผู้ป่วย ☐ ไม่ใช่ ☐ ใช่

17. ได้ตรวจสอบว่าผู้ป่วยพ่นยาได้ถูกต้อง ☐ ไม่ใช่ ☐ ใช่

18. ให้เภสัชกรประเมินดูว่าผู้ป่วยใช้ยาตามแพทย์สั่งกี่เปอร์เซ็น (0-100%) ☐☐☐ %

19. ได้สอนผู้ป่วยเรื่องโทษของบุหรี่ และการเลิก (กรณีที่สูบบุหรี่) ☐ ไม่ใช่ ☐ ใช่

APPENDIX D
EASY ASTHMA AND COPD GUIDELINE

Easy Asthma guideline

a. Patients who cannot control disease must be use inhaled corticosteroids in low to medium strength (500 – 1000 mcg) and then patients cannot still control disease should be add controllers such as inhaled corticosteroids, inhaled long-acting β_2-agonists, oral antileukotrienes, and oral theophyllines.

b. Patients who can control disease more than 3 months should reduce medicines by removing controllers and inhaled corticosteroids respectively.

c. Patients who can control disease more than 1 year should consider to stop medicines.

Easy COPD guideline

a. Patients who have FEV_1 > 80% should use short acting bronchodilator as needed.

b. Patients who have FEV_1 50 – 80% should use regular bronchodilator treatment.

c. Patients who have FEV_1 30 – 50% should use inhaled long-acting β_2-agonists plus inhaled corticosteroids.

d. Patients who have FEV_1 < 30% should use inhaled long-acting β_2-agonists plus inhaled corticosteroids and oxygen therapy.

APPENDIX E

แบบฟอร์มการประเมินเทคนิคการใช้ยาสูดพ่น MDI ในผู้ป่วย Asthma/COPD รพ.วังทอง จ.พิษณุโลก

ชื่อ-สกุล……HN…… เลขประจำตัวผู้ป่วยโรคเรื้อรัง……..

การประเมิน ครั้งที่.....วันที่.....	**ผลการประเมิน**
1. จำนวนครั้งที่ใช้ยาพ่นขยายหลอดลม/สัปดาห์	
2. เทคนิคการใช้ยาพ่นสูด (ข้อละ 1 คะแนน)	
2.1 เขย่าขวดยาให้ยากระจายตัวดี	
2.2 เปิดฝาครอบออกแล้วต่อท่อช่วยพ่นยา(ถ้ามี)เข้ากับหลอดยาจนแน่น	
2.3 หายใจเข้า-ออก 1 ครั้ง	
2.4 หายใจเข้าทางปากพร้อมกดพ่นยา 1ครั้งกับสูดยาเข้าปอดช้าๆลึกๆ	
2.5 กลั้นหายใจไว้อย่างน้อย 5-10 วินาที*	
2.6 หายใจออกทางจมูกช้าๆ	
2.7 หากต้องการพ่นยาซ้ำ ควรทิ้งช่วงจากครั้งแรก 1 นาที	
2.8 กรณีพ่นยาสูดสเตียรอยด์ให้บ้วนปากด้วยน้ำสะอาดหลังพ่นยาทุกครั้ง	
รวมคะแนน (8 คะแนน)	
Pharmacy’s note	

APPENDIX F

RATIO OF COST TO CHARGE BY SERVICE GROUP OF COMMUNITY HOSPITAL

Items	Ratio of Cost to Charge
Instrument	0.97
Drug	0.91
Medical supply	0.80
Blood bank	0.00
Lab	0.59
X-ray	0.65
Special investigation	0.24
Equipment	0.70
OR	1.92
Doctor fee and nursing services	1.22
Dental	1.52
Rehabilitation	5.21
Acupuncture & alternative medicine	1.78

APPENDIX G

DIRECT NON-MEDICAL COSTS OF COMMUNITY HOSPITAL

Items		Costs (baht)
Traveling cost	mean	72.33
	SE	4.12
Food cost	mean	26.23
	SE	3.17
Lost wages of patients	mean	49.07
	SE	5.84
Lost wages of caregivers	mean	43.52
	SE	5.45

APPENDIX H

EXPENDITURE OF HOSPITAL SERVICES (BAHT) FROM ASTHMA AND NON ASTHMA OF PATIENTS AT EASY ASTHMA/COPD CLINIC AT WANGTONG HOSPITAL

	Pre-intervention (N=105)						Post-intervention (N=105)					
	Asthma	**%**	**Non asthma**	**%**	**Total**	**%**	**Asthma**	**%**	**Non asthma**	**%**	**Total**	**%**
Outpatient services												
Drug : asthma	199,747	69.75	14,800	33.94	214,547	65.02	366,530	69.04	0	0.00	366,530	68.32
non asthma	41,956	14.65	13,847	31.76	55,803	16.91	84,532	15.92	941	16.92	85,473	15.93
Sub total	241,703	84.40	28,647	65.70	270,350	81.93	451,062	84.96	941	16.92	452,003.00	84.25
Medical supplies	160	0.05	240	0.55	400	0.12	0	0.00	0	0.00	0	0.00
Lab and X-ray	15,455	5.40	8,265	18.96	23,720	7.19	30,580	5.76	260	4.68	30,840	5.75
Surgery	1,070	0.37	0	0.00	1,070	0.32	60	0.01	3,860	69.41	3,920	0.73
Other services	28,000	9.78	6,450	14.79	34,450	10.44	49,200	9.27	500	8.99	49,700	9.26
Total	286,388	100.00	43,602	100.00	329,990	100.00	530,902	100.00	5,561	100.00	536,463	100.00
Average ± SD	2,727.51 ± 2,378.52		415.26 ± 818.70		3,142.76 ± 2,448.68		5,056.21 ± 2,936.74		52.96 ± 422.51		5,109.17 ± 2,962.96	
Emergency patient services												
Drug : asthma	36,508	55.58	973	11.17	37,481	50.38	28,173	54.98	10	0.71	28,183	53.54
non asthma	10,193	15.52	3,442	39.49	13,635	18.33	7,233	14.12	170	12.06	7,403	14.06
Sub total	46,701	71.10	4,415	50.66	51,116	68.71	35,406	69.10	180	12.77	35,586	67.60
Medical supplies	140	0.21	20	0.23	160	0.21	70	0.14	50	3.54	120	0.23
Lab and X-ray	1,190	1.81	570	6.54	1,760	2.37	1,220	2.38	40	2.84	1,260	2.39
Surgery	890	1.36	870	9.98	1,760	2.37	440	0.86	540	38.30	980	1.86
Other services	16,760	25.52	2,840	32.59	19,600	26.34	14,100	27.52	600	42.55	14,700	27.92
Total	65,681	100.00	8,715	100.00	74,396	100.00	51,236	100.00	1,410	100.00	52,646	100.00
Average ± SD	625.53 ± 1,701.55		83.00 ± 260.70		708.53 ± 1,716.50		487.96 ± 933.79		13.43 ± 101.32		501.39 ± 951.03	

	Pre-intervention (N=105)						Post-intervention (N=105)					
	Asthma	**%**	**Non asthma**	**%**	**Total**	**%**	**Asthma**	**%**	**Non asthma**	**%**	**Total**	**%**
Inpatient services												
Drug : asthma	46,846	27.40	7,663	11.84	54,509	23.13	15,234	31.58	1,756	25.08	16,990	30.76
non asthma	11,474	6.71	8,888	13.74	20,362	8.64	3,531	7.32	1,437	20.52	4,968	8.99
Sub total	58,320	34.11	16,551	25.58	74,871	31.77	18,765	38.90	3,193	45.60	21,958	39.75
Medical supplies	3,950	2.31	2,140	3.31	6,090	2.59	1,070	2.22	70	1.00	1,140	2.07
Lab and X-ray	15,925	9.32	8,095	12.51	24,020	10.19	4,480	9.29	830	11.85	5,310	9.61
Surgery	0	0.00	90	0.14	90	0.04	0	0.00	810	11.57	810	1.47
Hospitalization	33,900	19.83	15,000	23.19	48,900	20.75	8,100	16.79	900	12.85	9,000	16.29
Other services	58,870	34.43	22,820	35.27	81,690	34.66	15,820	32.80	1,200	17.13	17,020	30.81
Total	170,965	100.00	64,696	100.00	235,661	100.00	48,235	100.00	7,003	100.00	55,238	100.00
Average ± SD	1,628.24 ± 5,068.73		616.15 ± 2,108.81		2,244.39 ± 5,991.71		459.38 ± 1,754.34		66.70 ± 683.42		526.08 ± 2,231.31	
Total												
Drug : asthma	283,101	54.13	23,436	20.03	306,537	47.89	409,937	65.03	1,766	12.64	411,703	63.90
non asthma	63,623	12.16	26,177	22.37	89,800	14.03	95,296	15.12	2,548	18.23	97,844	15.18
Sub total	346,724	66.29	49,613	42.40	396,337	61.92	505,233	80.15	4,314	30.87	509,547	79.08
Medical supplies	4,250	0.81	2,400	2.05	6,650	1.04	1,140	0.18	120	0.86	1,260	0.19
Lab and X-ray	32,570	6.23	16,930	14.47	49,500	7.73	36,280	5.76	1,130	8.09	37,410	5.80
Surgery	1,960	0.38	960	0.82	2,920	0.46	500	0.08	5,210	37.28	5,710	0.89
Hospitalization	33,900	6.48	15,000	12.82	48,900	7.64	8,100	1.28	900	6.44	9,000	1.40
Other services	103,630	19.81	32,110	27.44	135,740	21.21	79,120	12.55	2,300	16.46	81,420	12.64
Total	523,034	100.00	117,013	100.00	640,047	100.00	630,373	100.00	13,974	100.00	644,347	100.00
Average ± SD	4,981.28 ± 6,727.65		1,114.41 ± 2,429.15		6,095.69 ± 7,476.64		6,003.55 ± 3,558.02		133.09 ± 828.13		6,136.64 ± 3,920.73	

APPENDIX I

EXPENDITURE OF HOSPITAL SERVICES (BAHT) FROM ASTHMA AND NON ASTHMA OF PATIENTS WHO DID NOT ENTER THE EASY ASTHMA/COPD CLINIC AT WANGTONG HOSPITAL

	Before implementation (N=40)						After implementation (N=40)					
	Asthma	**%**	**Non asthma**	**%**	**Total**	**%**	**Asthma**	**%**	**Non asthma**	**%**	**Total**	**%**
Outpatient services												
Drug : asthma	51,323	69.85	13,872	31.68	65,195	55.60	54,171	69.38	11,488	41.95	65,659	62.26
non asthma	9,438	12.85	15,203	34.72	24,641	21.01	11,888	15.23	8,625	31.50	20,513	19.45
Sub total	60,761	82.70	29,075	66.40	89,836	76.61	66,059	84.61	20,113	73.45	86,172	81.71
Medical supplies	70	0.09	60	0.14	130	0.11	0	0.00	0	0.00	0	0.00
Lab and X-ray	3,575	4.87	7,720	17.63	11,295	9.63	4,340	5.56	2,060	7.52	6,400	6.07
Surgery	140	0.19	1,680	3.84	1,820	1.55	30	0.04	2,710	9.90	2,740	2.60
Other services	8,930	12.15	5,250	11.99	14,180	12.10	7,650	9.79	2,500	9.13	10,150	9.62
Total	73,476	100.00	43,785	100.00	117,261	100.00	78,079	100.00	27,383	100.00	105,462	100.00
Average ± SD	1,836.90 ± 1,779.65		1,094.63 ± 1,793.65		2,931.53 ± 2,055.50		1,951.98 ± 1,829.45		684.58 ± 1,373.62		2,636.55 ± 2,135.90	
Emergency patient services												
Drug : asthma	6,459	49.71	1,254	25.91	7,713	43.26	4,820	46.69	933	49.18	5,753	47.07
non asthma	1,374	10.58	795	16.43	2,169	12.16	1,084	10.50	524	27.63	1,608	13.16
Sub total	7,833	60.29	2,049	42.34	9,882	55.42	5,904	57.19	1,457	76.81	7,361	60.23
Medical supplies	600	4.62	0	0.00	600	3.37	0	0.00	0	0.00	0	0.00
Lab and X-ray	400	3.08	1,000	20.67	1,400	7.85	90	0.87	0	0.00	90	0.74
Surgery	420	3.23	30	0.62	450	2.52	120	1.16	140	7.38	260	2.13
Other services	3,740	28.78	1,760	36.37	5,500	30.84	4,210	40.78	300	15.81	4,510	36.90
Total	12,993	100.00	4,839	100.00	17,832	100.00	10,324	100.00	1,897	100.00	12,221	100.00
Average ± SD	324.83 ± 514.23		120.95 ± 305.49		445.80 ± 600.36		258.10 ± 612.85		47.43 ± 170.57		305.53 ± 737.00	

	Before implementation (N=40)						After implementation (N=40)					
	Asthma	**%**	**Non asthma**	**%**	**Total**	**%**	**Asthma**	**%**	**Non asthma**	**%**	**Total**	**%**
Inpatient services												
Drug : asthma	6,250	39.71	2,874	11.60	9,124	22.52	5,398	18.08	4,059	21.99	9,457	19.57
non asthma	858	5.45	2,750	11.10	3,608	8.91	1,411	4.73	938	5.08	2,349	4.86
Sub total	7,108	45.16	5,624	22.70	12,732	31.43	6,809	22.81	4,997	27.07	11,806	24.43
Medical supplies	350	2.22	570	2.30	920	2.27	870	2.91	420	2.28	1,290	2.67
Lab and X-ray	1,780	11.31	4,175	16.86	5,955	14.70	3,130	10.48	2,755	14.91	5,885	12.18
Surgery	0	0.00	0	0.00	0	0.00	90	0.30	90	0.49	180	0.37
Hospitalization	3,000	19.07	5,100	20.59	8,100	20.00	5,700	19.09	3,000	16.25	8,700	18.00
Other services	3,500	22.24	9,300	37.55	12,800	31.60	13,260	44.41	7,200	39.00	20,460	42.35
Total	15,738	100.00	24,769	100.00	40,507	100.00	29,859	100.00	18,462	100.00	48,321	100.00
Average ± SD	393.45 ± 1,209.35		619.23 ± 1,704.04		1,012.68 ± 2,534.21		746.48 ± 1,894.34		461.55 ± 2,274.37		1,208.03 ± 3,690.24	
Total												
Drug : asthma	64,032	62.65	18,000	24.53	82,032	46.72	64,389	54.45	16,480	34.52	80,869	48.72
non asthma	11,670	11.42	18,748	25.54	30,418	17.32	14,383	12.16	10,087	21.13	24,470	14.74
Sub total	75,702	74.07	36,748	50.07	112,450	64.04	78,772	66.61	26,567	55.65	105,339	63.46
Medical supplies	1,020	1.00	630	0.86	1,650	0.94	870	0.74	420	0.88	1,290	0.78
Lab and X-ray	5,755	5.63	12,895	17.57	18,650	10.62	7,560	6.39	4,815	10.08	12,375	7.45
Surgery	560	0.55	1,710	2.33	2,270	1.29	240	0.20	2,940	6.16	3,180	1.92
Hospitalization	3,000	2.94	5,100	6.95	8,100	4.61	5,700	4.82	3,000	6.28	8,700	5.24
Other services	16,170	15.81	16,310	22.22	32,480	18.50	25,120	21.24	10,000	20.95	35,120	21.15
Total	102,207	100.00	73,393	100.00	175,600	100.00	118,262	100.00	47,742	100.00	166,004	100.00
Average ± SD	2,555.18 ± 2,126.06		1,834.83 ± 2,652.25		4,390.00 ± 3,104.97		2,956.55 ± 3,239.97		1,193.55 ± 2,581.74		4,150.10 ± 4,706.98	

APPENDIX J

EXPENDITURE OF HOSPITAL SERVICES (BAHT) FROM COPD AND NON COPD OF PATIENTS AT EASY ASTHMA/COPD CLINIC AT WANGTONG HOSPITAL

	Pre-intervention (N=171)						Post-intervention (N=171)					
	COPD	**%**	**Non COPD**	**%**	**Total**	**%**	**COPD**	**%**	**Non COPD**	**%**	**Total**	**%**
Outpatient services												
Drug : COPD	666,086	67.19	63,003	42.54	729,089	63.99	976,231	74.43	13,155	49.46	989,386	73.93
non COPD	192,987	19.47	40,852	27.59	233,839	20.52	165,410	12.61	5,605	21.07	171,015	12.78
Sub total	859,073	86.66	103,855	70.13	962,928	84.51	1,141,641	87.04	18,760	70.53	1,160,401	86.71
Medical supplies	968	0.10	200	0.13	1,168	0.10	440	0.03	0	0.00	440	0.03
Lab and X-ray	67,740	6.83	22,080	14.91	89,820	7.88	82,930	6.32	5,490	20.64	88,420	6.61
Surgery	4,820	0.49	8,200	5.54	13,020	1.14	720	0.05	300	1.13	1,020	0.08
Other services	58,710	5.92	13,750	9.29	72,460	6.36	85,850	6.56	2,050	7.71	87,900	6.57
Total	991,311	100.00	148,085	100.00	1,139,396	100.00	1,311,581	100.00	26,600	100.00	1,338,181	100.00
Average ± SD	5,797.14 ± 4,000.86		865.99 ± 2,072.40		6,663.13 ± 4,062.86		7,670.06 ± 4,752.82		155.56 ± 622.52		7,825.62 ± 4,711.59	
Emergency patient services												
Drug : COPD	186,823	60.01	14,028	25.87	200,851	54.95	221,282	68.83	3,671	45.49	224,953	68.26
non COPD	24,066	7.73	6,290	11.60	30,356	8.30	35,576	11.07	539	6.68	36,115	10.96
Sub total	210,889	67.74	20,318	37.47	231,207	63.25	256,858	79.90	4,210	52.17	261,068	79.22
Medical supplies	1,395	0.45	1,898	3.50	3,293	0.90	2,075	0.64	790	9.79	2,865	0.87
Lab and X-ray	52,585	16.89	6,260	11.55	58,845	16.10	8,910	2.77	340	4.21	9,250	2.81
Surgery	2,980	0.96	13,220	24.38	16,200	4.43	4,120	1.28	670	8.30	4,790	1.45
Other services	43,480	13.96	12,520	23.10	56,000	15.32	49,530	15.41	2,060	25.53	51,590	15.65
Total	311,329	100.00	54,216	100.00	365,545	100.00	321,493	100.00	8,070	100.00	329,563	100.00
Average ± SD	1,820.64 ± 5,065.49		317.05 ± 1,025.93		2,137.69 ± 5,343.41		1,880.08 ± 4,083.94		47.19 ± 283.26		1,927.27 ± 4,085.36	

	Pre-intervention (N=171)						Post-intervention (N=171)					
	COPD	**%**	**Non COPD**	**%**	**Total**	**%**	**COPD**	**%**	**Non COPD**	**%**	**Total**	**%**
Inpatient services												
Drug : COPD	215,991	38.16	76,752	22.05	292,743	32.02	144,508	33.42	27,282	26.31	171,790	32.04
non COPD	42,602	7.52	47,320	13.60	89,922	9.84	19,591	4.53	6,682	6.45	26,273	4.90
Sub total	258,593	45.68	124,072	35.65	382,665	41.86	164,099	37.95	33,964	32.76	198,063	36.94
Medical supplies	15,480	2.73	10,063	2.89	25,543	2.79	7,360	1.70	3,040	2.93	10,400	1.94
Lab and X-ray	37,075	6.55	41,160	11.83	78,235	8.56	24,805	5.74	6,560	6.33	31,365	5.85
Surgery	770	0.14	6,430	1.85	7,200	0.80	730	0.17	1,480	1.43	2,210	0.41
Hospitalization	96,000	16.96	67,200	19.31	163,200	17.85	70,200	16.23	19,200	18.52	89,400	16.68
Other services	158,150	27.94	99,110	28.48	257,260	28.14	165,250	38.21	39,430	38.03	204,680	38.18
Total	566,068	100.00	348,035	100.00	914,103	100.00	432,444	100.00	103,674	100.00	536,118	100.00
Average ± SD	3,310.34 ± 8,075.78		2,035.29 ± 4,801.45		5,345.63 ± 10,815.17		2,528.91 ± 6,940.40		606.28 ± 3,160.40		3,135.19 ± 7,936.91	
Total												
Drug : COPD	1,068,900	57.20	153,783	27.94	1,222,683	50.54	1,342,021	64.97	44,108	31.88	1,386,129	62.89
non COPD	259,655	13.89	94,462	17.17	354,117	14.64	220,577	10.68	12,826	9.27	233,403	10.60
Sub total	1,328,555	71.09	248,245	45.11	1,576,800	65.18	1,562,598	75.65	56,934	41.15	1,619,532	73.49
Medical supplies	17,843	0.96	12,161	2.21	30,004	1.24	9,875	0.48	3,830	2.77	13,705	0.62
Lab and X-ray	157,400	8.42	69,500	12.63	226,900	9.38	116,645	5.65	12,390	8.96	129,035	5.85
Surgery	8,570	0.46	27,850	5.06	36,420	1.51	5,570	0.27	2,450	1.77	8,020	0.36
Hospitalization	96,000	5.14	67,200	12.21	163,200	6.75	70,200	3.40	19,200	13.88	89,400	4.06
Other services	260,340	13.93	125,380	22.78	385,720	15.94	300,630	14.55	43,540	31.47	344,170	15.62
Total	1,868,708	100.00	550,336	100.00	2,419,044	100.00	2,065,518	100.00	138,344	100.00	2,203,862	100.00
Average ± SD	10,928.12 ± 10,954.67		3,218.34 ± 5,532.10		14,146.46 ± 13,009.77		12,079.05 ± 10,408.82		809.03 ± 3,237.81		12,888.08 ± 11,363.35	

APPENDIX K

EXPENDITURE OF HOSPITAL SERVICES (BAHT) FROM COPD AND NON COPD VISITS OF PATIENTS WHO DID NOT ENTER THE EASY ASTHMA/COPD CLINIC AT WANGTONG HOSPITAL

	Before implementation (N=46)						After implementation (N=46)					
	COPD	**%**	**Non COPD**	**%**	**Total**	**%**	**COPD**	**%**	**Non COPD**	**%**	**Total**	**%**
Outpatient services												
Drug : COPD	91,360	70.49	41,216	37.48	132,576	55.34	56,252	69.34	16,773	37.01	73,025	57.75
non COPD	17,963	13.86	38,980	35.45	56,943	23.77	10,550	13.00	15,914	35.12	26,464	20.93
Sub total	109,323	84.35	80,196	72.93	189,519	79.11	66,802	82.34	32,687	72.13	99,489	78.68
Medical supplies	0	0.00	100	0.09	100	0.04	0	0.00	228	0.50	228	0.18
Lab and X-ray	11,600	8.95	19,910	18.11	31,510	13.15	8,375	10.32	7,190	15.87	15,565	12.31
Surgery	80	0.06	1,200	1.09	1,280	0.54	0	0.00	1,360	3.00	1,360	1.08
Other services	8,600	6.64	8,550	7.78	17,150	7.16	5,950	7.34	3,850	8.50	9,800	7.75
Total	129,603	100.00	109,956	100.00	239,559	100.00	81,127	100.00	45,315	100.00	126,442	100.00
Average ± SD	2,817.46 ± 3,473.11		2,390.35 ± 3,466.80		5,207.80 ± 3,642.53		1,763.63 ± 2,591.06		985.11 ± 1,377.60		2,748.74 ± 2,848.49	
Emergency patient services												
Drug : COPD	10,522	54.62	975	10.93	11,497	40.79	19,275	67.74	7,005	45.87	26,280	60.10
non COPD	1,843	9.56	2,167	24.29	4,010	14.23	2,609	9.17	1,493	9.77	4,102	9.38
Sub total	12,365	64.18	3,142	35.22	15,507	55.02	21,884	76.91	8,498	55.64	30,382	69.48
Medical supplies	370	1.92	330	3.70	700	2.48	830	2.92	715	4.68	1,545	3.53
Lab and X-ray	790	4.10	2,740	30.71	3,530	12.52	1,040	3.65	1,280	8.38	2,320	5.31
Surgery	620	3.22	590	6.61	1,210	4.29	850	2.99	980	6.42	1,830	4.18
Other services	5,120	26.58	2,120	23.76	7,240	25.69	3,850	13.53	3,800	24.88	7,650	17.50
Total	19,265	100.00	8,922	100.00	28,187	100.00	28,454	100.00	15,273	100.00	43,727	100.00
Average ± SD	418.80 ± 925.23		193.96 ± 482.02		612.76 ± 984.37		618.56 ± 1,261.55		332.02 ± 861.48		950.59 ± 1,830.09	

	Before implementation (N=46)						After implementation (N=46)					
	COPD	**%**	**Non COPD**	**%**	**Total**	**%**	**COPD**	**%**	**Non COPD**	**%**	**Total**	**%**
Inpatient services												
Drug : COPD	22,226	30.97	6,675	6.02	28,901	15.82	31,707	26.92	14,071	16.48	45,778	22.54
non COPD	9,432	13.14	33,837	30.51	43,269	23.69	10,153	8.62	6,583	7.72	16,736	8.24
Sub total	31,658	44.12	40,512	36.53	72,170	39.51	41,860	35.54	20,654	24.20	62,514	30.78
Medical supplies	3,300	4.60	2,550	2.30	5,850	3.20	1,265	1.07	1,710	2.00	2,975	1.46
Lab and X-ray	7,855	10.94	11,030	9.94	18,885	10.34	12,995	11.03	8,640	10.13	21,635	10.65
Surgery	0	0.00	490	0.44	490	0.27	0	0.00	310	0.36	310	0.15
Hospitalization	11,400	15.88	21,900	19.75	33,300	18.23	30,000	25.48	16,800	19.68	46,800	23.04
Other services	17,550	24.46	34,430	31.04	51,980	28.45	31,650	26.88	37,240	43.63	68,890	33.92
Total	71,763	100.00	110,912	100.00	182,675	100.00	117,770	100.00	85,354	100.00	203,124	100.00
Average ± SD	1,560.07 ± 3,874.81		2,411.13 ± 8,475.31		3,971.20 ± 8,954.36		2,560.22 ± 7,002.10		1,855.52 ± 6,460.10		4,415.74 ± 11,651.08	
Total												
Drug : COPD	124,108	56.25	48,866	21.26	172,974	38.40	107,234	47.17	37,849	25.93	145,083	38.87
non COPD	29,238	13.25	74,984	32.64	104,222	23.14	23,312	10.25	23,990	16.44	47,302	12.67
Sub total	153,346	69.50	123,850	53.90	277,196	61.54	130,546	57.42	61,839	42.37	192,385	51.54
Medical supplies	3,670	1.67	2,980	1.30	6,650	1.48	2,095	0.92	2,653	1.82	4,748	1.27
Lab and X-ray	20,245	9.17	33,680	14.66	53,925	11.97	22,410	9.86	17,110	11.72	39,520	10.59
Surgery	700	0.32	2,280	0.99	2,980	0.66	850	0.37	2,650	1.82	3,500	0.94
Hospitalization	11,400	5.17	21,900	9.53	33,300	7.39	30,000	13.20	16,800	11.51	46,800	12.54
Other services	31,270	14.17	45,100	19.62	76,370	16.96	41,450	18.23	44,890	30.76	86,340	23.12
Total	220,631	100.00	229,790	100.00	450,421	100.00	227,351	100.00	145,942	100.00	373,293	100.00
Average ± SD	4,796.33 ± 6,362.79		4,995.43 ± 8,927.36		9,791.76 ± 9,959.25		4,942.41 ± 8,453.64		3,172.65 ± 6,872.37		8,115.06 ± 12,602.00	

APPENDIX L
CAPITAL COSTS, LABOR COSTS, AND MATERIAL COSTS BEFORE AND AFTER IMPLEMENTATION OF THE EASY ASTHMA/COPD CLINIC

Capital costs before implementation of the clinic

Item	Year of purchasing	Useful life (year)	Cost of purchasing (baht)	Cost in 2011 (baht)	Equivalent annual depreciation cost (baht)
1. Operating area (55.41 m^2)	1991	25	301,686.47	595,405.87	34,192.89
2. Air conditioner (1 pieces)	2009	8	34,000.00	36,472.73	5,195.77
3. Office desks (2 sets)	2009	8	5,000.00	5,363.64	860.90
5. Computer set (2 sets)	2009	3	18,374.00	19,710.29	6,968.19
Total capital costs (baht)	**47,217.75**				

Capital costs after implementation of the clinic

Item	Year of purchasing	Useful life (year)	Cost of purchasing (baht)	Cost in 2011 (baht)	Equivalent annual depreciation cost (baht)
1. Operating area (84.05 m^2)	1997	25	580,000.00	856,627.14	49,194.27
2. Air conditioner (1 pieces)	2009	8	34,000.00	36,472.73	5,195.77
3. Office desks (3 sets)	2011	8	20,370.00	20,370.00	2,901.84
4. Cabinet (1 pieces)	2011	8	6,500.00	6,500.00	925.97
5. Computer set (2 sets)	2011	3	30,980.00	30,980.00	10,952.37
6. Laser printer (1 sets)	2011	3	7,790.00	7,790.00	2,754.00
7. Peak flow meter (1 sets)	2011	7	5,498.70	5,498.70	882.58
8. Education	5,000 baht/person x 3 person = 15,000 baht				
Total capital costs (baht)	**87,806.80**				

Labor costs after implementation of the clinic

Item	Time used (hours)	Labor costs (baht)
Labor cost of recording data to NHSO [one nurse (OT = 75 baht/hr)]	192	14,400

Material costs after implementation of the clinic

Items	Costs
1. Office materials	9,600.00
Total material costs (baht)	**9,600.00**

APPENDIX M

OUTPATIENT, EMERGENCY AND INPATIENT COSTS BEFORE AND AFTER IMPLEMENTATION OF THE EASY ASTHMA/COPD CLINIC

Outpatient costs

Items	Before implementation		After implementation	
	Charges (baht)	Costs (baht)	Charges (baht)	Costs (baht)
Drug	1,519,611.08	1,382,846.08	2,118,294.99	1,927,648.44
Medical supplies	1,557.19	1,245.75	440.00	352.00
Lab	100,168.41	59,099.36	119,899.50	70,740.70
X-ray	56,807.19	36,924.68	38,716.30	25,165.59
Surgery	8,131.09	15,611.69	1,037.40	1,991.81
Other service	117,002.30	142,742.81	179,616.50	219,132.13
Total costs (baht)	**1,638,470.37**		**2,245,030.67**	

Emergency costs

Items	Before implementation		After implementation	
	Charges (baht)	Costs (baht)	Charges (baht)	Costs (baht)
Drug	355,600.61	323,596.55	388,711.12	353,727.12
Medical supplies	2,119.05	1,695.24	2,852.85	2,282.28
Lab	73,780.33	43,530.39	9,975.00	5,885.25
X-ray	9,884.31	6,424.80	4,003.30	2,602.14
Surgery	5,342.50	10,257.60	6,064.80	11,644.42
Other service	452,923.83	552,567.07	84,627.90	103,246.04
Total costs (baht)	**938,071.65**		**479,387.25**	

Inpatient costs

Items	Before implementation		After implementation	
	Charges (baht)	Costs (baht)	Charges (baht)	Costs (baht)
Drug	437,495.46	398,120.87	243,209.12	221,320.30
Medical supplies	26,822.93	21,458.34	11,211.90	8,969.52
Lab	111,398.70	65,725.23	36,023.05	21,253.60
X-ray	29,763.38	19,346.20	12,754.70	8,290.55
Surgery	14,536.57	27,910.21	8,073.10	15,500.35
Hospitalization	-	377,986.00	-	216,364.40
Other service	502,457.21	612,997.80	505,067.50	616,182.35
Total costs (baht)	**1,523,544.67**		**1,107,881.07**	

BIOGRAPHY

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