

Direct medical cost of Thai pediatric asthma management: a pilot study

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Summary

Background: The prevalence of asthma in Bangkok increased steadily over the last couple of decades and warrants an assessment of the costs associated with its treatment, particularly in the case of children.

Objective: To estimate the direct medical costs of asthma care in children at the Allergy unit of the Department of Pediatrics, Ramathibodi hospital.

Methods: In this retrospective study, we included asthmatic children aged less than 20 year-old having visited the allergy unit at least 4 times in 12 months between January and December, 2011. Cost data, retrieved from the allergy unit electronic database included billing invoices of inpatient care, outpatient and emergency room visits. From this dataset we estimated drug costs, physician and nursing services, diagnostic tests and procedures, supplies and room charges, and assessed an overall asthma-related direct medical cost.

Results: Ninety-seven asthmatic children (aged 11.5 ± 3.7 years) were included in the study. Annual median direct medical cost was 8,537.9 Baht or 278 USD per patient. Annual direct medical cost was the highest in patients younger than 5 years old ($p < 0.001$). Moreover, expenses of patients who had at least one exacerbation increased significantly compared to patients without exacerbation ($p = 0.02$). Furthermore, direct medical cost was the highest when patients had exacerbation requiring hospitalization ($p = 0.03$).

Conclusions: Cases of patients having asthma exacerbation or being diagnosed with asthma before 5 years of age were associated with higher treatment expenses. Policies developed to achieve asthma control and prevention should identify young children and patients presenting risk factors for asthma exacerbation as high risk groups deserving particular attention. (*Asian Pac J Allergy Immunol* 2015;33:296-300)

Keywords: asthma, hospital charges, fees, medical, Thailand, children

Introduction

Childhood asthma is a common serious chronic disease in infants and children. According to the WHO Global surveillance report of 2007, 300 million people around the world experienced a range of asthma-related complications.¹ It is estimated that by 2025 more than 100 million will be afflicted with asthma.² Worldwide, about 10% of children and 8% of adults were diagnosed with asthma in 2009. The total cost of illness for asthmatic patients is also increasing worldwide possibly indicating an increase of severity of asthma-related complications. For example, asthma-related cost in the USA has increased of 6% from 2002 to 2007.³

Several recent studies have assessed the economic burden of asthma care in several western countries the USA, Canada, Australia, Switzerland where the total annual direct cost per person were 3,180 US. dollars (USD) (65% of total cost), 397 USD (61% of total cost), 273 USD (77% of total cost), 869 USD (61% of total cost), respectively.⁴⁻⁷ Some other studies estimated the indirect cost of asthma treatment by including the impact of asthma-related morbidity and mortality on employment, productivity and social integrity and found that indirect cost greatly exceeded the direct cost. For instance, in Spain and Italy the mean annual indirect cost was estimated around 2,749 USD (69% of total cost) and 1,068 USD (52% of total cost) respectively.⁸⁻⁹ In Denmark, the asthma-related indirect cost per year was estimated to be 822,067 USD (67% of total cost) while studies from the USA

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and Germany reported that asthma-related indirect costs were representing respectively 55% and 75% of the total cost.¹⁰⁻¹²

Risk factors associated with increased cost of asthma are also increasingly reported. For instance, “poorly controlled asthma” was associated with a significant increased total cost of asthma care in Denmark,¹⁰ US,¹³ Italy⁹ and Hungary.¹⁴ Similarly, a study from the USA found that adolescents (ages 15 – 19 years) were significantly associated with lower inpatient and outpatient care costs¹⁵. Some studies conducted in Asia-Pacific found that extremes of age (less than 10 years and more than 60 years) was predictive of higher asthma related costs,¹⁶ while other reports show that females cases are associated with higher expenses.^{8,17,18} Finally, asthma treatment for African American were also found to be associated with higher cost compared to Caucasian patients.

In Bangkok, Thailand, an ISAAC study involving 6-7 years old children has found that the prevalence of asthma had increased from 11% to 15% from 1995 to 2001.¹⁹ In reaction to this alarming trend, several studies investigated the cost of hospitalizing asthma patients in regional hospitals. For instance, a recent report involving 183 adult patients admitted at Surin Hospital showed that the average hospital cost was $5,809.3 \pm 6,587.4$ Baht or (USD 134.5 ± 152.5) per patient (range, 740–57,980 Baht or USD 17.1–1342.1).²⁰ Similarly, the average medical charge per patient per admission and per day was reported to be 3,236 and 998 Baht respectively.²¹

Recently, a study investigating the economic burden of asthma in Thailand was conducted in Chiang Mai and Lumphun provinces.²² The study included both Direct and Indirect costs to assess the economic burden associated to asthma treatment and care. In this study, the average total person annual cost for adult was 16,287.27 Baht including direct costs and indirect costs reaching 15,299.87 Baht and 987.4 Baht respectively. In children, asthma related costs were found to be lower than for adults, with an average total cost of 8,009.37 Baht, including Direct and Indirect costs reaching 6,723.69 Baht and 1,285.69 Baht respectively.

In this study, our objective was to estimate the direct medical costs of asthma care in Thai children at the Allergy unit of the Department of Pediatrics, Faculty of Medicine Ramathibodi Hospital, Mahidol

University, Bangkok, Thailand. The total direct medical costs calculation included expenses associated with outpatient department, inpatients care and emergency visits as well as the charges of physician services, nursing services, drugs, supplies, diagnostic laboratory and procedures and rooms.

Methods

A retrospective descriptive study was conducted to estimate the direct medical cost associated to the treatment and care of asthmatic children who visited the Allergy Unit of the Department of Pediatrics, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand. The study protocol was approved by the Research Ethical Committee of Ramathibodi Hospital. Patients from the allergy clinic who were aged less than 20 years old and who had visited the unit at least 4 times in 12 months (January 1st, 2011- December 31st, 2011) were included. This study excluded patients who received asthma care at other hospitals and patients from the allergy clinic who could not be followed up. Medical records were reviewed and all billing invoices of inpatient care, outpatient visits and emergency room visits were analyzed to estimate the annual direct medical cost per patient. Information on asthma and asthma co-morbidities expenses were also collected. Finally, direct medical cost consisting of drug costs, nursing services, physician services, diagnostic tests and procedures, supplies and rooms charge were calculated.

To represent direct medical cost in public perspectives, we calculated all the expenses using quantity of resources multiplied by both reference price/charge from the Ministry of Public Health of Thailand (RF price)²³ and Ramathibodi Hospital price/charge (RA price). Moreover, direct medical costs were compared between groups of patients with and without exacerbation. Asthma exacerbation definition according to recommendations for pediatrics populations is “a worsening of asthma requiring the use of systemic corticosteroids to prevent a serious outcome” or 1). Systemic corticosteroids for asthma 2). Asthma-specific hospital admissions 3). Asthma-specific ED visits.²⁴

Statistic analysis

Demographic data was analyzed by descriptive statistics analysis using SPSS statistics software, version 17. Costs differences between groups was analyzed using Mann-Whitney Test with $P < 0.05$ considered to be statistically significant.

Table 1. Patients visited Outpatient department and Emergency room

Asthma episode took place	Number of visit	Number of patients	Number of visits per patients
OPD visits			
• Number visits	548	97	5.6
• Exacerbation	16	12	1.3
ER visits			
• Exacerbation	9	8	1.1

Results

One hundred nineteen patients who had at least four visits at the allergy clinic were screened. Ninety-seven patients were enrolled in to the study. Twenty-two were excluded because they received asthma treatment from other hospitals. The majority were male 67%, with average age 11.5 (± 3.7) years. Twenty four (24.7%) patients had at least one exacerbation in the past 12 months and 12 (12.3%) patients had severe exacerbation which required hospitalization, as shown in Table 1. Most of the patients (90%) had allergic rhinitis as co-morbidity condition and almost half experienced upper respiratory tract infection that required hospital visits.

The number of out-patient department visits in the Allergic unit in the past 12 months was 548, an average of 5.6 visit per patient annually. Among these 548 visits, 16 (2.9%) were motivated by cases of asthma exacerbation. Eight patients visited the emergency department because of asthma exacerbation.

The annual total direct medical cost of asthma care in Ramathibodi Hospital calculated via Ramathibodi prices (RA) was 1,316,941 Baht with a median direct medical cost per person per year being 8,537.9 Baht (range 3,990 - 20,815 Baht) or 278 USD. Calculated via the Reference prices (RF) according to the Ministry of Public Health of Thailand, the annual total direct medical cost of asthma care in Ramathibodi hospital was 1,187,026 Baht with a median direct medical cost per person per year of 8,492 Baht (range 3,443 -18,586 Baht)

Using Ramathibodi prices (RA), the median direct medical cost of asthma in the outpatient department (OPD), inpatient department (IPD) and emergency room (ER) were 8,226 Baht (range 3,846 - 16,017 Baht), 8,203 Baht (range 3,383 - 23,203 Baht), and 876 Baht (range 586 -1,227 Baht) respectively. Using reference prices (RF), the

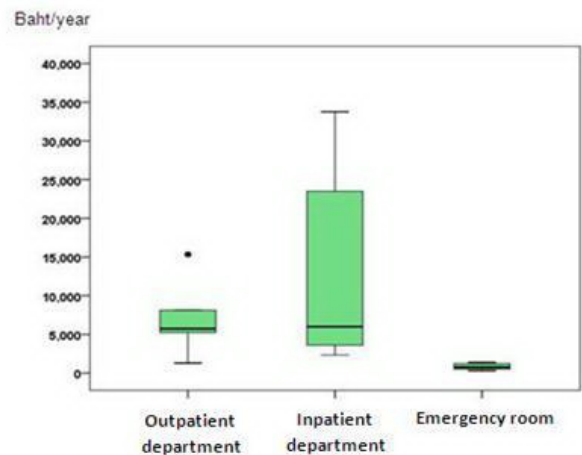


Figure 1. Box plots show annual direct medical cost of asthma care divided according to departments of patients visits (calculated by RF)

median direct medical cost of asthma in OPD, IPD, and ER were 8,226 Baht (range 3,291 - 14,327 Baht), 7,224 Baht (range 3,131 – 21,567 Baht), and 653 Baht (range 390 – 1,205 Baht) respectively, as shown in Figure 1.

Within the inpatient care department, there were 12 admissions in this study with a total length of stay of 46 days. The median length of stay was 4 days (1 - 6.8 days). Calculated with RA, the median direct medical cost of inpatient care was 2,933 Baht per day (1,984 – 4,977 Baht), compared to 2,751 Baht per day (2,010 – 4,516 Baht) by RF.

The drugs expenses related to asthma care were also assessed, with leukotriene antagonist, inhaled corticosteroid, combination of inhaled corticosteroid (ICS), long acting beta 2 agonist (LABA), short acting beta 2 agonist(SABA) and antihistamine being the drugs used the most. The overall drug expenses represented 85% of the total direct medical cost. The drugs associated with the highest expenses were leukotriene antagonist, combination of inhaled corticosteroid (ICS) and long acting beta 2 agonist (LABA). There were only little differences in the comparison between Ramathibodi Hospital prices and Reference price. The annual costs of inhaled corticosteroid per person were 1,377 Baht (RA) and 1,028 Baht (RF), of combination ICS and LABA were 4,402 Baht (RA) and 4,334 Baht (RF) and of leukotriene receptor antagonist were 7,882 Baht (RA) and 7,059 Baht (RF).

The annual direct medical cost comparison between group of patient with and without exacerbation in the past 12 months indicate that

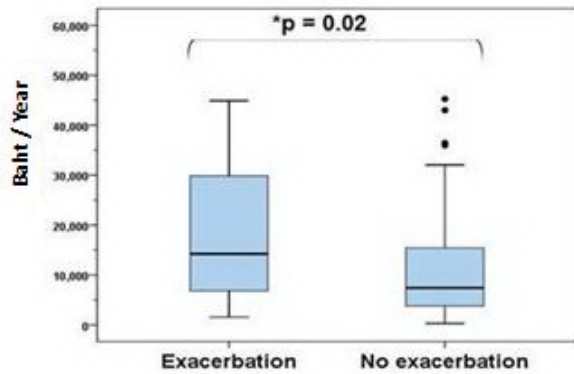


Figure 2. Median annual direct medical cost comparison between exacerbation and no exacerbation group (RA)

patients with at least one exacerbation represented significantly higher costs, reaching 14,232 Baht (range 6,505 - 30,635 Baht), compared to patients without exacerbation, reaching only 7,416 Baht (range 3,738 - 16,023 Baht) ($p = 0.02$), (both RA and RF) (Figure 2). Drug cost per person was compared between “at least one exacerbation” and “no exacerbation” groups. The only drug for which we observed a significant difference in annual drug cost per person between these two groups was leukotriene receptor antagonist, for which the exacerbation group had lower costs ($p = 0.007$).

When comparing between the group of patients who had exacerbation and required hospitalization with patients who had exacerbation but did not require hospitalization, the group of exacerbation patients who required hospitalization represented significantly higher annual direct medical costs, which was 29,827.5 Baht (range 15,747 - 36,346 Baht) compared to patients without exacerbation, 7,030 Baht (range 3,604 - 13,882 Baht) ($p = 0.03$). However, outpatient drug cost had no statistical significant difference ($p = 0.371$) (Figure 3).

The median annual direct medical cost compared between patients aged less than 5 years old and more than 5 years old, indicate that patients aged less than 5 were associated with significantly higher cost at 40,860 Baht (range 35,381 - 63,770 Baht), compared to older children for which the average cost was 8,226 Baht (range 3,846 - 18,143 Baht) ($p < 0.001$) (Figure 4).

Discussion

In this study, we found that the median annual direct medical cost of asthma care in children at Ramathibodi Hospital was 8,473 Baht (range 3,990-

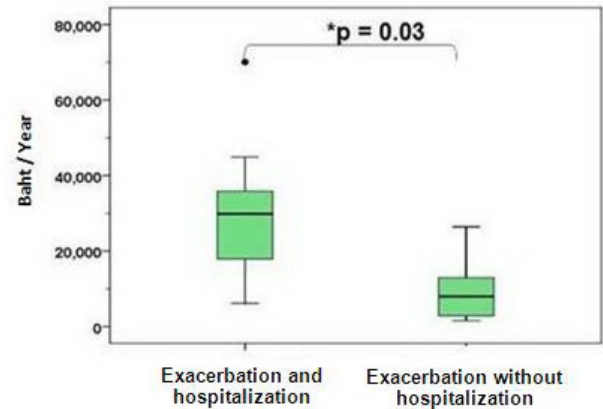


Figure 3. Comparison of median annual direct medical cost between exacerbation required hospitalization and no hospitalization groups (RA)

20,815 Baht) per patient. Understanding the economic burden associated with this increasingly frequent condition is fundamental in order to design public health policies better adapted to chronic non-communicable diseases care challenges. Patients having asthma exacerbation or diagnosis of asthma before five years of age were associated with higher expense for their treatment. This might be due to the fact that patients aged less than five in this study had higher exacerbation rate and required hospitalization more frequently. Policies developed to achieve asthma control and prevention should thus identify young children and patients presenting risk factors for asthma exacerbation as high risk groups deserving particular attention.

Comparing with previous studies in Thailand, the average inpatient charge increased almost twice from 3,236 Baht to 8,203 Baht between years 2000-2003²⁰ and now. In other regions of the country, in Chiang Mai and Lumphun for instance, the direct costs of asthma has been estimated to be 6,723.69 Baht,²¹ a much lower cost than that found in this study focusing on a Bangkok regional hospital. These differences could have resulted from the standard cost of living differences between the provincial and capital cities, with Bangkok life standards known to be higher than that in the rural areas. Time is another important factor influencing the price of medical care. The asthma related direct medical cost reported in this study was lower than that of developed countries such as USA (3,180 Baht vs. 273 USD),⁴ a difference likely due to the difference in cost of living.

The present study had several limitations. First, this was a pilot study using a small sample size from

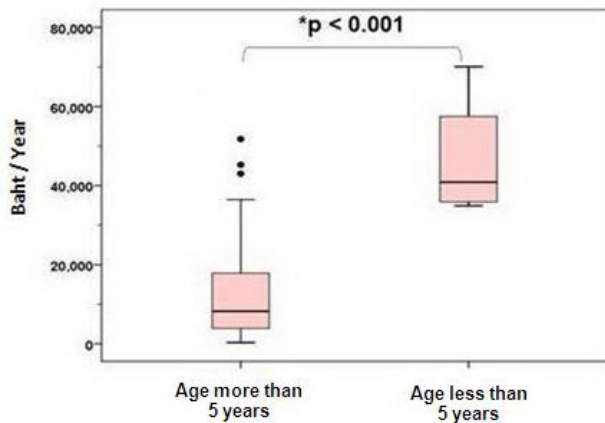


Figure 4. Comparison of median annual direct medical cost between age groups (RA)

a university hospital. Caution is therefore required as the expenses reported are possibly largely influenced by the setting. Second, this study did not examine indirect costs of asthma care with impedes the assessment of the total cost of asthma care. In order to complement this study and describe more precisely the cost on asthma care in Thailand, further investigations are needed, including studies involving larger sample size, sensitivity analysis and considering both direct non-medical cost and indirect cost.

References

- Masoli M, Fabian D, Holt S, Beasley R. The global burden of asthma: Executive summary of the GINA Dissemination Committee report. *Allergy*. 2004;59:469-78.
- Bousquet J, Khaltaev N. Global surveillance, prevention and control of chronic respiratory diseases: A comprehensive approach. Switzerland: WHO; 2007.
- Centers for Disease Control and Prevention. [Internet]. Atlanta: CDC Vital Signs; c 2011 [updated 2011 May 3; cited 2011 Dec 25]. Office of Surveillance, Epidemiology and Laboratory Services (OSELs); [about 1 screen]. Available from: <http://www.cdc.gov/vitalsigns/asthma/>
- Cisternas MG, Blanc PD, Yen IH, Katz PP, Earnest G, Eisner MD, et al. A comprehensive study of the direct and indirect costs of adult asthma. *J Allergy Clin Immunol*. 2003;111:1212-8.
- Krahn MD, Berka C, Langlois P, Detsky AS. Direct and indirect costs of asthma in Canada, 1990. *CMAJ*. 1996;154:821-31.
- Mellis CM, Peat JK, Bauman AE, Woolcock AJ. The cost of asthma in New South Wales. *Med J Aust*. 1991;155:522-8.
- Szucs TD, Anderhub H, Rutishauser M. The economic burden of asthma: direct and indirect costs in Switzerland. *Eur Respir J*. 1999;13:281-6.
- Serra-Batllés J, Plaza V, Morejon E, Comella A, Brugués J. Costs of asthma according to the degree of severity. *Eur Respir J*. 1998;12:1322-6.
- Antonicelli L, Bucca C, Neri M, De Benedetto F, Sabbatani P, Bonifazi F, et al. Asthma severity and medical resource utilisation. *Eur Respir J*. 2004; 23:723-9.
- Sorensen L, Weng S, Weng SL, Wulf-Andersen L, Ostergaard D, Bech PG. The cost of asthma in Denmark. *Br J Med Econ*. 1997;11:103-11.
- Gendo K, Sullivan SD, Lozano P, Finkelstein JA, Fuhlbrigge A, Weiss KB. Resource costs for asthma-related care among pediatric patients in managed care. *Ann Allergy Asthma Immunol*. 2003;91:251-7.
- Stock S, Redaelli M, Luengen M, Wendland G, Civello D, Lauterbach KW. Asthma: prevalence and cost of illness. *Eur Respir J*. 2005; 25:47-53.
- Van Ganse E, Laforest L, Pietri G, Boissel JP, Gormand F, Ben-Joseph R, et al. Persistent asthma: disease control, resource utilization and direct costs. *Eur Respir J*. 2002;20:260-7.
- Chew FT, Goh DY, Lee BW. The economic cost of asthma in Singapore. *Aust N Z J Med*. 1999;29:228-33.
- Stroupe KT, Gaskins D, Murray MD. Health-care costs of inner-city patients with asthma. *J Asthma*. 1999;36:645-55.
- Lai CKW, Kim YY, Kuo SH, Spencer M, Williams AE. Cost of asthma in the Asia-Pacific region. *Eur Respir Rev*. 2006;15:10-6.
- Accordini S, Bugiani M, Arossa W, Gerzeli S, Marinoni A, Olivieri M, et al. Poor control increases the economic cost of asthma. A multicentre population-based study. *Int Arch Allergy Immunol*. 2006;141:189-98.
- Stempel DA, Hedblom EC, Durcanin-Robbins JF, Sturm LL. Use of a pharmacy and medical claims database to document cost centers for 1993 annual asthma expenditures. *Arch Fam Med*. 1996;5:36-40.
- Trakultivakorn M, Sangsupawanich P, Vichayanond P. Time trends of the prevalence of asthma, rhinitis and eczema in Thai children-ISAAC (International Study of Asthma and Allergies in Childhood) Phase Three. *J Asthma*. 2007;44:609-11.
- Chuesakoolvanich K. Cost of hospitalizing asthma patients in a regional hospital in Thailand. *Respirology*. 2007;12:433-8.
- Visitsunthorn N, Durongpitsitkul W, Uoonpan S, Jirapongsananuruk O, Vichayanond P. Medical charge of asthma care in admitted Thai children. *J Med Assoc Thai*. 2005;88:S16-20.
- Trakultivakorn M. Economic burden of asthma in Thailand. *Asian Pac J Allergy Immunol*. 2012;30:1-2.
- Drugs and Medical Supplies Information Center, Ministry of Public Health [Internet]. Nonthaburi: Drugs and Supplies price; c 2001 [updated 2004; cited 2012 Jan 20]. Available from: <http://dmsic.moph.go.th/price.htm>
- Fuhlbrigge A, Peden D, Apter AJ, Boushey HA, Camargo C, Gern J, et al. Asthma outcomes: exacerbations. *J Allergy Clin Immunol*. 2012;129:S34-48.