The Cost of Asthma Treatment in Phramongkutklao Hospital: Population-Based Study in Adults

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Background: *Asthma is a chronic respiratory disease that affects patients' quality of life and work performance. The cost of asthma treatment is a global economic burden. The costs include the direct medical costs and the indirect costs, such as the loss of productivity, which is difficult to quantify.*
Objective: *Analyze the cost of asthma treatment in Thailand.*
Material and Method: *Seventy-four asthmatic patients who had exacerbation were enrolled in the present study. Self-answer questionnaires were completed by the subjects including characteristics, socioeconomic factors, and level of asthma control by asthma control test (ACT) score. We evaluated the cost of asthma treatment calculated from direct medical, direct non-medical, and indirect medical costs.*
Results: *The average total cost per month was 2,752 Thai baht (US$ 86). The direct medical, direct non-medical, and indirect medical costs were 52.39%, 20.73%, and 26.88%, respectively. The direct medical costs accounted for quick-relief medications 11.91% and control medications 36.85% of the total medical cost. Loss of productivity, loss of work caused by asthma exacerbation, was the majority cost of non-medical costs. The average cost of treatment in uncontrolled was higher than partly controlled asthmatic patients but without significant difference. Healthcare payment system and age range affected the total costs of asthma treatment.*
Conclusion: *The direct non-medical costs and indirect medical costs tend to play an important role of asthma treatment. The data suggested that cost savings could be achieved by improving asthma control.*

Keywords: *Cost of asthma treatment, Asthma exacerbation, Direct medical costs, Direct non-medical costs, Indirect costs, Asthma control test*

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Asthma is an important public health respiratory problem affecting more than 300 million people around the world[1]. The Global Initiative for Asthma suggests one in twenty people in the world have a problem with asthma[2]. Asthma prevalence is increasing in developing countries. Thailand has approximately 10 to 12% asthma cases in children and 6.9% in adults[3,4]. Asthma mortality rates rise rapidly and widely across different regions in the world, the highest in the developing and lowest in the developed economies[5]. Uncontrolled asthma is an important cost factor[6]. The economic burden of asthma is substantially high especially in developed countries[7].

The asthma treatment costs are classified by direct and indirect medical costs[8]. The direct medical or health care cost of the disease, defined as resources consumed, include costs associated with drugs and equipment, consultations with physicians, and hospital costs. The direct non-medical costs included travelling expenses, treatment expenses in private hospital or pharmacy and time spent by people looking after the patient at home. The indirect medical or non-healthcare costs of a disease are defined as lost resources including time absent from work as a result of the illness and early retirement or death. Increased asthma prevalence and costs of medication are responsible for the rise in the cost of illness[9,10].

The burden of asthma is high in Thailand. However, reports on the cost of asthma treatment in adult are few. Particularly in regards to indirect medical costs. No program or equipment estimate rates have been reported per patient per visit. For the direct medical costs, data records summarizes treatment rates per visit in the outpatient department, emergency department, or hospitalization. The present study aimed to describe the costs of asthma exacerbation's

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treatment, including direct and indirect medical costs based on the data from a public hospital.

Material and Method

Patients

Asthmatic patients who visited the outpatient department of the Allergy Clinic, Internal Medicine, or Emergency Department of Phramongkutklao Hospital, Bangkok Thailand were enrolled in the present study between January and December 2012. The age range of 15 to 65 years was chosen. Asthma confirmed diagnosis used the Global Initiative for Asthma (GINA) criteria[2]. A minimum of 12% reversibility of airway obstruction had been documented at least the previous year. The exclusion criteria are patient had co-morbidity lung disease, for example chronic obstructive pulmonary disease, cystic fibrosis, and lung cancer. This study sample size is calculated based on the number of patients with asthma in the population of Thailand, which is about four million people[3], and the proportion of patients who had asthma treatment in a Phramongkutklao Hospital is about 5%. The sample size calculation in the present study is seventy-four patients. Patient characteristic data were recorded in record forms including sex, age, residency, marital status, education level, salary, payment system for medical expense, duration of asthma, and number of work days lost after asthma exacerbation. Healthcare's payment systems in Thailand are four types, civil servants health fund (welfare for government officers who work in the civil service and military service and their families), national health security fund (universal coverage scheme for all other Thai people), social security fund (copayment system in health care for workers who employ in private company), and self-payment. The data were collected by physicians and self-questionnaires. The present study was approved by the Institutional Ethics Committee and written informed consents were signed by each subject.

Asthma control assessment

Asthma severity was evaluated on the basis of the Asthma Control Test (ACT)[11]. The ACT is a reliable and valid self-administered measure comprising five items relating to limitations in activities, shortness of breath, nighttime and early morning awakening, use of rescue medication, and the patient's perception of control. Each question is scored between 1 and 5, with a maximum five-question score of 25, which represents complete control of asthma over the past four weeks. Level of asthma control was divided into three groups, complete asthma control (ACT = 25), partial asthma control (ACT 21-24), and poor asthma control ACT <20).

Per-patient cost calculation

Per-patient costs were separated into direct medical, direct non-medical, and indirect costs. The direct medical costs included the drug costs of medical emergency care, medical control of asthma symptoms, hospital service cost including admission treatment and investigation that relate with asthma such as chest X-ray and pulmonary function test. The cost of medical control of asthma symptoms was calculated for one month after asthma exacerbation. The non-drug related costs, physician's fee were excluded because Phramonkugklao Hospital is a public hospital with no charge for physician. The direct non-medical costs were treatment expenses in private hospitals or pharmacies, travelling expenses, food expenses, and other costs such as housekeeping and nursemaid services. The indirect costs were determined using human capital approach. Indirect costs included loss of productivity (loss of work time x average income per day) and premature death. The average income per day was calculated by total income per month divided by thirty. Resource use was valued at 32 Thai baht = US$ 1.

Statistical analysis

The present study used descriptive and inferential statistics. The results were expressed as mean ± SD, frequency and percentage. For comparison of means, analysis of variance (ANOVA), post hoc test (Tukey's multiple comparison test), and paired t-tests were used. Data were analyzed using STATA version 11.1 (Stata Corp, TX, USA). A p-value <0.05 was considered statistically significant.

Results

Patient data

The patient data were shown in Table 1. Ninety-five asthmatic patients were enrolled in the present study but only 74 patients had completed data. Females were the majority in the study, 54/74 (73%) patients. The mean age was 48.89±13.08 years and most patients in the study were 46 to 65-years-old (70.28%). Of our patients, 62 (83.8%) asthmatic patients lived in urban areas. The majority of asthmatic patients in the present study were single (74.3%) and graduated with a bachelor degree (29.7%). Patient's

payment systems were civil servants health fund, national health security fund, social security fund, and self-payment [41 (51.4%), 13 (17.6%), 8 (10.8%), and 12 (16.2%) patients, respectively]. In all, 54 (73%) patients had asthma between 1 and 20 years. More than half of the patients had salaries of 5,001 to 20,000 Thai baht. Asthma control assessment indicated most asthmatic patients had uncontrolled asthma 63.5%, and partly control asthma 36.5%. The mean ACT score was 21.81±0.96. The patients lost their workdays at an average of 1.54 days after asthma exacerbation.

Table 1. Patients' characteristics data

Subject characteristics	n (%)	Mean (SD)
Sex		
Male	20 (27.0)	
Female	54 (73.0)	
Age (years)		48.89 (13.08)
15-30	10 (13.51)	24.20 (4.23)
31-45	12 (16.21)	37.83 (4.95)
46-65	52 (70.28)	56.19 (5.83)
Living area		
Urban area	62 (83.8)	
Rural area	12 (16.2)	
Marital status		
Single	55 (74.3)	
Married	17 (23.0)	
Divorce	2 (2.7)	
Educational level		
Elememtary	20 (27.0)	
Secondary	21 (28.4)	
Diploma	11 (14.9)	
Bachelor degree	22 (29.7)	
Payment system		
Civil servants health fund	41 (55.4)	
National health security fund	13 (17.6)	
Social security fund	8 (10.8)	
Self-payment	12 (16.2)	
Duration of ashtma (years)		
1-20	54 (73.0)	10.68 (4.82)
21-40	16 (21.6)	29.06 (8.05)
41-50	4 (5.4)	47.00 (6.00)
Salary Thai baht (US$)		
≤5,000 (≤156.25)	17 (23.0)	122.35 (95.83)
5,001-10,000 (156.26-312.5)	21 (28.4)	242.00 (41.50)
10,001-20,000 (312.51-625)	18 (24.3)	518.30 (81.18)
20,001-30,000 (625.1-937.5)	10 (13.5)	866.84 (133.29)
>30,000 (>937.6)	8 (10.8)	1,562.60 (377.30)
Working days lost (days)		
0-3	67 (90.5)	1.00 (0.97)
4-7	7 (9.5)	6.85 (0.38)
Asthma control test		
Uncontrolled ≤20	47 (63.5)	14.25 (4.50)
Partly controlled 21-24	27 (36.5)	21.81 (0.96)

Cost of asthma treatment

The cost of asthma exacerbation treatment on asthmatic patients was shown in Table 2. Per-patient, average cost per month was 2,752 Thai baht (US$ 86). The cost divided as direct medical cost 52.39%, direct non-medical cost 20.73%, and indirect cost 26.88% (Fig. 1A). The direct medical cost was classified as quick-relief medications 327 Thai baht (11.91%), control medications 1,014.02 Thai baht (36.85%), and hospital service 100 Thai baht (3.63%). The average cost of short acting beta2-agonist evohaler was 126 Thai baht, 38.46% of quick-relief medication (Fig. 1B). The asthma control medications such as combination inhaler (inhaled corticosteroid and long acting beta-2 agonist) and leukotriene modifier average costs were 599.16 Thai baht (59.09%) and 385.14 Thai baht (37.98%), respectively (Fig. 1C). The control medications were more than one third of the total costs. Indirect costs, especially loss of productivity (average 739.62 Thai baht per patient), was one quarter of the total costs.

Cost of treatment on level of asthma control, health care payment systems, and age

We analyzed the asthma cost on asthma control levels. The total costs of asthma treatment in uncontrolled asthmatic patients were higher than partly controlled asthmatic patients with no statistically significant difference, 2,877.20 Thai baht vs. 2,533 Thai baht, $p = 0.50$ (Fig. 2A). The medical cost (direct medical costs) and non-medical costs (direct non-medical costs and indirect medical costs) were higher in uncontrolled than partly controlled asthmatic patients (Fig. 2A). Payment systems affected the total costs but did not affect medical and non-medical costs of the asthma exacerbation treatment between civil servants health fund and national health security fund (Fig. 2B). Moreover, the average cost of asthma exacerbation treatment was costly comparing to another group. Elderly adult patients (46-65 years old) had higher costs of asthma treatment than young adult (15-30 years old). However, only the total costs were significantly different between age groups (Fig. 2C).

Discussion

The present study was progressive descriptive analysis regarding costs of asthma treatment per person per month at the Phramongkutklao Hospital, located in Bangkok, Thailand. It was classified as the tertiary care level. Approximately, asthmatic patient had asthma exacerbation every month; the cost of asthma

Table 2. The average costs of asthma exacerbation treatment per person/month

Per-patient cost	Thai baht, mean (SD)	US$, mean (SD)	%
Direct medical cost	1,441.73 (875.62)	45.05 (27.36)	52.39
Quick-relief medications	327.71 (168.93)	10.24 (5.28)	11.91
Control medications	1,014.02 (803.33)	31.69 (25.1)	36.85
Hospital service	100 (0)	3.13 (0)	3.63
Direct non-medical cost	570.58 (412.54)	17.83 (12.89)	20.73
Treatment expenses in private hospital or pharmacy	344.67 (254.7)	10.77 (7.95)	12.52
Travelling expenses	156.66 (80.52)	4.9 (2.52)	5.69
Food expenses	59.79 (25.68)	1.87 (0.8)	2.17
Other	9.46 (4.32)	0.30 (0.13)	0.34
Indirect cost	739.62 (315.67)	23.11 (9.86)	26.88
Loss of productivity	739.62 (315.67)	23.11 (9.86)	26.88
Total cost	2,752.00 (1,850.85)	86.00 (57.83)	100.00

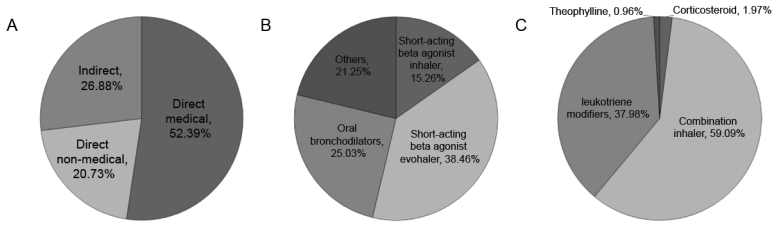

Fig. 1 A) Percentage of direct medical cost, direct non-medical cost, and indirect cost in asthmatic exacerbation treatment. B) Percentage of short acting beta-2 agonist evohaler, short acting beta-2 agonist inhaler, oral bronchodilators, and others medication in quick-relief medications. C) Percentage of combination inhaler (inhaled corticosteroid and long acting beta-2 agonist), leukotriene modifiers, theophylline, and corticosteroid.

treatment was 33,024 Thai baht (US$ 1,032) per person per year representing 19.14% of the gross domestic product (GDP) per capita. The GDP per capita of Thailand in 2012 was $5,390 and health expenditure was 4.5% of GDP[12,13]. The cost of asthma treatment in developing countries is high compare with GDP per capita such as in Vietnam, China, and the Philippines, estimated at 46%, 39%, and 28%, respectively[5,14]. In addition, reports from developed country such as the USA, Singapore, and Korea showed asthma costs is only 2 to 3% of GDP per capita[10,14]. However, the average cost of asthma treatment in developed countries per person per year such as the USA, Canada, and Switzerland were US$ 4,158, US$ 1,357, and US$ 1,413, respectively, more expensive than in developing countries[7,15]. The cost of treatment depended on income levels of the countries due to the pricing of asthma medication, the relative cost of physician fees, pattern of healthcare program, and value of lost productivity.

The studies of asthma treatment costs in Thailand are limited. In 2007, a study of the cost of asthma treatment in Chiang Mai and Lamphun province, northern Thailand showed the total cost per person per year in adults was US$ 525.4, consisting of direct cost US$ 493.5 (93.9%) and indirect cost US$ 31.9 (6.1%) indicating that direct cost was ten times higher than indirect cost[16]. Moreover, the present study showed the cost of asthma treatment was higher than that reported in previous studies and direct costs were higher than indirect costs of asthma treatment. However, comparing between medical cost and non-medical costs were nearly equal. The reasons may be explained by the fact that previous studies researched in rural regions and cost of living was cheaper than in urban regions, Bangkok is capital city. Besides, the health care system affects the direct cost of asthma treatment in Thailand. Patients in the civil servants health fund group could use higher cost of all kinds of asthma medication. The patients in civil servants health fund group who visit the public hospital do not pay for the treatment, the public hospitals get pay directly from the Thai government, and the cost of treatment is unlimited. On the other hand, patients in national health security group cannot access the original combination inhaler and original oral medications because of the restricted costs of treatment with fixed cost budget per person per year, approximately 2,700 Thai baht

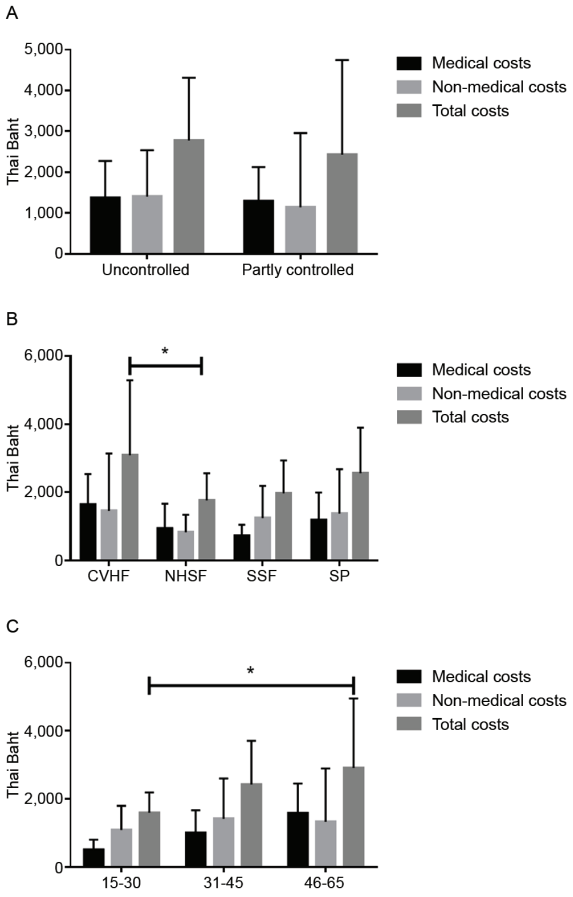

Fig. 2 The costs of asthma treatment show as medical costs (direct medical costs), non-medical costs (direct non-medical costs plus indirect costs), and total cost. A) The costs of asthma treatment related with level of asthma control, uncontrolled, and partly controlled. B) The costs of asthma treatment related with healthcare payment, civil servants health fund (CVHF), national health security fund (NHSF), social security fund (SSF), and self-payment (SP). The significant differences of total costs between CVHF and NHSF groups were analyzed by ANOVA. C) The costs of asthma treatment related with age ranges, 15-30, 31-45, and 46-65 years old. The total costs between age group 15-30 and 46-65 years old groups show significantly different, * $p<0.05$.

(US$ 84.37). The patients who live in the rural regions of Thailand usually use the universal coverage scheme supported by the national health security group. The payment systems affect the decision of physicians to treat the patients with different healthcare payment systems.

In developed countries such as the USA, Canada, and Switzerland, the direct cost of asthma treatment is usually higher than indirect cost similar to the present study, but some studies conducted in Spain, Italy, Denmark, and Germany showed that indirect cost was higher than direct cost[7,15,17]. The direct cost, especially in medication, varied from 47 to 84% of total cost[15]. In Asia-Pacific region, the control asthma medications were usually higher than quick-relief medications excepted in the studies from Hong Kong and Singapore that cost of maintenance care was lower than urgent care[5]. The level of asthma control was no significantly different from the cost of asthma treatment in the present study. Because this study did not have an asthma controlled group, we could not compare the cost of treatment between control and uncontrolled asthma. Moreover, many studies reported poor asthma control was associated with increase in healthcare costs[18,19]. The loss of productivity in the workplace due to illness is a constant concern for employers and employees alike. Workers suffer not only from the outcome of the illness, but often lose wages and leisure and family time[20]. It is difficult to estimate the true cost of loss of productivity.

Conclusion

In conclusion, asthma treatment cost is a serious economic problem for healthcare systems around the world. Particularly in Thailand, the healthcare payment systems affect the total cost of exacerbated asthma. Most likely, increasing age has influenced the medical costs of exacerbated asthma. Uncontrolled asthma causes increased costs of urgent care treatment and loss of productivity. Improved asthma control is not only provided to reduce the cost of asthma treatment but serves as an advantage to all in society.

What is already known on this topic?

The economic burden of asthma is substantially high, especially in developed countries where direct cost is higher than indirect cost.

What this study adds?

The present study showed cost of asthma exacerbation treatment in Thailand, not only affect medical cost but also affect total cost of asthma exacerbation treatment and non-medical cost. Uncontrolled asthma causes increased costs of urgent treatment and loss of productivity. The

healthcare payment systems and age affected total cost of asthma exacerbation treatment.

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Potential conflicts of interest

None.

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การศึกษาค่าใช้จ่ายการรักษาโรคหืดในโรงพยาบาลพระมงกุฎเกล้า: ศึกษาประชากรในผู้ใหญ่

ธเดช บุญปิยทัศน์, สิทธิพงษ์ ยิ้มสวัสดิ์, อธิก แสงอาสภวิริยะ

ภูมิหลัง: *โรคหืดเป็นโรคที่เกิดจากการอักเสบเรื้อรังของหลอดลมซึ่งมีผลต่อคุณภาพชีวิตและการทำงาน ค่าใช้จ่ายในการรักษาโรคหืดเป็นภาระทางเศรษฐกิจทั่วโลก ไม่เพียงแต่ค่าใช้จ่ายทางการแพทย์โดยตรง เช่น ยารักษา แต่ยังมีค่าใช้จ่ายทางการแพทย์ทางอ้อม เช่น การสูญเสียผลผลิตที่เป็นเรื่องยากที่จะศึกษาหาค่าใช้จ่าย*

วัตถุประสงค์: *การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์ค่าใช้จ่ายของการรักษาโรคหืดในประเทศไทย*

วัสดุและวิธีการ: *ผู้ป่วยโรคหืด 74 ราย ที่มีอาการโรคหืดกำเริบได้รับการคัดเลือกให้เข้าร่วมการศึกษา อาสาสมัครจะทำแบบสอบถามด้วยตนเอง ในเรื่องปัจจัยทางสังคมเศรษฐกิจและระดับของการควบคุมโรคหืดโดยการประเมินแบบทดสอบการควบคุมโรคหืด ประเมินค่าใช้จ่ายของการรักษาโรคหืดโดยคำนวณจากค่าใช้จ่ายตรงทางการแพทย์ ค่าใช้จ่ายตรงที่ไม่ใช่ทางการแพทย์ และค่าใช้จ่ายที่ไม่เกี่ยวกับทางการแพทย์*

ผลการศึกษา: *ค่าใช้จ่ายเฉลี่ยต่อเดือน 2,752 บาท (US$ 86) เป็นค่าใช้จ่ายตรงทางการแพทย์ ค่าใช้จ่ายตรงที่ไม่ใช่ทางการแพทย์ และค่าใช้จ่ายที่ไม่เกี่ยวกับทางการแพทย์ คิดเป็นร้อยละ 52.39, 20.73 และ 26.88 ตามลำดับ ค่าใช้จ่ายตรงทางการแพทย์คิดเป็นยาบรรเทาโรคหืดอย่างรวดเร็วร้อยละ 11.91 และยาควบคุมโรคหืดร้อยละ 36.85 ของค่าใช้จ่ายรวมทั้งหมด การสูญเสียผลผลิตและการสูญเสียการทำงานโดยสาเหตุจากกำเริบของโรคหอบหืดเป็นค่าใช้จ่ายส่วนใหญ่ของค่าใช้จ่ายที่ไม่เกี่ยวกับทางการแพทย์ ค่าใช้จ่ายเฉลี่ยในการรักษาผู้ป่วยโรคหืดที่ไม่สามารถควบคุมได้สูงกว่าค่าใช้จ่ายของผู้ป่วยโรคหืดที่ควบคุมโรคหืดได้บางส่วน แต่ไม่มีความแตกต่างอย่างมีนัยสำคัญ ระบบการดูแลสุขภาพและช่วงอายุมีผลกระทบต่อค่าใช้จ่ายรวมทั้งหมดของการรักษาโรคหืด*

สรุป: *ค่าใช้จ่ายตรงที่ไม่ใช่ทางการแพทย์และค่าใช้จ่ายที่ไม่เกี่ยวกับทางการแพทย์มีแนวโน้มจะมีความสำคัญในการพิจารณารักษาผู้ป่วยโรคหืด จากข้อมูลจะเห็นได้ว่าวิธีประหยัดค่าใช้ทั้งหมดของการรักษาโรคหืดจะสามารถประสบความสำเร็จได้ก็ต่อเมื่อปรับปรุงการควบคุมโรคหืดให้ดีขึ้น*