A real-world implementation of asthma clinic: Make it easy for asthma with Easy Asthma Clinic

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ABSTRACT

Background and objective: Asthma is a common disease. Although several practice guidelines for asthma exist, good control is still problematic, particularly in developing countries. The Easy Asthma Clinic (EAC) was established in 2004 with the aim of providing simplified asthma guidelines, a multidisciplinary approach, and an online database. This study aimed to evaluate the outcomes of EAC in a real-world setting.

Method: Clinical data were collected from the EAC database between 2004 and 2017. Treatment data and asthma control data were evaluated during the study period.

Results: In all, 358,182 patients with asthma were treated at EAC in 1,171 hospitals throughout Thailand during the 14-year period. For 3,264,117 visits, inhaled corticosteroid (ICS) was given at the highest percentage (average of 50.00%) with an average percentage of controllers at 75.08% and a trend of increasing treatment (coefficient 0.007; \(p < 0.001\)). The percentage of controlled asthma also increased from 20.48% to 27.76% with a coefficient of 0.015 (\(p\) for trend <0.001).

Conclusion: The EAC may facilitate controller use in patients with asthma thereby increasing asthma control according to a large sample size and long longitudinal study.

Keywords: Multidisciplinary, Controlled, Inhaled corticosteroid, Pragmatic study, Asthma

INTRODUCTION

Asthma is a common disease with an incidence rate of 43.12 million cases reported worldwide in 2017.\(^1\) It is related to several conditions and may lead to emergency room visits or admission due to uncontrolled asthma.\(^2\) While asthma mortality decreased from 1992 to 2017, incidence or disability-adjusted life years (DALYs) did not change significantly during the same period (\(r = -0.71; \ p = 0.114\) and \(r = -0.80; \ p = 0.058\)).\(^1\) These figures may indicate that physicians need to improve asthma management and quality of care. To achieve this, international and local guidelines have been established. Several factors that may hinder the efficacy of asthma guidelines for good management include the complexity of the guidelines, patients’ perceptions of them, and insufficient time for physicians, particularly in resource-limited settings.\(^8\) A study from Ethiopia found that uncontrolled asthma was highly prevalent at 71.67%, yet only 38.5% of doctors followed the Global Strategy for Asthma...
Management and Prevention (GINA) guidelines, and even fewer, 14.5%, had asthma action plans with patients.9 A survey from Thailand found that only 8% of patients with asthma experienced good control according to the GINA guidelines, and inhaled corticosteroids (ICS) were used by only 6.7% of patients.10

To overcome these obstacles, the authors established Easy Asthma Clinic (EAC) in 2004. The aim of the EAC was to simplify asthma guidelines, implement a multidisciplinary approach, and create an online database (Fig. 1). To simplify guidelines, patients with asthma were assessed using 4 questions that addressed daytime symptoms, nocturnal symptoms, reliever use, and emergency room (ER) visits for the previous 4 weeks and peak-expiratory flow (PEF) measurement at the visit. The EAC has a multidisciplinary team including physicians (general practitioners or internists), nurses, and pharmacists. Four steps are included: 1) registration and asthma-control assessment by nurses; 2) evaluation and treatment by physicians; 3) appointments with nurses; and 4) asthma education and device education by clinically-trained pharmacists. Asthma education comprised 2 important messages: 1) that asthma is an inflammatory disease and 2) that asthma treatments included controller and reliever medications provided to the patient. The rationales for asthma treatment followed a previous study11 and involve 2 steps. In step 1, ICS 500 µg/d were administered, and in step 2, ICS 500 µg/d plus other controllers such as ICS/long-acting beta-2 agonist (ICS/LABA), antileukotriene, or theophylline were used. These 2 steps are bidirectional. Stepping up is indicated if symptoms are uncontrolled or partially controlled as demonstrated by the presence of any item of the above questions or PEF less than 80% of expected values. To step down, symptoms and PEF should be controlled for at least one year. The online database monitored individual patient and overall asthma control in each hospital. This study aimed to evaluate and report the outcomes of the EAC.

METHODS

This study was a real-world study conducted by retrieving clinical data from the EAC database (http://eac2.dbregistry.com). The inclusion criteria were patients diagnosed with asthma who had been treated at an EAC anywhere Thailand. Those patients with incomplete data were excluded. The study period was between 2004 and 2017.

Diagnosis of asthma was made according to the GINA guidelines.12 Eligible patients were evaluated for treatment and asthma control at each visit. Treatment outcomes were classified as controlled, partially controlled, and uncontrolled. Definitions of asthma control were classified by the GINA guidelines12 as follows: controlled comprised less than twice a week for daytime symptoms and reliever use, no limitations of activities, no nocturnal symptoms, normal PEF

Fig. 1 Shows the steps of the Easy Asthma Clinics.
or FEV1, and no exacerbations; partially controlled was 1 or 2 unfavourable features of the controlled criteria; and uncontrolled was defined by the presence of 3 or more unfavourable features of the controlled criteria.\textsuperscript{12}

Data were reported as numbers and percentages of controller treatment including ICS, ICS/LABA, and overall controller percentage and treatment outcomes as controlled, partially controlled, and uncontrolled. Additionally, data for treatments and treatment outcomes were reported by year. A P value for trend was calculated for each treatment and asthma control by using a trend analysis for proportions. Coefficients or beta and p values were reported. All statistical analyses were performed using STATA software (College Station, Texas, USA).

RESULTS

There were 358,182 patients with asthma treated at the EAC in 1171 hospitals throughout Thailand during the 14-year period (Table 1). Of 3,264,117 visits, ICS was given at the highest percentage (average of 50.00%) and followed by ICS/LABA (24.95%) as shown in Table 2 and Fig. 2. The average percentage of controller prescription was 75.08% with a trend of increasing treatment of ICS/LABA and overall controller percentages (Fig. 2). Coefficients for ICS, ICS/LABA, and overall controller percentages were −0.003, 0.027, and 0.007 with a p value of <0.001 for these three treatments (Table 2). For other controllers, leukotriene antagonists were slightly increased from 2.43% in 2004 to 6.44% in 2017, while theophylline had a steady percentage (Fig. 3).

Regarding treatment outcomes, average percentages of controlled, partially controlled, and uncontrolled were 27.76%, 39.09%, and 21.00%, respectively (Table 3). Of 3,264,025 visits, percentage of controlled patients increased from 20.48% in 2004 to 36.47% in 2017 (Table 3 and Fig. 4), while percentages of partially controlled cases were increasing slightly from 36.57% to 39.72%. In contrast, the uncontrolled percentage was dramatically decreasing from 33.42% to 13.54% (Table 3 and Fig. 3). Coefficients for controlled asthma and partially controlled asthma

| year | Hospitals | Registered patients | Total patients |
|------|-----------|---------------------|----------------|
| 2004 | 367       | 4144                | 4144           |
| 2005 | 413       | 7079                | 11,223         |
| 2006 | 443       | 7333                | 18,556         |
| 2007 | 501       | 8042                | 26,598         |
| 2008 | 561       | 14,884              | 41,482         |
| 2009 | 618       | 17,710              | 59,192         |
| 2010 | 896       | 40,812              | 100,004        |
| 2011 | 1062      | 60,565              | 160,569        |
| 2012 | 1101      | 45,815              | 206,384        |
| 2013 | 1130      | 40,225              | 246,609        |
| 2014 | 1145      | 32,425              | 279,034        |
| 2015 | 1151      | 29,329              | 308,363        |
| 2016 | 1160      | 27,074              | 335,437        |
| 2017 | 1171      | 22,745              | 358,182        |

Table 1. Shows the numbers of hospitals, registered patients, and total patients treated at Easy Asthma Clinics by year
were positive at 0.015 and 0.004 ($p < 0.001$), while the coefficient for uncontrolled asthma was negative at $-0.011$ ($p < 0.001$), as shown in Table 3.

**DISCUSSION**

The results of this study showed that EAC was able to facilitate controller use and improve...
Fig. 3 Shows the percentages of treatment with leukotriene antagonists and theophylline at the Easy Asthma Clinics by year.

Table 3. Shows the numbers of visits, numbers and percentages of patients with controlled, partially controlled, and uncontrolled cases treated at the Easy Asthma Clinics by year. Note: There are missing data due to incomplete data collection; the total number of visits was not equal to the sum of the controlled, partially controlled, and uncontrolled cases column.
asthma control with easy treatment strategies, a multidisciplinary approach, and an available online database.

As previously reported, one factor associated with uncontrolled asthma is using only a bronchodilator without a controller or ICS. A study in Ethiopia or Zemedkun et al found that only 3.8% of patients received ICS with or without LABA. ICS is recommended in all stages of asthma according to recent guidelines and several studies because asthma is a disease caused by inflammation of the airway. The EAC uses ICS as the first line treatment immediately after the diagnosis of asthma. Without the ICS, the adjusted odds ratio for uncontrolled asthma was 13.642 (95% confidence interval of 4.403, 42.22). This study found an overall increase in asthma control which may be explained by the increased use of ICS/LABA but not ICS alone as the coefficients of both controlled asthma and ICS/LABA were positive (0.015 and 0.027), while the coefficient of ICS alone was negative (−0.003) as shown in Tables 2 and 3. Additionally, these treatments may indicate more-severe asthma in the population. Importantly, treatment at EAC facilitates controller treatment or treatment including ICS in three-fourths of patients, which is much higher than controller treatment in the survey study (75.08% vs. 6.7%). Recently, the 2020 GINA guidelines recommended controller-based treatment for patients with asthma which the EAC project has used for 14 years. Note that other controllers may not be related to controlled rates as they had small proportions with slightly increased for only leukotriene antagonists (Fig. 3).

This study found that the percentage of controlled asthma cases was high with an increasing trend from 20.48% to 36.47%. Compared with previous studies, the average controlled percentage at the end of this study was slightly higher than previous reports from Ethiopia as a result of EAC strategies (from 24.2% to 29.6%). Reasons for these results included the use of ICS, PEF evaluation, and a multidisciplinary approach, particularly, education regarding the technique for using the device. This education is critical to improving ICS delivery to the airways. A previous study found that incorrect inhaler-device use was identified in 70.4% of cases. These results imply that asthma control may be improved by up to 70.4% if patients understand and use correct device techniques. Additionally, poor inhaler technique was significantly associated with lack of education in the device as well as poor asthma control with adjusted odds ratios of 4.96 (1.08–22.89) and 3.67 (1.85–7.23) and p values of 0.04 and 0.001 respectively. The EAC offered health education on the device and how to use it properly. Early use of ICSs and their fast step-up may be additional benefits of EAC. A meta-analysis found that simplified regimens improved patient compliance by 4% points (95% CI of 1.88, 6.16). These factors may improve asthma control in patients treated with the EAC concepts. Note that the proportion of partially controlled asthma initially increased up to 2013 and then progressively decreased (Table 3); these findings may be due to higher percentages of ICS/LABA.
(Table 2) resulting in higher controlled percentages but decreasing percentages of partially controlled asthma. These data suggest that ICS/LABA may be associated with well-controlled asthma.

There are several strengths of this study. First, this was a real-world, longitudinal 14-year study comprising a large cohort and covering more than 1000 hospitals throughout Thailand. Second, 358,182 patients with asthma participated at the EAC with over 3,000,000 visits. Third, the 4 steps used by the EAC provided more time for physicians to manage patients and also to see more patients. As there are nurses and pharmacists to assist with treatment, providing education, evaluation, and device training, physicians spend less time per patient. Therefore, physicians have more time to see more patients. Physicians at the EAC are general practitioners or internists. These data showed that patients’ asthma could be controlled by general practitioners or internists. Patients with more complex cases were referred to pulmonologists at higher level hospitals as per the national referral guidelines. Finally, this study simplified asthma guidelines for individual treatment with a multidisciplinary approach. However, several limitations must be noted. First, no control group for comparison was used in this study. Second, ICSs or other medications used in this study were not specific to any particular drugs. Finally, some factors, such as obstructive sleep apnoea, occupational asthma, or personal factors, were not evaluated.

CONCLUSION

The EAC may facilitate controller use in patients with asthma and result in an increasing trend of asthma control according to a large sample size and long longitudinal study.

Abbreviations
DALYs, Disability-adjusted life years; EAC, Easy asthma clinic; FEV1, Forced expiratory volume during the first second; GINA, Global Strategy for Asthma Management and Prevention; ICS, Inhaled corticosteroid; LABA: Long acting beta 2 agonist; PEF, Peak expiratory.

Availability of data and materials
Data are available as printed material and as electronic files in the hospital computer. Patients’ data protection.

Authors’ contribution
The authors are involved in the collection of the data and the writing of the manuscript. The authors read and approved the final manuscript.

Ethics approval
The Institutional Review Board (IRB) of Khon Kaen University exempted the study from IRB ethics approval and informed consent as it used a de-identified data set of the electronic medical record system of the EAC system stripped of all Health Insurance Portability and Accountability Act (HIPPA) identifiers.

Consent to participate
Not applicable.

Authors’ consent for publication
The authors provided consent for publication.

Declaration of competing interest
The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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