The Effect of Easy Breathing on Asthma Management and Knowledge

Michelle M. Cloutier, MD; Dorothy B. Wakefield, MS; Penelope S. Carlisle, MSN; Howard L. Bailit, DMD, PhD; Charles B. Hall, PhD

Objective: To determine whether Easy Breathing, an asthma management program, improves adherence to national asthma guidelines.

Design: Before and after intervention trial.

Setting: Six urban primary care clinics in Hartford, Conn.

Participants: Thirty-four primary care physicians, 37 midlevel practitioners, 32 nurses, and 69 pediatric and family practice residents and medical students.

Interventions: Knowledge was assessed before (pretest) and after (posttest) a training program and 12 to 18 months after (follow-up) implementing Easy Breathing. Questions were divided into factual, guideline recommendation, and guideline application.

Main Outcome Measures: The percentage of correct responses on the pretest, posttest, and follow-up tests; clinician adherence to national guidelines; and clinician attitudes.

Results: The percentage of correct responses on the pretest was higher for physicians (mean, 61%; 95% confidence interval [CI], 57%-65%) than for midlevel practitioners (mean, 54%; 95% CI, 50%-59%) (P = .01). Correct responses increased significantly on the posttest for physicians (mean, 77%; 95% CI, 74%-81%) in all 3 subgroups of questions (P < .001) and for midlevel practitioners (mean, 69%; 95% CI, 63%-75%) overall and for factual and guideline questions. On the follow-up test, improvements in factual and guideline responses disappeared for all clinicians but were sustained for applied questions (mean, 78% [95% CI, 63%-94%] for physicians and 65% [95% CI, 51%-78%] for midlevel practitioners). Adherence to prescribing guidelines after implementing Easy Breathing was 93% to 99% and was associated with a 3-fold increase in inhaled corticosteroid prescriptions. Physicians reported that they had integrated Easy Breathing into practice but did not think this represented a substantial change.

Conclusions: Easy Breathing increases clinicians’ knowledge and use of national guidelines. Primary care physicians believe they are adhering to guidelines even when they are not.

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Asthma is the most common chronic disease of children. Despite effective, available treatments, asthma is associated with high morbidity and significant mortality. Reducing asthma morbidity is a national health care objective, and to this end, the National Heart, Lung, and Blood Institute published consensus treatment guidelines in 1990 and 1997. The National Asthma Education and Prevention Program (NAEPP) guidelines recommend first-line use of anti-inflammatory drugs to reduce the airway inflammation and hyperresponsiveness that underlie chronic asthma and use of β-adrenergic agonists as “rescue” medications. Despite the wide dissemination of these guidelines, anti-inflammatory drugs are underprescribed. Factors associated with underprescribing include deficiencies in clinician knowledge, lack of self-efficacy and outcome expectancy, concerns regarding the safety of inhaled corticosteroids in children, and confusion regarding how to implement the guidelines in practice.

Easy Breathing, a copyrighted asthma management program for primary care clinicians, was developed in 1998. The goals of Easy Breathing are to improve the diagnosis, determination of disease severity, and treatment of asthma for disadvantaged, urban, primarily minority children. In this article, we describe the effect of Easy Breathing on clinician knowledge, adherence to asthma guidelines, and attitudes.
Easy Breathing is an asthma management program for clinicians who care for children who reside or receive their medical care in Hartford, Conn.16 Eighty-four percent of the children in Hartford are eligible for medical assistance, which is now administered entirely through managed care programs. Elements of the program have been previously described.16,17 The program was designed for busy primary care physicians who work in clinic settings with a high volume of patients. (It is available free of charge to qualified health care clinicians via an e-mail request to Dr Cloutier.) The program consists of a validated survey that is completed by the parents of all children (6 months to 18 years of age) who present for care, for any reason, at any of the 6 primary care clinics in Hartford.17 The survey has been previously described17 and consists of 4 questions related to asthma symptoms, 6 questions about triggers for symptoms, previous diagnosis of and treatment for asthma, and family history, and 8 demographic and environmental exposure questions. The Easy Breathing program and its educational components have been approved by the Institutional Review Board of Connecticut Children’s Medical Center. Children are diagnosed as having asthma by their primary care physician, who reviews their responses to the survey questions and their medical record and obtains additional history and testing as needed. Physicians consider a diagnosis of asthma when children report recurrent (>2) episodes of wheezing, cough, and/or shortness of breath in response to known asthma triggers, and when other diseases have been excluded. For children who are diagnosed as having asthma, asthma severity is determined by the physician with the aid of a separate written instrument. The asthma severity instrument consists of 6 questions about the frequency of daytime and nocturnal symptoms, exercise impairment, and frequency of emergency department visits, hospitalizations, intensive care unit admissions, and school absenteeism for asthma. For each child with asthma, a comprehensive management plan consisting of a daily sick and emergency treatment plan is developed using a severity-specific treatment selection guide and color-coded (by severity) peel-away labels. The medication labels are placed on a standardized, field-tested, written asthma treatment plan that tells the parent what medications to use daily, when to use the sick plan, what medications to use, and whom and when to call.16 Physicians can also prescribe asthma therapies not listed in the treatment selection guide. All aspects of Easy Breathing, however, are in compliance with the NAEPP asthma guidelines.

Before implementing Easy Breathing, clinicians at each site participated in 4 hours of training. Approximately 90 minutes of each training session was spent on how to use the Easy Breathing forms. The remainder of the time was spent discussing asthma demographics, pathophysiology, and medications and rationale for the recommendations for asthma management as outlined in the NAEPP guidelines. A pediatric pulmonologist (M.M.C. and others) was available for on-site consultation and was turned to the investigators for analysis.

The program is ongoing.

All physicians and midlevel practitioners (advanced practice nurses, pediatric nurse practitioners, and physician assistants) completed a 50-question pretest before the training session. All participants then received a 50-question posttest approximately 2 to 4 weeks after the training and a 50-question follow-up test 12 to 18 months after completion of the training session. Ten questions were repeated on the pretest, posttest, and follow-up test. Questions were divided into 3 categories. Factual questions dealt with symptoms of asthma, triggers for asthma, and asthma epidemiology. Guideline recommendation questions dealt specifically with NAEPP guideline recommendations, such as who should have a flu shot, pulmonary function testing, and/or an allergy evaluation. Guideline application or applied questions used clinical vignettes to determine whether physicians could determine asthma severity based on patient symptoms and choose appropriate asthma therapy. These questions also determined whether the clinician knew when and how to step up (increase) and step down (decrease) therapy. Sample questions are shown in Table 1. The tests were based in part on a previous asthma instrument that was modified and adapted for children.13 A panel of 4 specialists and 3 generalists reviewed all of the questions for clarity and consistency with the NAEPP guidelines. Questions in which there was disagreement were discussed using a modified Delphi approach and discarded or rewritten and retested.

Clinician adherence to NAEPP guidelines was determined by comparing patient treatment plans with the severity-specific treatment selection guide. As a further indication of adherence to treatment guidelines, information regarding the number and type of prescription refills for asthma medications were obtained for the year before beginning Easy Breathing and for the year after instituting Easy Breathing for children covered by all Medicaid managed care organizations. Clinical and utilization data were merged by a third party, identification information was encrypted, and the data were returned to the investigators for analysis.

Clinician attitudes toward Easy Breathing were investigated using a Provider Satisfaction Survey that was distributed to all clinicians 12 to 18 months after program implementation. The survey used a Likert scale (1, strongly agree, to 5, strongly disagree, with 3 indicating neither agree nor disagree) and focused on the effect of Easy Breathing on knowledge, self-efficacy (whether one can implement Easy Breathing), outcome expectancy (whether implementing Easy Breathing will improve asthma management and medical service utilization), and agreement with the guidelines.

For each of the 3 tests (pretest, posttest, and follow-up), both 2-sample t tests and Wilcoxon rank sum tests were used to compare the differences between physicians and midlevel practitioners. Overall scores and scores by question type (factual, guideline, and applied) were compared this way.

For physicians and midlevel practitioners, both paired t tests and Wilcoxon signed rank tests were used to compare change (pretest vs posttest, posttest vs follow-up, and so on) in overall scores and scores by question type.

Medical care for 73% of the Medicaid population in Hartford is provided in 6 primary care clinics. All clinics and all practitioners at the sites agreed to participate in the Easy Breathing program. Training began June 1, 1998, and was completed December 31, 1998. Thirty-four physicians, 37 midlevel practitioners, 32 nurses, and 69 pediatric and family practice residents and medical students participated in the Easy Breathing program.

The number of clinicians who completed the pretest and posttest is shown in Table 2. The overall response rate for the posttest was 65%, a response rate similar to what others have reported.15,19

Mean test scores on the pretest were higher for physicians than for midlevel practitioners (P = .01). Test scores increased for both groups on the posttest. The mean correct score for all physicians on the pretest was 61% (95% confidence interval [CI], 57%-65%) and increased on the posttest to 77% (95% CI, 74%-81%) (P < .001). The mean
Correct percentage score for all midlevel practitioners on the pretest was 54% (95% CI, 50%-59%) and increased on the posttest to 69% (95% CI, 63%-75%) (P = .001). Scores listed by question subgroups are shown in Table 3.

There was no difference in pretest subgroup scores for physicians compared with midlevel practitioners. Significant increases in the percentage of correct responses were noted on the posttest for physicians in all question subgroups, with the greatest improvement in responses to applied questions. Subgroup scores for factual and guideline questions increased for midlevel practitioners on the posttest; scores for applied questions were not significantly changed. On the posttest, physicians demonstrated a greater number of correct responses on applied questions compared with midlevel practitioners (P = .01). In the 12 to 18 months after implementing Easy Breathing, there was a 34% decrease in the number of primary care clinicians in Hartford secondary to a financial crisis caused by low reimbursement rates. Of potential respondents, the response rate for the follow-up test was 46%. Respondents were not different from nonrespondents in their overall scores or in the individual subgroup scores for either physicians or midlevel practitioners (P = .21). The mean percentage of correct responses for the follow-up test was 68% (95% CI, 60%-76%) for physicians and 59% (95% CI, 49%-69%) for midlevel practitioners. The differences in mean scores on the pretest and follow-up test were not statistically significant (physicians: P = .72; midlevel practitioners: P = .76).

Improvements in factual and guideline knowledge observed on the posttest were not sustained on the follow-up test. The mean scores for factual and guideline questions between the pretest and the follow-up test were not significantly different. The improvements made in the applied questions on the posttest were maintained on the posttest; scores for applied questions were not significantly changed. On the posttest, physicians demonstrated a greater number of correct responses on applied questions compared with midlevel practitioners (P = .01). In the 12 to 18 months after implementing Easy Breathing, there was a 34% decrease in the number of primary care clinicians in Hartford secondary to a financial crisis caused by low reimbursement rates. Of potential respondents, the response rate for the follow-up test was 46%. Respondents were not different from nonrespondents in their overall scores or in the individual subgroup scores for either physicians or midlevel practitioners (P = .21). The mean percentage of correct responses for the follow-up test was 68% (95% CI, 60%-76%) for physicians and 59% (95% CI, 49%-69%) for midlevel practitioners. The differences in mean scores on the pretest and follow-up test were not statistically significant (physicians: P = .72; midlevel practitioners: P = .76).

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by physicians \((P = .04)\), whereas midlevel practitioners showed further improvements on the follow-up test compared with the posttest \((P = .01)\). There was no difference in the pretest results for clinicians who completed the posttest and follow-up test and those who did not.

### GUIDELINE ADHERENCE

Clinician adherence to the NAEPP guidelines was determined by examining the specific therapy prescribed by the clinicians. Using initial asthma severity, overall clinician adherence to NAEPP prescribing guidelines ranged from 93% for moderate, persistent asthma to 99% for mild, persistent asthma. The lower rate of adherence to NAEPP prescribing guidelines for children with moderate, persistent asthma was due to use of leukotriene modifiers by some clinicians, which is currently not recommended in the NAEPP guidelines for asthma of this severity, but it is of potential benefit based on recent literature.4,20 When this therapy was excluded from the analysis, overall adherence to guidelines for inhaled corticosteroids was 98% to 99%. Clinician adherence to the NAEPP guidelines has not changed during the first 2 years, except for the use of leukotriene modifiers for children with moderate, persistent asthma, which has increased with time.

Another marker of NAEPP guideline adherence that was examined was referral to a subspecialist. Subspecialty referral for children with severe, persistent asthma was 58% in 1998 and was 70% in 2000.

### Table 3. Correct Responses by Different Groups of Clinicians to Categories of Questions on the Pretest, Posttest, and Follow-up Test*

<table>
<thead>
<tr>
<th>Clinician Type</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Follow-up Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fact</td>
<td>Guide</td>
<td>Applied</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Physician</td>
<td>63 (58-68)</td>
<td>67 (61-73)</td>
<td>54 (50-58)</td>
</tr>
<tr>
<td>Midlevel practitioner</td>
<td>53 (49-57)</td>
<td>62 (55-69)</td>
<td>53 (47-58)</td>
</tr>
<tr>
<td>Nurse</td>
<td>45 (40-50)</td>
<td>42 (36-49)</td>
<td>40 (35-45)</td>
</tr>
</tbody>
</table>

*There were 50 questions on the pretest and posttest and 30 questions on the follow-up test.

### Table 4. Prescription Drugs for Asthma by Asthma Severity for Children Before (1997-1998) and After (1999) Enrollment in Easy Breathing*

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Mild, Intermittent</th>
<th>Mild, Persistent</th>
<th>Moderate, Persistent</th>
<th>Severe, Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of inhaled corticosteroid prescriptions per child per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before enrollment</td>
<td>0.05 (0.01-0.12)</td>
<td>0.33 (0.23-0.44)</td>
<td>1.25 (0.86-1.72)</td>
<td>1.61 (0.82-2.67)</td>
</tr>
<tr>
<td>After enrollment</td>
<td>0.30 (0.21-0.41)</td>
<td>1.15 (0.95-1.38)</td>
<td>2.46 (1.96-3.02)</td>
<td>5.70 (3.4-8.59)</td>
</tr>
<tr>
<td>(P) value</td>
<td>.003</td>
<td>.001</td>
<td>.02</td>
<td>.009</td>
</tr>
<tr>
<td>No. of nonsteroidal inhaled anti-inflammatory prescriptions per child per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before enrollment</td>
<td>0.14 (0.09-0.19)</td>
<td>0.49 (0.35-0.66)</td>
<td>1.07 (0.67-1.57)</td>
<td>2.06 (0.74-4.04)</td>
</tr>
<tr>
<td>After enrollment</td>
<td>0.13 (0.07-0.20)</td>
<td>0.43 (0.31-0.57)</td>
<td>0.16 (0.05-0.33)</td>
<td>0</td>
</tr>
<tr>
<td>(P) value</td>
<td>.86</td>
<td>.66</td>
<td>.002</td>
<td>.007</td>
</tr>
<tr>
<td>No. of oral steroid prescriptions per child per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before enrollment</td>
<td>0.37 (0.26-0.50)</td>
<td>0.64 (0.51-0.77)</td>
<td>0.94 (0.72-1.18)</td>
<td>1.72 (1.0-2.64)</td>
</tr>
<tr>
<td>After enrollment</td>
<td>0.10 (0.04-0.19)</td>
<td>0.10 (0.06-0.15)</td>
<td>0.28 (0.19-0.39)</td>
<td>0.50 (0.13-1.10)</td>
</tr>
<tr>
<td>(P) value</td>
<td>.01</td>
<td>.001</td>
<td>.001</td>
<td>&lt;.04</td>
</tr>
<tr>
<td>No. of bronchodilator prescriptions per child per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before enrollment</td>
<td>1.28 (1.06-1.51)</td>
<td>2.32 (1.96-2.71)</td>
<td>4.06 (3.28-4.92)</td>
<td>11.33 (6.51-17.48)</td>
</tr>
<tr>
<td>After enrollment</td>
<td>1.64 (1.43-1.87)</td>
<td>2.56 (2.23-2.91)</td>
<td>4.52 (3.72-5.39)</td>
<td>10.15 (6.42-14.73)</td>
</tr>
<tr>
<td>(P) value</td>
<td>.10</td>
<td>.51</td>
<td>.60</td>
<td>.69</td>
</tr>
</tbody>
</table>

*Numbers represent the average number of claims in that category divided by the number of children in that asthma severity category. The 95% confidence intervals are shown in parenthesis. \(N = 860\).*

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severity ($P=0.1$). This pattern is in keeping with the NAEPP guidelines that recommend nonsteroidal anti-inflammatory therapy only in children with mild, persistent asthma. Overall, there was a 3-fold increase in prescribed inhaled corticosteroid therapy after implementing Easy Breathing. The increase in inhaled corticosteroid therapy was also associated with a decrease in oral corticosteroid therapy for asthma of all severities (Table 4).

### CLINICIAN ATTITUDES

All clinicians thought that the Easy Breathing training curriculum had increased their knowledge of asthma and the Easy Breathing program (Table 5). All clinicians felt positively toward the program, but for all other areas of the Easy Breathing program, midlevel practitioners were consistently more enthusiastic than physicians. Midlevel practitioners thought that Easy Breathing had significantly improved their ability to diagnose asthma, whereas physicians were less convinced. This was despite the observation that 18% of the children with asthma were newly diagnosed as having asthma through the program. Both physicians and midlevel practitioners did not believe strongly that Easy Breathing had replaced their former asthma management practice model.

<table>
<thead>
<tr>
<th>Clinician Type</th>
<th>Knowledge</th>
<th>Self-efficacy</th>
<th>Self-management</th>
<th>Guideline Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician</td>
<td>2.75</td>
<td>2.39</td>
<td>2.28</td>
<td>2.0</td>
</tr>
<tr>
<td>Midlevel practitioner</td>
<td>1.4</td>
<td>1.5</td>
<td>1.77</td>
<td>1.6</td>
</tr>
</tbody>
</table>

$P$-value for difference (Bonferroni adjusted for multiple comparisons) (1 indicates strongly agree; 5, strongly disagree; and 3, neither agree nor disagree).21

In our study, baseline clinician knowledge about asthma was low but similar to results reported by others.13,19 Although improvements in knowledge were found immediately after an intensive educational program, these improvements were not sustained. Educational programs, including continuing medical education courses and local programs, have not been effective in changing clinician behavior when used alone.23 With Easy Breathing, clinicians are guided to determine asthma severity, treatment, and adequacy of asthma control for every child with asthma in their practice. We believe that the daily, consistent repetition of this approach is the major strength of the Easy Breathing program and is the reason why improvements in asthma management (applied questions) have been sustained 1 year after program implementation. Whether such improvements would be sustained if the program were withdrawn is unknown, but based on other studies, we believe that it is unlikely.31 Easy Breathing has not, however, changed all elements of clinician adherence. The program has increased the number of patients with severe, persistent asthma who were referred to a specialist, but adherence to this element of the guidelines is not as high as that for anti-inflammatory drug use.

We did not have a control group. Thus, it is possible that general changes in clinician knowledge may have occurred during this 18-month program. We think this is unlikely since clinician behavior in using the guidelines has not significantly changed since their release in 1991.7,9-11

Easy Breathing was directly modeled after the NAEPP guidelines. This close adherence to the NAEPP guidelines and the support for the guidelines by the pediatric pulmonary specialists in the community markedly reduced the “disagreements” about asthma management by clinicians. In addition, the flexibility of the program that allowed clinicians to choose asthma therapy dispelled concerns about rigidity and challenges to autonomy in patient management. Feedback to clinicians, including specific clinician and clinic feedback, along with subspecialty availability, has reinforced this approach.

Previous studies have, in general, used either responses to clinical vignettes or prescribing behaviors as indicators of adherence to guidelines. Responses to surveys do not always correlate with actual practice behaviors.32 Results from other studies5,10,11 suggest that clinicians are more likely to use inhaled corticosteroids in clinical vignettes than in their actual prescribing behavior. For this reason, we used prescribing patterns and pharmacy prescriptions as further evidence of a change in behavior. Before Easy Breathing, only 18% of children with asthma in Hartford received a prescription for an in-
haled anti-inflammatory drug. After implementation of Easy Breathing, there was a significant increase in prescriptions for inhaled corticosteroids overall with appropriate use according to asthma severity. Bronchodilator use was unchanged, whereas oral corticosteroid therapy decreased. Although other aspects of medical services utilization are currently being examined, underuse of anti-inflammatory drugs has been associated with greater risk of fatal and near-fatal asthma and increased rates of hospitalization.11,33,34

Primary care clinicians readily accepted Easy Breathing into their practice. Clinicians particularly liked the asthma treatment guide that gave them a broad selection of potential appropriate therapies. Despite the ease of use, however, clinicians still expressed concerns about the length of time that managing this chronic disease imposed on their already busy schedules. The decline in the number of clinicians in Hartford has further heightened these issues. Nevertheless, adherence to prescribing guidelines is greater than 93%, with increased inhaled corticosteroid therapy and decreased oral corticosteroid use, suggesting fewer asthma exacerbations. Despite the significant changes in inhaled corticosteroid use in the community, clinicians did not believe that Easy Breathing had substantially changed their prescribing patterns. Clinicians believed that they were implementing appropriate asthma care before Easy Breathing began, and Easy Breathing has not changed this perception. This observation could explain in part why educational programs, such as continuing medical education courses, have not been effective in changing clinician behavior regarding asthma treatment. If clinicians think they are already using corticosteroids in their practice, they will not be motivated by continuing medical education courses to change their behavior.

In summary, the Easy Breathing program improved primary care clinician adherence to asthma guidelines, increased inhaled corticosteroid therapy, and decreased the need for oral corticosteroids in an urban community with a high prevalence of poverty and asthma. Studies using the program in other communities and in private practice settings are currently under way.

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Easy Breathing is available from the author (Dr Cloutier).

Corresponding author and reprints: Michelle M. Cloutier, MD, Connecticut Children’s Medical Center, 282 Washington St, Hartford, CT 06106 (e-mail: mclouti@ccmckids.org).

What This Study Adds

Despite the wide dissemination of asthma guidelines, anti-inflammatory drugs are underprescribed. Factors associated with underprescribing include deficiencies in knowledge, lack of self-efficacy and outcome expectancy, concerns regarding the safety of inhaled corticosteroids in children, and confusion regarding how to implement the guidelines in practice. In this article, we describe the effect of an asthma management program, called Easy Breathing, on clinician knowledge, adherence to asthma guidelines, and attitudes. We demonstrate that use of an asthma management program can improve clinician adherence to guidelines and increase anti-inflammatory therapy. We also demonstrate that Easy Breathing increases clinicians’ knowledge and use of national guidelines. Primary care physicians believe they are adhering to guidelines, even when they are not, which may explain, in part, why continuing medical education courses have been insufficiently ineffective in changing clinician behavior.

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22. Smith WR. Evidence for the effectiveness of techniques to change physician behavior. *Chest.* 2000;118(suppl 2):8S-17S.


**Correction**

In the Commentary titled “Genetic Epidemiology and Congenital Malformations: From the Chromosome to the Crib,” published in the April issue of the *ARCHIVES* (2002;156:315-320), there was an error in a statement on page 317 in the second and third sentences in the “Twin Studies” subsection. The sentences should have read as follows: “Twin studies are based on the premise that monozygotic twins share all of their genes, whereas dizygotic twins share, on average, half of their genes. Thus, if a birth defect resulted exclusively from fully penetrant genetic factors, monozygotic twins would share the malformation in 100% of twins studied, whereas dizygotic twins would be expected to share the malformation in 50% of twins studied.”