Impact of a Targeted Asthma Intervention Program on Treatment Costs in Patients with Asthma

Dong-Churl Suh, PhD, MBA; Soung-Kook Shin, PhD; Ijeoma Okpara, PharmD; Robert M. Voytovich, PharmD; and Allan Zimmerman, MBA, RPh

Objective: To evaluate the impact of a targeted asthma intervention on treatment costs, utilization of medical services, number of prescription drugs filled, and trends of medication use from a third-party perspective.

Study Design: Longitudinal population-based study.

Methods: Study asthmatic patients were classified into intermittent and persistent asthma groups according to the Health Plan Employer Data and Information Set (HEDIS) 2000 asthma measurement. The intervention instituted appropriate asthma drug therapy according to National Heart, Lung, and Blood Institute guidelines. A paired t test and analysis of covariance were used to compare treatment costs and the number of prescriptions dispensed in the 9 months before and the 9 months after the intervention.

Results: The study patients (n = 1616) included 566 with intermittent asthma and 1050 with persistent asthma. After the intervention, treatment costs per patient increased significantly by $122 in the intermittent asthma group (P = .001) but decreased significantly by $247 in the persistent asthma group (P < .001). Costs incurred by patients with persistent asthma decreased by $149 for hospitalization (P = .003), $16 for emergency room visits (P < .001), $82 for physician visits (P < .001), and increased by $1 for asthma medications (P = .938). The number of asthma medication prescriptions per patient increased by 0.72 prescriptions in the intermittent asthma group (P < .001), whereas the persistent asthma group had a per patient reduction of 0.99 prescriptions (P < .001).

Conclusion: A targeted asthma intervention resulted in decreased hospitalization, emergency room, and physician visit costs in patients with persistent asthma.

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ment plans, and providing education on the proper use of inhalers and factors that worsen asthma.

In addition to the NHLBI guidelines, a new Health Plan Employer Data and Information Set (HEDIS) 2000 asthma measure was developed by the National Committee for Quality Assurance; it utilizes a risk-stratification process to identify patients with persistent asthma based on use of health services (ie, hospitalization, emergency room visits, physician office visits) and asthma medications.5 Recently published studies have demonstrated that an intervention targeting the appropriate use of asthma medications and/or disease management can improve respiratory function, increase the number of symptom-free days, and reduce overall healthcare costs, despite greater expenditures for medications.6-11 The economic impact of adherence to the NHLBI treatment guidelines for asthma has been studied on a few separate occasions; however due to characteristics of the data used, asthmatic patients were not classified.9 Use of strictly controlled environments with fixed populations or analysis of small samples of patients also caused the limited generalizability of previous study results.12,13

We evaluated the impact of a targeted asthma intervention program using 2 methods. First, we compared asthma treatment costs and utilizations associated with hospitalization, emergency room visits, physician office visits, and medications before and after the program was implemented. Second, we evaluated trends in the number of prescriptions filled for asthma medications and the manner in which those medications were used before and after initiation of the intervention. Patients were classified into intermittent and persistent asthma groups according to the HEDIS 2000 asthma measure.

METHODS

Study Design and Patient Sample

This longitudinal population-based study was designed to determine the impact of a targeted asthma intervention program by comparing the 9-month period before (January 1997 through September 1997) and the 9-month period after (January 1998 through September 1998) implementation of the intervention. Although the intervention program was provided for 1 year (October 1997 through September 1998), the first 3 months of the intervention period were arbitrarily chosen as a washout period (October 1997 to December 1997) and excluded from the data analysis. This washout period was included to allot time for changes to occur in patient behavior and prescribing patterns since observing changes in costs associated with prescriptions and related service utilization was our objective.

Because we assumed that implementing the intervention program would decrease asthma treatment costs by $20 per patient during the study period, 700 patients were required to provide a power of 90% to detect such a difference at a 2-sided $\alpha$ level of .05.9,14 Throughout the study period, participants were active members of an organization that provides medical and prescription benefits to its members residing in the northeastern United States.

All claims for the use of hospitals, emergency rooms, and physicians’ offices were obtained for each member of the study organization, and prescription drug claims were obtained from the corresponding pharmacy benefit manager. Asthma patients were identified from claims data using International Classification of Diseases, 9th Revision (ICD-9) code 493. Patients were included in the study if this code represented a primary or secondary diagnosis during the 9 months before intervention.

Patients with chronic obstructive pulmonary disease were excluded from the analysis. Children less than 4 years old and adults more than 55 years old also were excluded from this study because it often was difficult to obtain a definitive asthma diagnosis in the former group and to differentiate asthmatic patients from those with other respiratory conditions in the latter group.5

Intervention

The goal of the intervention was to encourage adherence to the NHLBI prescription guidelines in order to improve clinical outcomes while delivering cost-efficient asthma management. The targeted intervention program guidelines were developed by a panel of 5 pharmacists according to NHLBI guidelines. The intervention program targeted the following: (1) patients who overused quick-relief medications (ie, use of 1 or more short-acting inhalers per month or 8 or more inhalers per year) without using adequate long-term controller medications; and (2) patients who seemed to be non-compliant with their long-term controller medications, with or without the use of quick-relief medications. Case managers reviewed patients’ use of asthma medication; if either of the preceding problems were identified, asthma interventions were initiated for patients and their physicians to ensure that patients received appropriate asthma treatment.
An asthma management fact sheet was developed and sent along with the patients’ profiles, intervention letters, and response forms to the physicians of all the identified patients. In addition to the drug utilization review, sequential educational materials were mailed every 3 months to the study patients for the duration of the study intervention (1 year). The educational materials were designed to (1) increase patients’ understanding of asthma pathophysiology; (2) increase patients’ familiarity with commonly used asthma medications; and (3) optimize techniques for the avoidance of asthma attacks.

Statistical Analysis

Study patients were classified as either those with persistent asthma or those without persistent asthma (ie, with intermittent asthma) using the HEDIS 2000 asthma measure. Patients with persistent asthma identified in this study are not the same as patients with persistent asthma identified by the clinically focused NHLBI guidelines.

All medications used by study patients were classified by a panel of 5 pharmacists as either asthma or nonasthma medications. Additionally, asthma medications were classified as either quick-relief or long-term controllers and were categorized by therapeutic class (eg, β2-agonists, corticosteroids, mast cell stabilizers, leukotriene modifiers).4,15

A t test and chi-square analysis were performed to compare age and gender in patient groups. Since the distribution of costs and utilization of asthma services was skewed, a bootstrap method was used to calculate 95% confidence intervals for the differences in mean costs and utilization for each asthma patient before and after the intervention.16-18 A paired t test also was used to test the differences in various types of costs and associations associated with asthma treatment before and after the intervention. An analysis of covariance was performed to compare changes in treatment costs between the intermittent and persistent asthma groups, after adjusting for disparities in the treatment costs during the preintervention period.

The treatment cost per patient was calculated using the entire asthmatic study population. These costs included those associated with hospitalization, emergency room visits, physician visits, and medications. These asthma treatment costs were classified into 2 groups: asthma nonmedication costs (ie, costs of hospitalization, emergency room visits, and physician visits) and asthma medication costs.

The nominal dollars for 1998 were deflated by the healthcare price deflator for medical costs in order to convert to 1997 constant dollars.19 All statistical analyses were conducted with SAS software (SAS Inc, Cary, NC) and S-Plus (Insightful Co., Seattle, WA).

RESULTS

Sample Patients

The demographics of the sample patients are shown in Table 1. Of the 1616 patients who met the inclusion criteria for the study group, 566 patients had intermittent asthma and 1050 patients had persistent asthma. A total of 1512 patients had asthma as a primary diagnosis. The 104 patients who had asthma as a secondary diagnosis most commonly had the following disorders as their primary diagnoses: osteoarthrosis and allied disorders (19%), acute upper respiratory infections (14%), allergic rhinitis (12%), acute bronchitis and bronchiolitis (8%), and esophageal disease (5%).

The mean ages of patients comprising the intermittent and persistent asthma groups were 26.0 years and 29.9 years, respectively (P < .01). The greatest percentage of patients with intermittent asthma (40.5%) and persistent asthma (31.9%) were from 4 to 15 years old. No significant difference was found in gender between the groups (P = .879), and both groups included more females than males.

Asthma Treatment Costs

Asthma treatment costs per patient, grouped by asthma severity, are presented in Table 2. Nonmedication costs per patient increased from $73 to $172 (P = .017) in the intermittent asthma group, while there was a reduction in the persistent asthma group from $507 to $259 (P < .001). Both hospitalization and emergency room costs were $0 for patients with intermittent asthma before the intervention since HEDIS 2000 criteria for being classified as an intermittent asthmatic included no prior asthma-related admissions to the hospital or emergency room. Hospitalization and emergency room costs per patient declined by $148 and $15, respectively (P = .003 and P < .001), in the persistent asthma group. Physician visit costs per patient decreased from $73 to $69 (P = .649) in the intermittent asthma group. There was a significant decrease in these costs in the persistent asthma group from $197 to $114 (P < .001).

After the intervention patients with intermittent asthma had a significant increase in the medication...
cost per patient, from $27 to $49 ($P < .001), whereas this cost remained about the same during this time for patients with persistent asthma, increasing from $263 to $265 ($P = .938). Costs of long-acting controllers were more significantly increased than costs of short-acting controllers in the intermittent asthma group. Patients with persistent asthma had a slight increase in long-acting controller costs after the intervention, while short-acting controller costs decreased slightly.

Overall, after initiation of the intervention, treatment costs per patient with intermittent asthma increased from $100 to $221 ($P = .004), while these costs in patients with persistent asthma decreased from $767 to $524 ($P < .001). The 95% confidence interval estimated by the bootstrap method did not include zero in the cost differences in both intermittent ($74 to $221) and persistent (-$347 to -$170) asthma groups after the intervention program, indicating that our findings are of statistical significance.

After adjusting for the differences in observed treatment costs before the intervention, a significant difference remained between the intermittent and persistent asthma groups when trends in treatment costs before and after initiation of the intervention were compared ($P < .05).

Asthma treatment costs (including nonmedication and medication costs) per patient stratified by age group are presented in Figure 1. The intervention resulted in increased treatment costs in all intermittent asthma age groups. The largest proportional increase was observed in patients from 26 to 35 years old (from $169 to $573, a 239% increase) in the intermittent asthma group, while the smallest increase was observed in patients from 16 to 25 years old (from $113 to $135, a 19% increase).

Treatment costs decreased in all age groups of patients with persistent asthma after the intervention. A significant reduction in treatment costs was seen in patients 16 to 35 years old. Persistent asthma patients aged 26 to 35 years had the largest reduction rate (a 55.3% decrease, from $944 to $422) for treatment costs, while patients aged 36 to 45 years had the lowest reduction rate (a 24.5% decrease, from $595 to $449).

Utilization of Asthma Nonmedication Services and Medications

Table 3 shows the average utilization of asthma nonmedication services and the average number of asthma medication prescriptions using the total number of patients as the denominator. The frequencies of hospitalization and emergency room visits ($P = .003$ and $P < .001$, respectively) were reduced significantly in the persistent asthma group after the intervention. The average number of physician office visits was reduced in both the intermittent asthma group and the persistent asthma group, but the reduction was significant in patients with persistent asthma only.

Patients with intermittent asthma obtained an average of 1 to 2 asthma prescriptions during the study period, and patients with persistent asthma obtained an average of 8 to 9 asthma prescriptions during the study period. The number of prescriptions per patient in the intermittent asthma group increased significantly after intervention ($P < .001$); however, the use of the prescriptions by patients with

### Table 1. Demographics of Sample Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Intermittent Asthma Group (n = 566)</th>
<th>Persistent Asthma Group (n = 1050)</th>
<th>Total (n = 1616)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 – 15</td>
<td>229 (40.5)</td>
<td>335 (31.9)</td>
<td>564 (34.9)</td>
</tr>
<tr>
<td>16 – 25</td>
<td>60 (10.6)</td>
<td>110 (10.5)</td>
<td>170 (10.5)</td>
</tr>
<tr>
<td>26 – 35</td>
<td>73 (13.0)</td>
<td>115 (11.0)</td>
<td>188 (11.6)</td>
</tr>
<tr>
<td>36 – 45</td>
<td>111 (19.5)</td>
<td>222 (21.1)</td>
<td>333 (20.6)</td>
</tr>
<tr>
<td>46 – 55</td>
<td>93 (16.4)</td>
<td>268 (25.5)</td>
<td>361 (22.4)</td>
</tr>
<tr>
<td>Female gender</td>
<td>330 (58.3)</td>
<td>617 (58.8)</td>
<td>947 (58.6)</td>
</tr>
</tbody>
</table>

*Mean ± SD ages were 26.0 ± 16.7 for the intermittent asthma group, 29.9 ± 17.2 for the persistent asthma group, and 28.6 ± 17.1 for the study population as a whole.
persistent asthma decreased ($P < .001$). The use of both short-acting and long-acting controllers increased similarly in patients with intermittent asthma, but the use of both controllers in patients with persistent asthma decreased. The reduction in use of long-acting controllers (-0.69; $P < .001$) was less than the reduction in the use of short-acting controller (-0.30; $P = .009$) in patients with persistent asthma. The confidence intervals estimated by the bootstrap method for both groups (0.51 to 0.89 for the intermittent asthma group and -1.24 to -0.69 for the persistent asthma group) showed that the number of prescriptions for both groups changed significantly.

### Table 2. Asthma Treatment Costs per Patient*

<table>
<thead>
<tr>
<th>Asthma Treatment</th>
<th>Before Intervention†</th>
<th>After Intervention†</th>
<th>Mean Difference‡</th>
<th>Before Intervention†</th>
<th>After Intervention†</th>
<th>Mean Difference‡</th>
</tr>
</thead>
</table>
| **Intermittent Asthma Group**  
(n = 566)             |                      |                     |                  |                      |                     |                  |
| Nonmedication     | $73 ± $105$         | $172 ± $975$       | $99              | $100 ($52, $200)    | $259 ± $769$       | $248 ($352, $175) |
| Hospitalization   | $0                   | $93 ± $950$        | $93              | $94 ($50, $195)     | $131 ± $698$       | $149 ($244, $78) |
| Emergency room    | $0                   | $9 ± $50           | $9               | $9 ($6, $14)        | $14 ± $63          | $16 ($21, $12) |
| Physician visits  | $73 ± $105$         | $69 ± $152         | -$4             | -$4 ($16, $9)       | $260 ± $202        | $83 ($95, $68) |
| **Medication**    |                      |                     |                  |                      |                     |                  |
| Short acting      | $11 ± $17$          | $16 ± $37$         | $5               | $5 ($2, $8)         | $86 ± $122         | -$3 ($10, $7) |
| Long acting       | $16 ± $32$          | $34 ± $80$         | $18              | $18 ($12, $23)      | $232 ± $257        | $4 ($7, $13) |
| **Total**         | $100 ± $111$        | $221 ± $999        | $122            | $122 ($74, $221)    | $1747 ± $524       | $874 ($347, $170) |
| **Persistent Asthma Group**  
(n = 1050)            |                      |                     |                  |                      |                     |                  |
| Nonmedication     | $507 ± $1702$       | $259 ± $769$       | -$248           | -$247 ($352, $175) |
| Hospitalization   | $280 ± $1638$       | $131 ± $698$       | -$149           | -$148 ($244, $78) |
| Emergency room    | $30 ± $95$          | $14 ± $63          | -$16            | -$15 ($21, $12) |
| Physician visits  | $197 ± $260$        | $114 ± $202$       | -$83            | -$82 ($95, $68) |
| **Medication**    |                      |                     |                  |                      |                     |                  |
| Short acting      | $263 ± $280$        | $265 ± $322$       | $2              | $0 ($11, $16)       |
| Long acting       | $89 ± $109$         | $86 ± $122$        | -$3             | -$3 ($10, $7)       |
| **Total**         | $767 ± $1747$       | $524 ± $874$       | -$247           | -$246 ($347, $170) |

*Included are all asthmatic patients who participated in the study. Costs may sum incorrectly due to rounding.  
†Values are mean ± SD.  
‡Bootstrap mean difference with 95% confidence interval in the parentheses.
Asthma Medication Costs and Utilization

The number of asthma medication prescriptions per therapeutic class and the associated costs are reported in Table 4. The total medication cost increased from $15,087 to $27,841 after intervention in the intermittent asthma group and from $275,586 to $277,356 in the persistent asthma group.

Before the intervention, inhaled β₂-agonists accounted for the greatest proportion of prescription costs for patients with both intermittent and persistent asthma. However, after the intervention, inhaled corticosteroids accounted for the greatest proportion of prescription costs in both groups. The total cost of inhaled corticosteroids increased by 119.0% in the intermittent asthma group and decreased by 3.6% in the persistent asthma group during the same period. The cost of inhaled β₂-agonists increased by 42.9% in the intermittent asthma group, but decreased by 8.2% in the persistent asthma group.

The largest increase in medication costs was seen with the use of leukotriene modifiers after intervention in both groups. The largest proportional reduction in costs was seen with the use of oral β₂-agonists after intervention in both groups.

The number of asthma prescriptions obtained by patients with intermittent asthma increased from 670 during the 9-month period before the intervention to 1074 during the postintervention period. The number of asthma prescriptions obtained by the patients with persistent asthma decreased from 9600 to 8557. The largest reduction was seen in the number of prescriptions written for oral β₂-agonists in both groups: There was a 40.9% reduction in the intermittent asthma group and a 44.6% reduction in the persistent asthma group.

Although leukotriene modifiers accounted for the smallest portion of the total number of asthma prescriptions before the intervention in both groups, the greatest proportional increase was seen in the use of these agents: a 428.6% increase in the intermittent asthma group and a 142.9% increase in the persistent asthma group. The number of prescriptions for inhaled β₂-agonists increased by 75.1% in the intermittent asthma group, but decreased by 7.4% in the persistent asthma group. Similarly, the number of prescriptions for inhaled corticosteroids increased by 104.4% in the intermittent asthma group, but decreased by 10.8% in the persistent asthma group.

The trends of average cost per prescription for asthma medication (classified by therapeutic class)

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**Table 3. Number of Uses of Asthma Treatments per Patient**

<table>
<thead>
<tr>
<th>Asthma Treatment</th>
<th>Intermittent Asthma Group (n = 566)</th>
<th>Persistent Asthma Group (n = 1050)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Intervention†</td>
<td>After Intervention†</td>
</tr>
<tr>
<td>Nonmedication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitalization</td>
<td>0</td>
<td>0.02 ± 0.14</td>
</tr>
<tr>
<td></td>
<td>(P = .001)</td>
<td>(0.12, 0.03)</td>
</tr>
<tr>
<td>Emergency room</td>
<td>0</td>
<td>0.06 ± 0.32</td>
</tr>
<tr>
<td></td>
<td>(P &lt; .001)</td>
<td>(0.04, 0.09)</td>
</tr>
<tr>
<td>Physician visits</td>
<td>1.92 ± 1.58</td>
<td>1.80 ± 1.73</td>
</tr>
<tr>
<td></td>
<td>(P = .193)</td>
<td>(0.27, 0.03)</td>
</tr>
<tr>
<td>Medication</td>
<td>1.18 ± 1.03</td>
<td>1.90 ± 2.77</td>
</tr>
<tr>
<td></td>
<td>(P = .001)</td>
<td>(0.51, 0.89)</td>
</tr>
<tr>
<td>Short acting</td>
<td>0.78 ± 0.89</td>
<td>1.13 ± 1.74</td>
</tr>
<tr>
<td></td>
<td>(P = .001)</td>
<td>(0.23, 0.48)</td>
</tr>
<tr>
<td>Long acting</td>
<td>0.40 ± 0.67</td>
<td>0.77 ± 1.67</td>
</tr>
<tr>
<td></td>
<td>(P &lt; .001)</td>
<td>(0.25, 0.47)</td>
</tr>
</tbody>
</table>

* Included are all asthmatic patients who participated in the study.
† Values are mean ± SD.
‡ Bootstrap mean difference with 95% confidence interval in the parentheses.
before and after the intervention are presented in Figure 2. This figure shows a relationship between the total asthma medication costs and the number of asthma prescriptions as shown in Table 4. The average cost per prescription of a leukotriene modifier was highest in both groups after the intervention ($41.71 before and $71.46 after the intervention in the intermittent asthma group; $46.88 before and $66.80 after the intervention in the persistent asthma group).

The average cost for a prescription of an inhaled corticosteroid increased after the intervention in both groups. It was $42.02 before and $45.02 after the intervention in the intermittent asthma group and $47.40 before and $51.23 after the intervention in the persistent asthma group.

The average cost of a prescription for an inhaled β2-agonist was reduced in both groups after the intervention ($22.42 before and $18.30 after the intervention in the intermittent asthma group; $23.80 before and $23.61 after the intervention in the persistent asthma group). The average cost of an oral β2-agonist during the study period was approximately less than $8 per prescription for the intermittent asthma group and less than $16 per prescription in the persistent asthma group; it represented the lowest average cost per prescription.

DISCUSSION

The HEDIS 2000 asthma classification criteria used in this study were designed to evaluate treatment performance in a large population. We demonstrated that an intervention for asthma patients in accordance with NHLBI guidelines resulted in a significant reduction in treatment costs in patients with persistent asthma. The mean per patient reduction was $247 (a 31.7% decrease). This reduction was composed of a slight increase in asthma medication costs per patient by $1 (a 0.8% increase), but a significant decrease in costs associated with the use of hospitalization ($149; a 53.2% decrease), emergency room visits ($16; a 53.3% decrease), and physician office visits ($82; a 53.2% decrease). A similar trend was observed in utilization of these services in the persistent asthma group. However, costs and utilization of asthma services...
were increased in patients with intermittent asthma after the intervention.

These results are consistent with those of previous studies, which found a significant reduction in hospitalization and emergency room use by asthmatic patients after intervention. A significant increase in total treatment costs in the intermittent asthma group was due to increases in use of hospitals, emergency rooms, and asthma medications. Supporting these findings, 1 previous study involving patients with newly diagnosed mild asthma found no cost effectiveness or monetary net benefit as a result of intervention. Combining intermittent and persistent asthma patients resulted in a decrease in asthma nonmedication costs per patient from $354 to $228 (not reported in table) but an increase in asthma medication costs per patient from $180 to $190, which is consistent with the study by Groban et al.

Study patients were further stratified by age, and the impact of the intervention was influenced by this classification. Although treatment costs decreased in all age groups with persistent asthma, the largest reduction was seen in the 26-35 age bracket.

Contradictory to previous findings, initiation of an intervention program resulted in increased asthma treatment costs in patients with intermittent asthma. A possible explanation is that the intervention program increased patient awareness, which may have resulted in the perception that intensified treatment was advantageous within the limited time patients were observed. Thus, examining long-term effects of intervention in patients with intermittent asthma is recommended in future studies.

Consistent with the NHLBI guidelines, which recommend use of anti-inflammatory agents for maintenance therapy in all asthmatic patients except those with mild intermittent asthma, the number of prescriptions for corticosteroids was increased 2-fold after intervention in the intermittent asthma group. This increase was partially responsible for the increase in the total number of prescriptions dispensed to intermittent asthma patients, which suggests that case evaluations revealed that mismanagement or disease progression required intensified therapies.

Examination of use of leukotriene and steroid medications in asthmatic patients aged 11 years or younger showed a steroid-sparing effect. Two patients in the intermittent asthma group and 18 patients in the persistent asthma group used leukotrienes only after the intervention; before the intervention they were maintained on alternative medications. Fifty percent of these patients showed steroid-sparing effects when switched from a steroid to leukotriene. It seems leukotriene was used as a substitute for steroids in young (≤11 years old) asthmatic patients.

Previous studies have confirmed the clinical efficacy, as well as the cost effectiveness, of anti-inflamm-
drug-related costs; however, our intervention.

13,22,27-30 NHLBI guidelines specifically 

Use of inhaled anti-inflammatory therapy in combination 

with β2-agonists can significantly improve respiratory 

function while resulting in a small net increase in 

drug-related costs; however, our intervention 

resulted in an overall decrease in both the number 

of prescriptions for asthma medications and in treat-

ment costs. This intervention, which consisted of 

both a drug utilization review and an educational 

component, assisted in proper disease management 

and allowed for the removal of unnecessary medica-

tions. Prescribing patterns observed in our study 

were consistent with NHLBI guidelines.

Overall treatment costs in patients with primary 

asthma and in patients with secondary asthma were 

not significantly different. However, costs for hospi-

talization and physician visits were significantly dif-

ferent in the preintervention period; asthma 

medication costs were different in the postinterven-

tion period. No further analysis of cost differences 

was conducted for primary and secondary asthma 

patients, however, this analysis may provide useful 

information for future study.

It has been shown that structured asthma educa-

tion programs increase patient understanding of 

asthma and its management; decrease treatment 

costs; and improve outcomes by reducing the num-

ber of emergency room visits, absenteeism from 

work/school, and hospital admission in children12,25-27 

and adults.13,22,27,30 NHLBI guidelines specifically 

recommend that patients be provided with written 

asthma management plans and be educated on the 

proper use of inhalers and environmental factors 

that worsen asthma. The educational component of 

this intervention program informed patients on 

the avoidance of asthma triggers and taught them how 

to effectively handle an acute asthma occurrence.

The majority of previous studies seeking to eval-

uate the effectiveness of asthma therapies relied on 

randomized controlled trials with small samples.

Our study achieved its objective by using a large 

claims database, which permitted the evaluation of 

a large patient population and therefore lent statisti-

cal power. Using a large claims database also allowed 

for the evaluation of patients with various degrees of 

disease severity. The inclusion of patients whose 

asthma varied in severity provided a comprehensive 

picture of the possible impact of intervention and 

should be more useful to healthcare professionals 

and decision makers.

Much consideration went into this study’s design, 

methodology, and analysis; however some limita-

tions warrant discussion. Although the study fol-

lowed patients for 9 months after implementation of 

the intervention program, measuring comprehen-

sive impact of the intervention may take longer than 

that. The HEDIS 2000 asthma measurement criteria 

are unique in using minimal standards of care to 

define disease severity; however, justification for 

using this method to classify asthma patients has 

not been extensively pursued (eg, a patient who 

requires only 1 emergency room visit, regardless of 

symptom severity, is considered to have persistent 

asthma). Future studies evaluating the advantages 

and disadvantages of classification methods based on 

various disease severities and datasets are suggested.

Since this study was conducted using claims data, 

we could not evaluate the impact of intervention on 

medication compliance and the patient’s quality of 

life. In addition, patients could not be classified 

based on the clinical severity of their symptoms, as 

suggested by the NHLBI guidelines.4 Further inves-

tigations are warranted to measure physicians’ 

acceptance rate of NHLBI guidelines, to identify 

patterns of inappropriate use of asthma medication, 

to find factors that influence compliance, and to 

determine the correlation between patient classifi-

cations based on NHLBI guidelines and the HEDIS 

asthma measure.

CONCLUSION

The study demonstrated that a targeted asthma 

intervention, aimed at providing patient education 

and increasing appropriate prescribing of asthma 

medication as suggested by the NHLBI, resulted in a 

significant decrease in asthma treatment costs from 

the third-party payer’s point of view.

After implementation of the asthma program, 

patients with intermittent asthma experienced a sig-

nificant increase in their per patient treatment 

costs, whereas patients with persistent asthma expe-

rienced a significant reduction in their per patient 

treatment costs, specifically via a decrease in non-

medication costs (ie, hospitalization, emergency 

room, and physician visit costs). The most signifi-

cant reduction in treatment costs was observed in 

patients 26 to 35 years old.

After implementation of the intervention, medica-

tion costs significantly increased in the intermit-

tent asthma group, but did not change significantly 

in the persistent asthma group. Costs of long-acting 

medications were significantly increased in the 

intermittent asthma group after intervention,
whereas these costs were only slightly increased in the persistent asthma group.

The use of hospital, emergency room, and physician visits significantly decreased in the persistent asthma group after intervention. The number of medication prescriptions per patient significantly increased in the intermittent asthma group, but the persistent asthma group had a significant reduction. Among the different therapeutic classes of asthma medications, leukotriene modifiers had the greatest increases in use and cost in both groups in the postintervention period, whereas oral β2-agonists had the greatest decreases.

We recommend that further studies be conducted to determine effective methods to increase adherence to the asthma treatment guidelines and minimize the barriers to implementing asthma disease management programs.

Acknowledgments

We are grateful to Wendy Agnese, PharmD, and Yung-Seop Lee, PhD, for their contribution and helpful comments on the study.

REFERENCES