

The Economic Impact of an Urban Asthma Management Program

Michelle M. Cloutier, MD; Scott D. Grosse, PhD; Dorothy B. Wakefield, MS;
Tursynbek A. Nurmagambetov, PhD; and Clive M. Brown, MBBS, MPH, MSc

The mean healthcare expenditures for children with asthma are roughly 1.5 times higher compared with those for children without asthma.¹ This economic burden of asthma is disproportionately distributed among blacks and Hispanics, who have higher rates of hospitalization and emergency department (ED) visits than whites.²⁻¹² These higher costs are thought to be due to the greater asthma prevalence and severity among minority populations and to the consequences of uncontrolled asthma, which potentially could be reduced with improved asthma management.^{9,10,13,14}

However, asthma management guidelines^{15,16} disseminated by the National Asthma Education and Prevention Program (NAEPP), including the 2007 NAEPP Expert Panel Report 3, have not been widely adopted by primary care clinicians, and few studies have assessed the costs of guideline interventions. Of these, most have demonstrated cost savings only when used among individuals with severe disease or during times of high utilization (eg, hospitalization or ED visits).¹⁷⁻²²

Easy Breathing is an NAEPP guideline-adapted asthma management program that is used by more than 325 clinicians in Connecticut. Easy Breathing participants increased their use of inhaled corticosteroid (ICS) therapy for children with persistent asthma from 38% before program implementation to 95% after implementation.²³ These increases in ICS therapy were associated with decreases in hospitalizations, ED visits, and outpatient visits among urban minority children with asthma and with decreases in outpatient visits and ED visits among children cared for in private practices.²³⁻²⁵

The objectives of this study were to examine the costs associated with implementation of Easy Breathing in an urban setting, the cost changes associated with a decrease in medical services utilization and an increase in pharmacy charges for children enrolled in Easy Breathing, and the potential return on investment (ROI) from a managed care perspective. In Connecticut, the Medicaid agency placed most children under capitated managed care plans in 1996. Most of the plans reimbursed providers on a fee-for-service or contact capitation basis, which meant that the managed care plans were at risk for changes in utilization and costs. Consequently, any reduction in utilization of healthcare services by Medicaid-enrolled children with asthma resulted in direct cost savings to the Medicaid managed care plans during this period. No fees were charged to the plans by Easy Breathing.

Objectives: To examine costs associated with an asthma management program that reduces asthma-related health services utilization and to calculate potential return on investment (ROI) from the Medicaid managed care plan perspective.

Study Design: Cross-sectional.

Methods: Clinical and economic data were obtained for 3298 ethnically diverse children with asthma (48% with persistent asthma) who resided in a poor urban community (Hartford, Connecticut) and were enrolled in Easy Breathing, an asthma management program for pediatricians. We calculated the cost per participating child with asthma during the first 3 years (July 1998 to June 2001) relative to the difference in costs for participating and nonparticipating children calculated by applying Medicaid reimbursement rates to data on services.

Results: Start-up costs were \$28.95 per child with asthma in year 1, and operating costs averaged \$10.28 in years 2 and 3. The mean reduction in costs was \$36.72 per child per year in years 2 and 3. If Medicaid managed care plans had been charged an amount equal to program operating costs after year 1 (\$10.28 per child with asthma per year), at-risk health plans could have incurred cost savings of approximately \$26.44 per child with asthma per year. The potential ROI for years 2 and 3 was \$3.58 per US dollar spent.

Conclusions: Easy Breathing reduced overall costs of care for urban children with asthma of varying severities. If managed care plans held at risk by Medicaid had reimbursed program operating costs for participants in Easy Breathing, they would have experienced a positive ROI.

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Take-Away Points

Asthma-related costs in urban children can be reduced by simple programs that are designed to move practices toward compliance with recommendations for instituting inhaled corticosteroid therapy for children with persistent asthma and for creating a severity-appropriate, written asthma treatment plan.

- Improved health is associated with savings for at-risk public payers.
- Start-up and operating costs are modest (\$28.95 per child with asthma during the first year and \$10.28 per child with asthma in each subsequent year).
- The potential return on investment in implementing Easy Breathing for an ethnically diverse group of minority children was \$3.58 per US dollar spent.

and when other diseases have been excluded.²⁷ For children with asthma, the clinician determines asthma severity by asking 4 questions about the frequency of daytime and nocturnal symptoms, exercise impairment, and school absenteeism for asthma (provider assessment).²⁸ Treatment is chosen using the asthma treatment selection guide, a list of severity-appropriate medications grouped

ing, but our objective was to assess the potential ROI if fees had been assessed or paid voluntarily.

METHODS

Study Design

We projected financial effects for Medicaid managed care plans among children before and after enrollment in Easy Breathing. Although Easy Breathing was privately funded and not reimbursed by insurers, we modeled the potential financial effect as if the operating costs had been apportioned to the health plans. Specifically, we calculated the Medicaid payments associated with observed changes in utilization of healthcare services by Medicaid-enrolled children with asthma enrolled in Easy Breathing and subtracted the estimated changes in payments to clinicians resulting from changes in the utilization of services from the cost of the program.

The Easy Breathing program^{11,23} consists of the following 4 major elements: a survey, a provider assessment, an asthma treatment selection guide, and an asthma treatment plan. A fifth element, the assessment of asthma control, was added after the release of the 2007 NAEPP Expert Panel Report 3.¹⁶

The Easy Breathing Survey contains 15 questions, 4 of which have been validated for the diagnosis of asthma.²⁶ In addition, there are 2 questions about a previous diagnosis of and treatment for asthma, 1 family history question, and 8 demographic and environmental exposure questions. The survey is completed by the parents of children (age range, 6 months to 18 years) who present for care for any reason at any of the primary care clinics in Hartford, Connecticut, usually while the parent is waiting to be seen. Of 6 primary care clinics in Hartford, 2 are hospital-based clinics, 2 are federally funded health centers, and 2 are university-affiliated clinics. Using parent responses to the 4 asthma-validated questions, the child's medical record, and additional history and testing as needed, the clinician determines whether the child has asthma. Clinicians consider a diagnosis of asthma when children report recurrent (≥ 3) episodes of wheezing, cough, or shortness of breath in response to known asthma triggers

by potency, with annotation of which Medicaid plans cover which drugs. A preprinted asthma treatment plan with parent instructions is generated, to which the clinician adds the prescribed medications. The asthma treatment plan tells the parent what medications to use daily, when to use the sick plan and what medications to use, and who and when to call. A new asthma treatment plan is generated every time that treatment is changed. Changes in the asthma treatment plan that occurred within 12 months of the initial Easy Breathing Survey were assumed to reflect asthma control rather than changes in severity, as changes in intrinsic disease severity usually occur slowly over time.^{29,30}

Clinicians and staff participated in a 2-hour training session about how to use Easy Breathing and how to create a written treatment plan. Training and remediation were provided by a physician champion who was available for consultation and by a program coordinator who made weekly visits to pick up and review forms and to provide feedback to clinicians. During the first year, a pediatric pulmonologist provided on-site consultation and program-related education for 1 to 2 hours per week.

The Easy Breathing program and this study were approved by the institutional review boards at the University of Connecticut Health Center and Connecticut Children's Medical Center. They were also approved by the Centers for Disease Control and Prevention, with oversight deferred to Connecticut Children's Medical Center.

Personnel costs (physician champion and program coordinator) for program start-up (year 1) and ongoing support (years 2 and 3) were based on the grant that supported the program and the actual time spent in the various activities. The budgeted costs for personnel were compared with the estimated actual annual costs, and the larger of the 2 personnel costs was used in each case. Other costs (eg, travel and forms) were taken directly from the costs reported in the grant. Research-related costs (eg, database creation and data entry) were not included.

Program costs were examined by year and were separately tabulated for the first year and for the second and third years.

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Start-up during year 1 was associated with higher costs. The rationale was that it would not be reasonable to charge payers for start-up costs but that it would be reasonable for operating costs during years 2 and 3 to be apportioned to the payers. All costs are expressed in 2006 US dollars.

The healthcare costs associated with asthma (*International Classification of Diseases, Ninth Revision* code 493.xx), including hospitalizations, ED visits, outpatient visits, and asthma-related drug prescriptions, were estimated in 2 steps. First, observed utilization was calculated based on claims data and eligibility files that were obtained from Connecticut's peer review organization, Qualidigm, Inc, for Medicaid enrollees from July 1997 to June 2001. Second, 2006 Medicaid reimbursement rates in Connecticut were used as unit costs. This approach is consistent with the payer perspective for economic evaluation. The potential ROI to plans was calculated as the ratio of reduction in healthcare expenditures during years 2 and 3 to the mean program costs during the same years.

Asthma drugs were identified using National Drug Codes and were grouped into 4 categories (bronchodilators, ICSs, nonsteroidal anti-inflammatory drugs, and oral corticosteroids). The mean cost for a drug within each category in 2006 was multiplied by the number of filled prescriptions to yield the annual cost. The 2006 prices of prescription drugs for asthma and medical services were obtained from the Connecticut Department of Social Services.

Statistical Analysis

Healthcare services costs were calculated for 1 year before program implementation (July 1997 to June 1998) and for 3 years after program implementation (July 1998 to June 2001) for children who were continuously enrolled in Easy Breathing between June 1, 1998, and July 1, 2002. Each child contributed 1 month of person-time to the analysis for every month of claims data that were available at any point during the data analysis. During years 1 through 3, at any point in time there were children already enrolled in Easy Breathing and children not yet enrolled; all of these children contributed person-time and incident events such as hospitalizations to the analyses. We determined utilization by pooling the person-time and events of all children, both before and after their enrollment.²³ On average, children were Medicaid eligible for at least 10 months of each year.

For each child during the preenrollment and postenrollment periods in Easy Breathing per year, we calculated the following: the total number of paid claims for each of the asthma drug classes; the total number of hospitalizations, ED visits, and outpatient visits; and the total number of hospitalizations, ED visits, and outpatient visits for which the primary discharge diagnosis was asthma. Because all children contrib-

uted prior time to both the preenrollment and postenrollment periods, the preenrollment and postenrollment utilizations for an individual child are not independent. Therefore, marginal Poisson distribution regression models that were fit using generalized estimating equations were used.³¹ Predicted values from these equations were used to estimate utilization. All analyses were controlled for sex, race/ethnicity, clinic site, asthma severity, calendar time,³² and aging of the cohort to account for the uneven distribution of asthma rates by these variables.

RESULTS

The demographics of the children enrolled in Easy Breathing between June 1, 1997, and December 31, 2001, have been reported.²³ Claims data were identified for 8324 of 9339 children (89%) enrolled in Easy Breathing during this period. Of these, 3298 children were enrolled between July 1, 1997, and June 30, 2001, and had physician-confirmed asthma. Of 3298 enrolled children with asthma, 1569 (48%) were diagnosed as having persistent asthma (29% mild, 17% moderate, and 2% severe). Almost two-thirds of the children with asthma were Hispanic (primarily Puerto Rican), 22% were African American, and 5% were non-Hispanic white; the remaining 7% reported mixed or no race/ethnicity. One-third of the children were aged 6 months to 4 years, 38% were 5 to 9 years, 25% were 10 to 14 years, and the remaining children were 15 to 17 years. Thirty-four percent of the children with asthma reported exposure to environmental tobacco smoke. Claims data were available for 2841 children during year 2, of whom 2238 were enrolled in Easy Breathing, and for 2678 children during year 3, of whom 2386 were enrolled in Easy Breathing.

Program Costs

The total program start-up cost during year 1 divided by the number of children with physician-diagnosed asthma enrolled in the program in year 1 was \$28.95. The total program costs during the second and third years of the program divided by the number of children with physician-diagnosed asthma enrolled in the program during those years were \$10.28 (**Table 1**). These costs included the program coordinator's time to visit the sites and provide feedback and support and the physician champion's time to oversee the project's data quality.

Prescription Drug Costs

Children with asthma who were enrolled in Easy Breathing filled more prescriptions for ICSs and fewer prescriptions for oral corticosteroids in the 12 months after enrollment than children with asthma in the 12 months before their enroll-

■ **Table 1.** Easy Breathing Enrollment Numbers, Healthcare Expenditure Savings, and Program Costs^a

Variable	Year 1	Year 2	Year 3
No. of children with asthma enrolled and with claims	1533	2238	2386
Savings per child in healthcare expenditures after vs before enrollment in the program, \$	(31.94)	36.88	36.56
Program costs, \$			
Personnel ^b	43,250	22,275	22,943
Forms and supplies	750	750	750
Travel	388	388	388
Total	44,388	23,413	24,081
Program costs per child with asthma enrolled, \$	28.95	10.46	10.09
Potential return on investment as the difference between reduction in healthcare expenditures and program costs, \$	—	26.42	26.47

^aAdjusted to 2006 US dollars.

^bConsists of costs for physician champion and program coordinator.

ment in Easy Breathing (Table 2). However, the frequency of filled prescriptions for ICSs (123.6 prescriptions per 100 children per year) is far less than what would have been predicted from the asthma treatment plans. The increase in filled prescriptions for ICSs among children with intermittent asthma (from 6.2 to 22.3 prescriptions per 100 children per year) reflects reclassification of children to greater disease severity in the 12 months after enrollment. Within 6 months of enrollment in Easy Breathing (ie, completion of a survey), asthma therapy (and the classification of asthma severity) increased in 3.3% of children with intermittent disease. There was no change in the number of bronchodilator prescriptions for either group. As expected, expenditures for asthma drugs were higher among children with persistent asthma than among children with intermittent asthma.

Medical Service Utilization

Children with persistent asthma experienced significant decreases in the number of hospitalizations, ED visits, and outpatient visits for asthma after enrollment in Easy Breathing, while utilization rates for children with intermittent asthma were low before and after enrollment in Easy Breathing (Table 3). Consequently, after enrollment in Easy Breathing, there was a 48.5% decrease in the costs associated with medical services for children with persistent asthma but a 10.0% increase for children with intermittent asthma.

Potential ROI

Taking into account the difference in Medicaid reimbursements for children with intermittent and persistent asthma, the mean start-up cost (year 1) was \$31.94 per child. In years 2 and 3, there was a reduction in costs to Medicaid managed

care plans associated with ongoing support of the Easy Breathing program of \$36.72 per child per year. Assuming that managed care plans were assessed a fee equal to the mean cost of supporting the program (\$10.28), there was a net cost savings of \$26.44 per child in years 2 and 3. After the initial start-up, implementing Easy Breathing would have a positive ROI for Medicaid managed care plans that were at risk. If they paid the mean operating costs of the program in years 2 and 3, the ROI would have been \$3.58 to \$1.00.

DISCUSSION

Implementation of Easy Breathing has improved the health and decreased medical services utilization among urban minority children in Hartford with asthma. Children with asthma enrolled in Easy Breathing experienced a 35% decrease in overall hospitalization rates ($P < .006$), a 27% decrease in asthma ED visits ($P < .01$), and a 19% decrease in outpatient visits ($P < .001$).²³ This study was not subject to bias due to regression to the mean, as (unlike many other studies) our study did not enroll children after ED visits or hospitalizations or target enrollment of children with severe disease.^{17-21,33-35} Rather, any child with asthma who received care at any primary care clinic in Hartford for any reason was eligible for enrollment.

Over a 3-year period in which 3298 unique low-income Medicaid-enrolled urban children with asthma were enrolled, Easy Breathing helped to reduce direct medical care costs. The magnitude of the reduction in medical costs was such that, if a healthcare payer had been charged a fee equal to the mean operating cost of the program, the payer would have saved more than \$3.50 for each US dollar spent on the program. Be-

■ **Table 2.** Prescription Drugs and Drug Costs for Children With Asthma by Severity^a

Variable	Before Enrollment in Easy Breathing		After Enrollment in Easy Breathing		Cost Differential, \$
	No. ^b	Cost, \$ ^c	No. ^b	Cost, \$ ^c	
Persistent asthma					
Bronchodilators	280.8	4953.82	272.8	4811.86	141.94
Inhaled corticosteroids	78.4	8973.70	123.6	14,147.87	(5174.18)
Nonsteroidal	44.0	2482.73	30.4	1718.51	764.22
Oral corticosteroids	32.1	224.70	10.8	75.51	149.19
Total	—	16,634.95	—	20,753.75	(4118.83)
Intermittent asthma					
Bronchodilators	120.5	2125.27	128.1	2260.18	(134.91)
Inhaled corticosteroids	6.2	706.32	22.3	2551.32	(1845.00)
Nonsteroidal	7.3	410.96	5.9	332.60	78.35
Oral corticosteroids	13.3	93.09	5.6	39.26	53.82
Total	—	3335.64	—	5183.36	(1847.74)

^aControlled for asthma severity, sex, age, clinic, chronological time, and race/ethnicity.
^bNumber of prescriptions per 100 children per 12 months of eligibility.
^cBased on the mean unit cost of drugs in the category adjusted to 2006 US dollars.

■ **Table 3.** Medical Services Utilization and Associated Costs by Asthma Severity^a

Variable	Before Enrollment			After Enrollment		Cost Differential, \$
	No. ^b	Cost, \$ ^c	Unit Cost, \$	No. ^b	Cost, \$ ^c	
Persistent asthma						
Outpatient visits	116.0	4871.50	42	89.5	3757.57	1113.92
Emergency department visits	15.4	2456.16	159.50	10.6	1691.84	764.32
Hospitalizations	7.9	21,860.96	2782	3.4	9,572.86	12,288.09
Total	—	29,188.62	—	—	15,022.27	14,166.33
Intermittent asthma						
Outpatient visits	47.6	1997.18	42	41.3	1734.56	262.63
Emergency department visits	6.0	952.96	159.50	6.1	983.04	(30.08)
Hospitalizations	0.9	2503.80	2782	1.2	3302.23	(798.43)
Total	—	5453.94	—	—	6019.83	(565.88)

^aControlled for asthma severity, sex, age, clinic, chronological time, and race/ethnicity.
^bNumber of visits per 100 children per 12 months of eligibility.
^cBased on the mean unit cost of visits adjusted to 2006 US dollars.

cause the study was performed in multiple urban-based clinics with an ethnically diverse population, the findings are likely to be generalizable to inner-city populations, among whom the burden of asthma is especially high.

A major focus of Easy Breathing is the appropriate use of ICSs in children with persistent asthma in association with a written asthma treatment plan. Despite the demonstrated benefits of ICS use in managing asthma, ICSs are underpre-

scribed and underused by primary care clinicians and their patients.¹² Remarkably, patients with persistent asthma enrolled in Easy Breathing filled a mean of only 1.2 ICS prescriptions per year. Although we were unable to monitor free-sample dispensing, the use of over-the-counter asthma medications, or the use of nonsteroidal anti-inflammatory therapy for mild persistent asthma, it seems that patients are continuing to underuse prescribed asthma medications.³⁶ We did not assess

other elements of asthma management such as quality of life or measurements of pulmonary function, as the program staff did not directly contact participating children or their families and did not review individual medical records.

A significant increase in ICS use was observed among children with asthma in Hartford during the implementation of Easy Breathing. Before implementation, 38% of children with persistent asthma were prescribed an ICS, a percentage similar to what has been reported nationally.³⁷ Afterward, the use of ICSs increased to 95% among children enrolled in Easy Breathing and to 42% among children not enrolled in Easy Breathing. Although these increases occurred shortly after the release of the 1997 NAEPP guidelines,¹⁵ the release of the guidelines was not associated with any observable increase in ICS use nationally.³⁷ The small increase in ICS use among children not enrolled in Easy Breathing may have been due to a “halo” effect, as clinicians (trained to prescribe ICSs) stated that they were “using the program” with patients who were not enrolled in the program because of time constraints. However, the nonparticipants who were prescribed an ICS did not experience a reduction in medical costs.

The program’s simplicity, ease of use, and improved efficiency have encouraged adoption of the program by primary care clinicians. However, its simplicity also limited our access to data on other outcomes of asthma management such as quality of life or spirometry results. Statewide, 85% of practices that began using Easy Breathing more than 5 years ago are still using the program. The 2007 NAEPP Expert Panel Report 3¹⁶ recommends the formal assessment of asthma control in the domains of impairment and exacerbation risk. Easy Breathing now systematically assesses control at the time of a follow-up visit. It is too early to determine the effectiveness of this new element in managing asthma, but studies are under way.

This study has several limitations. We did not include fixed costs for facilities or other personnel costs (eg, respiratory therapists and receptionists). Therefore, our estimates are conservative. In addition, our results do not necessarily apply to the general non-Medicaid enrolled population of children, to uninsured children, or to children living in other geographic areas. It is also possible that unrecognized confounding factors such as changes in management practices or economic conditions unrelated to the program might have had an effect on the healthcare utilization and costs.

Costs of the program during the first year were greater than costs for subsequent years. In large part, this was because of personnel costs related to the activities of the physician champion at training sites, in program modifications, and during weekly visits to the practices. In expanding Easy Breathing beyond Hartford, we have reduced these costs significantly. The recruitment of the practices is largely performed by a pro-

gram coordinator, although a physician champion remains an essential element of the program; training is now completed over 1 hour during lunch by the physician champion, and the physician champion visits the individual clinics and practices once or twice a year instead of weekly. Consequently, the balance of financial benefits and costs is likely to be even more favorable than it was when the original Easy Breathing study was conducted in Hartford.

Our results show that asthma-related costs among urban children can be reduced when primary care clinicians implement a simple disease management program. Easy Breathing has moved practices toward compliance with recommendations for instituting ICS therapy for children with persistent asthma. Improved health, as evidenced by decreases in outpatient visits, hospitalizations, and ED visits, is associated with savings for public payers, including Medicaid managed care plans that are at risk as a result of reimbursing providers on a fee-for-service or contact capitation basis. Since 2008, Medicaid managed care plans in Connecticut are no longer at risk.

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Author Affiliations: From the Department of Pediatrics (MMC, DBW), University of Connecticut Health Center, Farmington; Asthma Center (MMC), Connecticut Children’s Medical Center, Hartford; National Center on Birth Defects and Developmental Disabilities (SDG); National Center for Environmental Health (TAN, CMB), Centers for Disease Control and Prevention, Atlanta, GA.

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Address correspondence to: Michelle M. Cloutier, MD, Asthma Center, Connecticut Children’s Medical Center, 282 Washington St, Hartford, CT 06106. E-mail: mclouti@ccmckids.org.

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