

## Economic and Clinical Outcomes of Easy Asthma and Chronic Obstructive Pulmonary Disease Clinic at Wangtong Hospital, Phitsanulok

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### Abstract

Wangtong Hospital has implemented an Easy Asthma/COPD Clinic since October 2010 to provide standard treatment system for the patients. The objective of this study was to determine economic and clinical outcomes before and after implementation of Easy Asthma/COPD Clinic at the hospital. The study with a comparative design was carried out using patient database from January 1, 2010 to December 31, 2011. Patients with the diagnosis of asthma and COPD and had treatment continuously for 9 months both before and after implementation of the clinic were included. Data of economic and clinical outcomes were obtained from the hospitals' electronic database and National Health Security Office website, respectively. Data were analyzed using descriptive statistics, Wilcoxon signed-rank, paired-samples t-tests, and Chi-square. A total of 145 asthma and 217 COPD patients were assessed. All clinical outcomes were improved significantly ( $P < 0.05$ ). After intervention, results showed that average outpatient visit and expenditure increased 18.90-25.76% and 32.31-85.38%, respectively for asthma and COPD. By contrast, use and expenditure associated with emergency and inpatient service decreased 3.26-29.54% and 23.60-71.79%, respectively. Use of inhaled corticosteroid (ICS) increased 5.76-55.33%. For economic outcomes, the program was cost beneficial from societal perspective (incremental benefit to cost ratio of 1.63:1). The outcomes of this study indicate that the interventions of Easy Asthma/COPD Clinic can improve all outcomes and should be implemented at all community hospitals nationwide.

**KEYWORDS:** Easy Asthma/COPD Clinic, Economic outcomes, Clinical outcomes

### INTRODUCTION

Asthma and chronic obstructive pulmonary disease (COPD) are respiratory diseases of considerable importance because of high morbidity and mortality rates and high consumption of healthcare resource.<sup>1-3</sup> Acute exacerbations requiring hospital admissions are a major problem because of their negative impact on patient's quality of life, and treatment costs for the health care system.<sup>4</sup> In Thailand, there has been a rise in the prevalence of asthma over the last decade with 10-15%

of children<sup>5</sup> and 3-7% of adults<sup>6</sup> affected by the disease. The COPD prevalence in Thailand was 7,035 cases per 100,000 populations in 2010.<sup>7</sup>

Many countries have created programs or interventions for asthma and COPD control.<sup>8</sup> In Thailand, the National Health Security Office has set up an 'Easy Asthma/COPD Clinic' in hospitals as an effective way to care for the patients by implementing asthma and COPD treatment guidelines and support budget for inhaled corticosteroid.<sup>9</sup> The clinic is easy enough to

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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 standard 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.<sup>10,11</sup>

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 admissions in the hospital.<sup>12</sup> In addition, it was found that most of asthma and COPD patients did not get continuous and standard treatment.<sup>12</sup> Due to these problems, Wangtong Hospital has implemented an Easy Asthma/COPD Clinic since October 2010 to provide standard treatment system for asthma and COPD patients. The objective of this study is to determine economic and clinical outcomes before and after implementation of Easy Asthma/COPD Clinic at Wangtong Hospital.

## **MATERIALS AND METHODS**

### ***Study design***

This is a comparative and prospective research.

### ***Study location***

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

### ***Study period***

Study period was divided into two phases; before (January 1 to September 30, 2010), and after implementation (October 1, 2010 to December 31, 2011) of the clinic.

### ***Data source***

There were two data sources, hospital 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). The data records in Easy Asthma/COPD Clinic of NHSO website were clinical outcomes.

### ***Study population***

From electronic database, all patients who had a diagnosis of asthma or COPD as the International Statistics Classification Diagnostics and Health Problem tenth revision (ICD-10) code (J45, J45.0, J45.1, J45.8, J45.9, J46, J44, J44.0, J44.1, J44.8, J44.9) at Wangtong Hospital during January 1, 2010 to December 31, 2011 were the population.

#### *Inclusion criteria*

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

#### *Exclusion criteria*

- Patients with incomplete medical record.

### ***Study procedure***

The study was divided into two periods: 1) Pre-intervention, and 2) Post-intervention period. The intervention program started on October 1, 2010. Because of patients entered the clinic at difference times, each patient should have data covered a period of 9 months both before and after entering the clinic. For patients who did not enter the clinic, study period covered a period of 9 months before and after implementing clinic.

### *Pre-intervention period*

Before implementing an Easy Asthma/COPD Clinic, 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 write a prescription through the hospital's database.

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

Step 4, appointment by nurse.

### *Post-intervention period*

After implementing an Easy Asthma/COPD Clinic since October 2010, asthma and COPD patients were asked for their willingness to participate in this clinic. Patients who entered the clinic received interventions as the followings.

Step 1, nurse registered and recorded patient history into hospital's database during the first visit. Then, patients were assessed for disease control based on assessment guideline of asthma/COPD control and performed pulmonary function test by peak flow meter.

Step 2, while waiting for physician, there was a 15-minute comprehensive self-management education, rehabilitation and exercise program, provided by nurse and physiotherapist.

Step 3, physician treated patients based on Easy Asthma/COPD guideline, educated patients about their disease and write a prescription drug onto the hospital's database.

Step 4, pharmacist dispensed drug, counselled patients about medication, and checking inhalation technique.

Step 5, appointment by nurse.

### **Data collection**

Data were collected in 4 parts: demographics, resource utilization, economic outcomes, and clinical outcomes.

### *Demographics*

Demographics are age, gender, marital status, co-morbidity, and health insurance coverage (Universal Coverage, Social Security, and Civil Servant Medical Benefit Scheme).

### *Resource utilization*

Data of service use and expenditure were collected separately for outpatient, emergency, and inpatient services.

### *Economic outcomes*

Cost-benefit analysis was performed based on societal perspective. Costs were collected for both before and after implementation of the Easy Asthma/COPD Clinic. The relevant costs were divided into three categories, administrative costs, direct medical costs, and direct non-medical costs, the last two categories were determined from cost-to-charge ratio of services in community hospital. Benefits of Easy Asthma/COPD Clinic were determined as cost saving from emergency department visit and/or hospitalization avoided.

### *Clinical outcomes*

Clinical outcomes were collected at the start of the intervention period (baseline) and the last follow-ups.

Peak Expiratory Flow Rate were divided into 4 groups as  $PEFR < 30\%$ ,  $30\% \leq PEFR < 50\%$ ,  $50\% \leq PEFR < 80\%$ , and  $PEFR \geq 80\%$ .

Levels of asthma control were uncontrolled, partly controlled, and controlled. Levels of COPD control were poor, total control, and well.

Daytime and nighttime symptom were classified as none, less than once a week, more than once a week, and every day.

Reliever drug use were categorized as no use, less than once a week, almost every day, and every day.

% proper inhalation technique were collected 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 with descriptive statistic for demographics, Wilcoxon signed rank test for comparison of resource utilization, paired samples t-tests and Chi-square tests for comparison of clinical outcomes. A p-value <0.5 was considered statistically significant. In addition, benefit to cost ratio was calculated to determine net benefits of this clinic.

## Results

### Demographics

A total of 362 patients were assessed, 145 for asthma (105 entered and 40 did not enter the clinic) and 217 for COPD (171 entered and 46 did not enter the clinic). Demographics of asthma and COPD patients are presented in Table 1. The average age of asthma and COPD patients were 46 and 67 respectively. More than half of asthma patients were female, while COPD patients were male. Approximately 50% of asthma and COPD patients had comorbidities. Most of those were under UC program.

**Table 1.** Demographics of patients who entered the Asthma/COPD Clinic at Wangtong Hospital, Phitsanulok

	Asthma (N = 145)		COPD patients(N = 217)	
	Entered (N = 105)	Did not enter (N = 40)	Entered (N = 171)	Did not enter (N = 46)
<b>Age, years, mean (SD)</b>	46.47 (17.71)	46.03 (18.52)	66.80 (11.97)	67.28 (10.83)
<b>Gender, No. (%)</b>				
Male	28 (26.67)	10 (25.00)	143 (83.63)	31 (67.39)
Female	77 (73.33)	30 (75.00)	28 (16.37)	15 (32.61)
<b>Comorbidities, No. (%)</b>				
No	62 (59.05)	24 (60.00)	87 (50.88)	20 (43.48)
Yes	43 (40.95)	16 (40.00)	84 (49.12)	26 (56.52)
<b>Health insurance, No. (%)</b>				
Universal Coverage (UC)	99 (94.29)	37 (92.50)	152 (88.89)	40 (86.96)
Social Security Scheme (SSS)	1 (0.95)	2 (5.00)	5 (2.92)	1 (2.17)
Civil Servant Medical Benefits Scheme (CSMBS)	5 (4.76)	1 (2.50)	14 (8.19)	5 (10.87)

### Resource utilization

Table 2 summarizes the average resource utilization incurred per asthma/COPD patients who entered and did not enter the clinic. Overall, patients who entered the clinic showed higher utilization than patients who did not enter the clinic. Asthma patients who entered the clinic had significantly higher utilization and expenditures of outpatient and inhaled corticosteroid after implementation (p=0.000, p=0.000 respectively), whereas average admissions, expenditure, and number of bed days were also decreased significantly

after implementation (p=0.005, p=0.003, p=0.003 respectively).

COPD patients who entered the clinic had significantly higher utilization and expenditure of outpatient after implementation (p=0.000). Average admissions and number of bed days were decreased significantly after implementation (p=0.012, p=0.021 respectively) but not the expenditure.

### Clinical outcomes

All clinical outcomes were improved significantly (Table 3).

**Table 2.** Average resource utilization before and after implementation of the Easy Asthma/ COPD Clinic

	Patients entered the clinic			Patients did not enter the clinic		
	Before (mean)	After (mean)	P-value†	Before (mean)	After (mean)	P-value†
<b>Asthma</b>						
<b>Utilization of service</b>						
Outpatient visits	2.95	3.71	0.000*	2.53	1.95	0.048*
Emergency visits	0.88	0.62	0.082	0.55	0.53	0.314
Hospitalizations	0.37	0.13	0.005*	0.15	0.18	0.369
No. of bed days (days)	1.38	0.37	0.003*	0.40	0.60	0.201
ICS use (packs)	3.56	5.53	0.000*	2.30	2.80	0.113
<b>Medical expenditure (THB)</b>						
Outpatient	2,727.51	5,056.21	0.000*	1,836.90	1,951.98	0.422
Emergency services	625.53	487.96	0.449	324.83	258.10	0.115
Hospitalizations	1,628.24	459.38	0.003*	393.45	746.48	0.172
Total	4,981.28	6,003.55	0.000*	2,555.18	2,956.55	0.347
ICS	1,380.80	2,123.12	0.000*	874.00	1,099.80	0.092
<b>COPD</b>						
<b>Utilization of service</b>						
Outpatient visits	3.65	4.34	0.000*	1.98	1.22	0.022*
Emergency visits	1.50	1.41	0.461	0.43	0.48	0.458
Hospitalizations	0.69	0.43	0.012*	0.39	0.41	0.374
No. of bed days (days)	2.54	1.71	0.021*	1.26	2.35	0.174
ICS use (packs)	4.51	4.77	0.206	2.35	1.50	0.020*
<b>Medical expenditure (THB)</b>						
Outpatient	5,797.14	7,670.06	0.000*	2,817.46	1,763.63	0.038*
Emergency services	1,820.64	1,880.08	0.232	418.80	618.56	0.327
Hospitalizations	3,310.34	2,528.91	0.054	1,560.07	2,560.22	0.345
Total	10,928.12	12,079.05	0.009*	4,796.33	4,942.41	0.356
ICS	1,784.51	2,045.59	0.123	954.43	616.70	0.016*

†Tested by Wilcoxon signed-rank test. (\* Statistic significant different at p-value<0.05)  
ICS = inhaled corticosteroid

*Lung function*

No significant changes were found for asthma and COPD patients in each group of lung function. However, overall % Peak Expiratory Flow Rate (PEFR) of asthma and COPD patients increased significantly after intervention (p=0.000, p=0.002 respectively).

*Disease control*

Asthma patients were increased in controlled and partly controlled stage, 12.38% and 15.24%, respectively, while

decreased in uncontrolled stage; 27.62% after intervention. Similarly, COPD patients were increased in well and total control stage 2.93% and 14.04%, respectively, while decreased in poor stage, 16.97% after intervention.

*Daytime and nighttime symptom*

Patients have better symptom control, with lower frequency of daytime and nighttime attacks after intervention in asthma and COPD patients.

**Table 3.** Clinical outcomes of Easy Asthma/COPD Clinic

	Asthma (N=105)			COPD (N=171)		
	Before	After	P-value	Before	After	P-value
<b>1. Lung function (PEFR<sup>†</sup>)</b>						
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)	
% PEF, mean (SD)	62.93 (20.80)	70.05 (21.51)	0.000*	49.46 (18.61)	52.65 (21.55)	0.002*
<b>2. Disease control, No. (%)</b>						
<b>Asthma</b>						
Uncontrolled	67(63.81)	38 (36.19)	0.000*			
Partly controlled	38 (36.19)	54 (51.43)				
Controlled	0 (0.00)	13 (12.38)				
<b>COPD</b>						
Poor				145 (84.80)	116 (67.83)	0.000*
Total control				23 (13.45)	47 (27.49)	
Well				3 (1.75)	8 (4.68)	
<b>3. Daytime symptoms, No. (%)</b>						
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)	
<b>4. Nighttime symptoms, No. (%)</b>						
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)	18 (18.09)		36 (21.05)	31 (18.13)	
4) Everyday	23 (21.91)	16 (15.24)		21 (12.28)	16 (9.35)	
<b>5. Reliever drug use, No. (%)</b>						
1) Not use	15 (14.29)	43 (40.95)	0.000**	26 (15.20)	47 (24.79)	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)	
<b>6. % inhalation technique</b>						
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)	
% inhalation technique, mean (SD)	55.99 (29.65)	84.77 (23.89)	0.000*	51.42 (27.23)	78.29 (27.82)	0.000*

† PEF = Peak Expiratory Flow Rate

\*Tested by Paired sample t-test (Statistic significant different at p-value<0.05)

\*\* Tested by Pearson Chi-Square test (Statistic significant different at p-value<0.05)

**Table 4.** Economic outcomes of Easy Asthma/COPD Clinic

	Before	After	Difference
<b><u>Costs (THB)</u></b>			
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: OPD service	1,638,470.37	2,245,030.67	606,560.30
3. Direct non-medical cost	412,451.20	499,570.62	87,119.42
<b>Total cost</b>			<b>758,268.77</b>
<b><u>Benefits</u></b>			
1. Number of ER visits/hospitalization avoided	943	528	415 visits
2. Cost of Emergency visits and hospitalization (THB)			
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	410,231.53	221,494.10	188,737.43
2.3 Indirect cost	315,989.57	144,046.18	171,943.39
<b>Cost saving from Emergency visits/hospitalization avoided</b>			<b>1,235,028.82</b>
<b>Benefit to Cost Ratio</b>	<b>1,235,028.82/758,268.77 = 1.63</b>		

*Reliever drug use*

Use of reliever drug in asthma and COPD patients decreased significantly after intervention ( $p = 0.000$ ,  $p = 0.005$  respectively).

*% Proper inhalation technique*

The number of asthma/COPD patients who used the inhaler correctly (100%) increased significantly after intervention. Moreover, average % inhalation technique increased significantly after intervention in both patients ( $p = 0.000$ ).

**Cost benefit of Easy Asthma/COPD Clinic**

Table 4 displays costs, outcomes, and benefit to cost ratio of Easy Asthma/COPD Clinic. Total incremental costs of Easy Asthma/COPD Clinic was 758,268.77 Thai baht in 2011, which is determined from summation of administrative costs of program, direct medical costs, direct non-medical costs, and indirect costs of patients.

The benefits of this clinic were 1,235,028.82 Thai baht which is determined as cost saved from emergency and hospitalization avoided. Therefore, the incremental benefit to cost ratio was 1.63:1, which indicated that the Easy Asthma/COPD Clinic program is cost beneficial from societal perspective.

**RESULTS AND DISCUSSION**

The study has shown that an Easy Asthma/COPD Clinic could improve in economic and clinical outcomes of patients. This improvement might be a result from several interventions in clinic. These included careful consultation with patients which incorporate accurate assessment of disease severity and appropriate medication according to Easy Asthma/COPD guideline.

The results of resource utilization are consistent with the outcomes of cost savings from an intervention program, demonstrating that the intervention can reduce treatment costs by reducing hospitalization and emergency

room visits, the results are similar to previous studies.<sup>13-16</sup> 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 to patients and family and also financially to payers, because they are expensive and present an economic burden to the healthcare system.

Like previous studies<sup>17-19</sup>, inhaled corticosteroid use increased after implementation of the clinic. Physician followed the Easy Asthma/COPD guideline that recommended inhaled corticosteroid as the first-line maintenance therapy for asthma patients and reserved for COPD patients who are not adequately managed with bronchodilators.<sup>9</sup> Nevertheless, we found that some patients did not use this drug because misperceptions about the role of inhaled corticosteroid, and worried about the adverse effects. For this problem, pharmacists can play an important role in educating patients that regular ICS therapy would reduce the risks of uncontrolled disease and alerting physician to prescribed ICS appropriately.

Regarding clinical outcomes, after 9 months, this Easy Asthma/COPD Clinic program resulted in improvements of clinical outcomes of patients who entered the clinic. The results are the same as previous studies.<sup>17-20</sup>

The cost-benefit analysis indicated that the Easy Asthma/COPD Clinic is beneficial in terms of cost savings from emergency visit and hospitalization avoided at Wangtong Hospital from societal point of view. 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 cost-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.<sup>21</sup>

## CONCLUSION

The Easy Asthma/COPD Clinic program is effective from societal perspective. The program could reduce the number and expenditure of emergency visits and hospitalizations and improve clinical outcomes in asthma and COPD patients. This suggests that the Easy Asthma/COPD Clinic program should be promoted at all community hospital.

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