

# Emergency Department Allies: A Controlled Trial of Two Emergency Department–Based Follow-up Interventions to Improve Asthma Outcomes in Children

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## ABSTRACT

**OBJECTIVE.** We sought to study the impact of emergency department (ED)–based intensive primary care linkage and initiation of asthma case management on long-term, patient-oriented outcomes for children with an asthma exacerbation.

**METHODS.** Our study was a randomized, 3-arm, parallel-group, single-blind clinical trial. Children aged 2 through 17 years treated in a pediatric ED for acute asthma were randomly assigned to standard care (group 1), including patient education, a written care plan, and instructions to follow up with the primary care provider within 7 days, or 1 of 2 interventions. Group 2 received standard care plus assistance with scheduling follow-up, while group 3 received the above interventions, plus enrollment in a case management program.

**OUTCOMES.** The primary outcome was the proportion of children having an ED visit for asthma within 6 months. Other outcomes included change in quality-of-life score and controller-medication use.

**RESULTS.** Three hundred fifty-two children were enrolled; 78% completed follow-up, 69% were black, and 70% had persistent asthma. Of the children, 37.8% had a subsequent ED visit for asthma, with no difference among the treatment groups (group 1: 38.4%; group 2, 39.2%; group 3, 35.8%). Children in all groups had a substantial, but similar, increase in their quality-of-life score. Controller-medication use increased from 69.4% to 81.4%, with no difference among the groups.

**CONCLUSION.** ED-based attempts to improve primary care linkage or initiate case management are no more effective than our standard ED care in improving subsequent asthma outcomes over a 6-month period.

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### Key Words

emergency, asthma, intervention, chronic disease management

### Abbreviations

ED—emergency department  
CM—case management  
NAEPP—National Asthma Education and Prevention Program  
PCP—primary care provider  
CC—care coordination  
QoL—quality of life  
FAM—Fight Asthma Milwaukee  
ITG-CASF—Integrated Therapeutics Group Child Asthma Short Form

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**A**STHMA, WHICH AFFECTS >6 million US children, is a chronic disease marked by acute exacerbations that account for much of the associated morbidity.<sup>1-3</sup> Much of the care of these acute flare-ups is provided in emergency departments (EDs), with >728 000 ED visits for childhood asthma in 2000.<sup>1</sup> Because the ED is a frequent source of care for patients with asthma, it may have a role in chronic disease management as well.<sup>4</sup> A 2002 publication by an expert panel outlined multiple policy recommendations to improve childhood asthma outcomes.<sup>5</sup> Three of these recommendations focused on improving access to and quality of asthma health care services, improving primary asthma care, and providing case management (CM) for high-risk asthmatic children.

Linkage between the ED and the source of primary asthma care has been the subject of some investigation. In 1997, the National Asthma Education and Prevention Program (NAEPP) Expert Panel Report 2<sup>6</sup> emphasized the importance of ongoing preventive care and follow-up with a primary care provider (PCP) after acute care treatment in reducing asthma morbidity. However, although NAEPP guidelines recommend follow-up with a PCP within 3 to 5 days of an acute asthma exacerbation, numerous studies have demonstrated low rates of compliance with this recommendation.<sup>7,8</sup> A variety of strategies have been found to improve the rate of post-ED care follow-up, including scheduling of follow-up appointments at the ED visit, postdischarge telephone reminders, assistance with scheduling an appointment after ED discharge, assistance with child care, and transportation assistance.<sup>7,9-11</sup> However, none of these studies investigated the impact of such follow-up care on longer-term, patient-oriented asthma outcomes. In 1 study, adults with acute asthma who were given an appointment for primary care follow-up during the ED visit were less likely to relapse than those not given an appointment, suggesting that primary care follow-up may result in improved short-term outcomes; however, the impact on long-term outcomes and disease control is unknown.<sup>12</sup>

Another approach to improving disease control in children with asthma is comprehensive education, care coordination (CC), and CM. Asthma outreach has been demonstrated to improve various outcomes in children, but evidence is limited.<sup>13,14</sup> Moreover, the effectiveness of initiating CC and CM from the ED has not been studied previously.

The objective of our study was to evaluate the impact of 2 ED-based follow-up asthma care interventions on long-term outcomes in children with asthma. Outcomes studied included subsequent ED utilization, health-related quality of life (QoL), and controller-medication use.

## METHODS

### Study Design

This was a randomized, 3-arm, parallel-group, single-blind clinical trial. We compared standard ED care and follow-up to 2 alternative strategies: intensive primary care linkage and CC/CM. The study was reviewed and approved by the Children's Hospital of Wisconsin institutional review board, and informed consent for participation was obtained from the parent or guardian.

### Study Subjects

Children 24 months to 18 years of age treated at the Children's Hospital of Wisconsin ED for acute asthma were eligible to participate. Acute asthma was defined as wheezing or respiratory distress that was treated with at least 1 inhaled bronchodilator treatment, in a patient with a physician diagnosis of asthma, or in a patient with a prior history of wheezing treated with  $\beta_2$  agonists. Only patients who resided in Milwaukee County, Wisconsin, were included in this intervention study. In addition, because the standard asthma educational materials being used in the ED (including asthma care plans and the *Mastering Asthma* videotape)<sup>15</sup> were available only in English, families in which none of the primary caregivers were English-speaking were excluded. Patients with other chronic pulmonary disease (eg, cystic fibrosis, bronchopulmonary dysplasia) or presence of tracheostomy were excluded, as were those who had been previously enrolled in this study. Finally, we excluded those children who had previously received CC/CM, defined as a response of  $\geq 2$  to either of the following questions:

- "During the past year, how many times did a nurse visit your home to train you how to manage your child's asthma?"
- "During the past year, how many times did a nurse phone you to train you how to manage your child's asthma, NOT just to schedule an appointment?"

Participating subjects were also enrolled in the ED Allies tracking system, a Web-based computer database of ED visits for asthma or wheezing illnesses to 6 participating hospitals in the Milwaukee metropolitan area, including Children's Hospital of Wisconsin. Details of the tracking system are described elsewhere in this supplement.<sup>16</sup>

### Interventions

Subjects were assigned to intervention groups by simple random allocation using a computer-generated list. Group assignment was placed in a sealed, opaque envelope in a sequentially numbered study packet. After consent, each subject was enrolled using the next numbered packet. Figure 1 shows the flow of patients

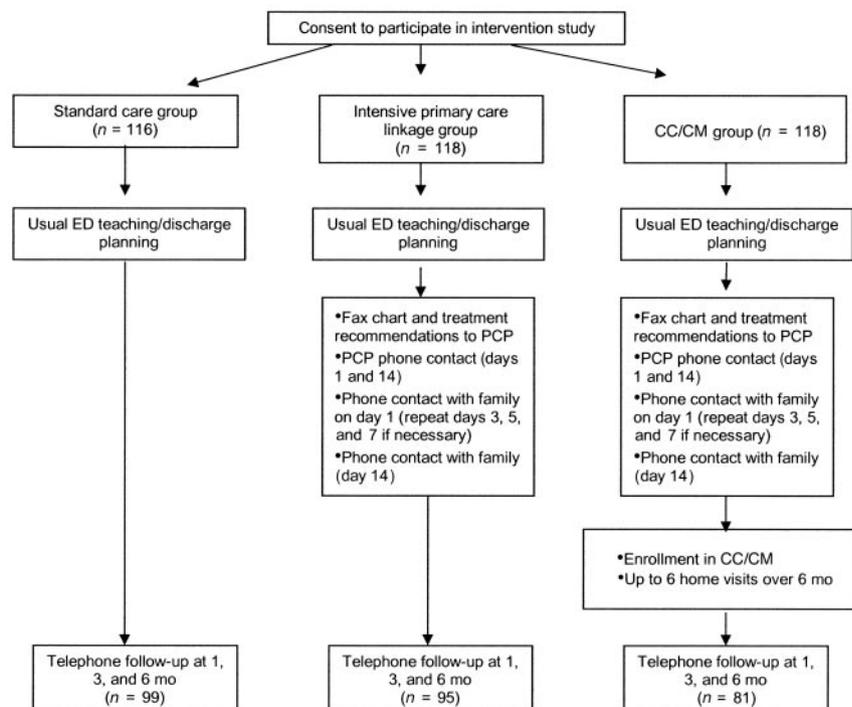


FIGURE 1  
Study procedure.

through the study and outlines the interventions for each group.

#### Standard Care (Group 1)

For patients assigned to group 1, usual ED education and discharge planning were provided. In the Children's Hospital of Wisconsin ED, the current standard of care before the study included:

- *Mastering Asthma* videotape (produced by the Nemours Center for Children's Health Media for the American Academy of Pediatrics) shown during the ED visit;
- assessment and teaching of proper use of peak-flow meter and metered-dose inhaler with spacer device;
- acute asthma medications as indicated for care of the current exacerbation;
- instructions to make follow-up appointment with PCP within 7 days; and
- written asthma care plan based on patient's chronic level of asthma severity.

#### Intensive Primary Care Linkage (Group 2)

Subjects assigned to the intensive primary care linkage arm of the study received the same asthma education and discharge planning as group 1. In addition, a copy of the ED chart and a letter with recommendations for an asthma care plan, based on the patient's chronic severity level as determined at the ED visit according to NAEP guidelines, were faxed to the PCP's office. On the next weekday after the ED visit, the research coordinator

telephoned the PCP's office to notify the provider of the patient's ED visit and inquire whether a follow-up appointment had been scheduled yet. All subjects in group 2 were also contacted by telephone on the day after the ED visit (or after hospital discharge for those patients who were admitted to the hospital) and asked if a follow-up visit had been arranged with their PCP. If not, the parent was asked if he or she wished to have assistance in making an appointment. For those parents or guardians wishing assistance, best times for an appointment were requested, and the study coordinator contacted the PCP's office directly to make the appointment. Similar follow-up calls were made on days 3, 5, and 7 after the ED visit or hospital discharge until an appointment was reported. Finally, 14 days after the ED visit, the family was contacted again to inquire whether the patient had had a follow-up visit. Reported visits were verified by a telephone call to the PCP.

Situations in which families reported not having a source of primary care were handled in 1 of 2 ways: those with insurance were instructed to contact their insurance carrier for a list of approved providers in their plan, and those with Medicaid or no insurance were given the telephone numbers for Milwaukee health clinics that were accepting new patients.

#### CC/CM (Group 3)

Subjects in group 3 received standard ED teaching and discharge planning, as well as the primary care linkage described above for group 2. In addition, these patients were enrolled in CC/CM, provided by the Fight Asthma

Milwaukee (FAM) Allies coalition. This program helped coordinate health and social services across different agencies and clinicians for children with asthma and their families.

For subjects who were randomly assigned to group 3, their ED record and referral for CC/CM services were faxed from the ED to the project coordinator. Within 2 days of enrollment, subjects were assigned to a nurse or social worker case manager based at a home health agency, a medical center, or the health department, depending on the subject's insurance coverage. The case manager made up to 6 home visits and several telephone calls during the 6-month follow-up period. During these visits and calls, the case manager:

- performed standardized asthma needs assessment and environmental and smoking assessments;
- identified and addressed family asthma goals by using a personalized care plan;
- provided asthma education by using the FAM Allies asthma tool kit<sup>17</sup> and additional materials; and
- made referrals to community and other services as appropriate.

### Measurements

Baseline data obtained on all subjects included demographic information, level of chronic asthma severity (using the National Heart, Lung, and Blood Institute classification system),<sup>7</sup> medication use and past asthma history (including self-reported hospitalization and ED visits), smoking status of family members and caregivers, and health-related QoL. We used the Integrated Therapeutics Group Child Asthma Short Form (ITG-CASF), a 10-item asthma-specific questionnaire completed by parents/caregivers. This instrument has been previously validated in the ED setting.<sup>18</sup> Higher scores indicate better QoL (range: 0–100).

At 1 and 3 months after the ED visit, families of children enrolled in the study were contacted by telephone to remind them of the ongoing follow-up and to determine if any change of address or telephone number was anticipated. Six months after the ED visit, follow-up information was obtained from the primary caregiver by telephone survey. This information included number of ED visits for asthma since the initial prestudy visit (index visit); number of hospitalizations for asthma since index visit; use of controller medications; ITG-CASF QoL assessment score; and smoking status of family and caregivers. The person performing the telephone interviews was blinded to the subjects' treatment-group assignment.

### Data Analysis

Descriptive statistics, with 95% confidence intervals, were calculated for study variables. The primary out-

come of interest was the proportion of patients in each group having any ED visits for acute asthma in the 6-month follow-up period. Proportions among the 3 treatment groups were compared by using a  $\chi^2$  test. For continuous variables, analysis of variance was used. Poisson regression was used for comparing the number of ED visits. When comparing use of controller medicines at follow-up, we used the Mantel-Haenszel method to adjust for baseline use of controller medicines. All statistical tests were 2-tailed, with an a priori significance level of  $P < .05$ .

Sample size was based on the ability to find, with 90% power, a relative 33% decrease in the proportion of patients with any ED visit. Assuming a 20% loss to follow-up, the target enrollment was 132 subjects in each of the 3 treatment groups.

## RESULTS

### Study Subjects

During the 16-month study period (February 2003 through May 2004), 1349 patients met the eligibility criteria and agreed to be entered into the ED Allies tracking system. Of those approached for enrollment in this trial, 57% agreed to participate, yielding a total of 352 subjects. The flow of study subjects is shown in Fig 1. Overall, 78% of the subjects completed follow-up. The characteristics of the study subjects in each group are shown in Table 1. There were no important differences among the groups in clinical and demographic features. Overall, 69% of the patients were black. The majority (70%) had persistent asthma; of these, 69.4% reported using controller medications at the time of their index visit. Enrolled patients had a median of 2 ED visits for asthma in the preceding 12 months, with 16.7% reporting  $\geq 5$  ED visits. Twenty-seven percent had at least 1 asthma-related hospital admission in the previous 12 months. The 77 patients lost to follow-up or excluded from the analysis were similar to those completing the study with regard to age (mean: 6.4 years for lost to follow-up versus 6.8 years for those who completed the study), chronic asthma severity (70% persistent asthma versus 61%), and ED visits in the previous 12 months (mean: 2.3 vs 2.4). Those lost to follow-up were more likely to have public insurance than those completing the study (80% vs 60%) and to be nonwhite (88% vs 78%).

Subjects who met eligibility criteria but were not enrolled in the study were similar to those who did participate, with a mean age of 6.8 years, a median of 2 ED visits in the previous 12 months, and 63% with persistent asthma.

### Interventions

For the patients in the 2 intervention groups who received intensive efforts to link patients back to primary

**TABLE 1** Baseline Characteristics of Study Participants According to Intervention Group

Characteristic at ED Visit	Usual Care (n = 99)	Intensive Primary Care Linkage (n = 95)	CC/CM (n = 81)
Mean age, y	6.4	7.1	6.8
Mean ITG-CASF score	54.5	58.9	57.1
Male, %	66.7	61.1	69.1
Race/ethnicity, %			
Black	66.7	70.5	70.4
White	22.2	23.1	18.5
Latino	8.1	5.3	9.9
Public insurance, %	66.7	60.0	53.1
Chronic severity index, % <sup>a</sup>			
Mild intermittent	28.2	31.7	31.3
Mild persistent	31.0	24.1	28.1
Moderate persistent	23.9	27.9	31.3
Severe persistent	16.9	16.5	9.4
Median ED visits in previous 12 mo	2	2	2
Median hospitalizations in previous 12 mo	0	0	0
Lives with smoker, %	39.8	36.5	41.1
Cared for by smoker, %	31.4	35.1	34.7
Uses controller medications, %	65.6	60.7	54.1
Uses controller medications, % of those with persistent asthma only	73.0	72.3	61.1

<sup>a</sup> Fifty-five subjects were missing baseline chronic severity categorization.

care, a total of 379 telephone calls were made. The median number of calls per patient was 2, with a mean of 2.25 and a range of 1 to 7. The total time required for the calls was 18.3 hours, for an average of 2.9 minutes per call and 6.5 minutes per subject. Overall, 71% of these subjects had a follow-up visit with the PCP in the 2 weeks after the ED visit.

In the CC/CM arm, 85 (72%) of 118 enrolled patients had at least 1 successful home care visit during the 6-month follow-up period. There were a total of 529 attempted home visits, including 345 successful home visits, an average of 4 per patient, and an average of 2 missed (ie, attempted but unsuccessful) visits per patient.

### Outcomes

During the 6-month follow-up period, 37.8% of the patients had at least 1 self-reported ED visit for asthma, with a median of 0 and mean of 0.59 visits. There were fewer visits recorded in the tracking system: 18.2% of patients had at least 1 visit, with a median of 0 and mean of 0.25 visits. Using either measure of subsequent ED visits, there were no significant differences among the 3 treatment groups (see Table 2). Those lost to telephone follow-up had somewhat fewer subsequent ED visits, with 9.2% having at least 1 ED visit in the tracking system ( $P = .061$ ). Patients in the tracking system who were eligible for the intervention study but did not participate were similar to those in the study, with 16.1%

**TABLE 2** Outcomes According to Intervention Group

Characteristic	Usual Care (n = 99)	Intensive Primary Care Linkage (n = 95)	CC/CM (n = 81)	P
Mean ITG-CASF score	75.1	77.2	77.7	.50
Mean change in ITG-CASF score from baseline	20.6	18.2	20.6	.62
Mean No. of ED visits (self-reported)	0.60	0.56	0.57	.99
Any self-reported ED visits, %	38.4	39.2	35.8	.90
Any ED visits recorded in tracking system, %	19.2	17.9	17.3	.94
Lives with smoker, %	39.8	42.7	36.5	.72
Lives with smoker, % of those living with smoker at baseline	88.8	90.3	83.3	.69
Cared for by smoker, %	29.4	33.3	24.3	.46
Cared for by smoker, % of those cared for by smoker at baseline	85.2	86.7	64.0	.077
Uses controller medications, % of those with persistent asthma only	84.8	88.6	68.9	.11 <sup>a</sup>

<sup>a</sup> Adjusted for controller use at baseline (Cochran-Mantel-Haenszel test).

having at least 1 visit and a mean of 0.19 visits per patient.

As shown in Table 2, patients in all 3 groups had a substantial increase in their asthma-specific QoL score from the time of the ED visit to the 6-month follow-up, with similar increases regardless of group assignment. Self-reported controller-medication use among patients with persistent asthma increased to 81.4% overall, but there was no significant difference in improvement in the 3 groups after adjusting for controller-medication use at baseline. Although there was no change in the percentage of patients reported to be living with a smoker in the 3 groups, there was a decrease in the percentage of children reportedly cared for by a smoker in the CC/CM group, but this was not statistically significantly different from the other groups.

We performed subgroup analyses restricted to the 163 children who reported frequent past ED use in the year before enrollment, defined as  $\geq 2$  visits in the previous 12 months. Subsequent ED use during follow-up was similar in all 3 treatment groups, with 45% of those in the standard care arm, 52% in the intensive primary care linkage arm, and 43% in the CC/CM arm reporting any ED visit in the 6-month follow-up period ( $P = .63$ ). There was a trend toward greater improvement in QoL scores in the 2 intervention groups: an increase of 19.9 points in the primary care linkage arm and 23.9 points in the CC/CM arm, compared with 17.9 points in the standard care arm, but the difference was not significant ( $P = .096$ ). Similar results were found when frequent past ED use was defined as  $\geq 3$  visits during the previous 12 months.

## DISCUSSION

Our results failed to demonstrate any important improvement in outcomes for children with asthma using 2 complementary approaches to follow-up care after an ED visit. Neither intensive efforts to promote early linkage back to primary care nor implementation of a home visit–based model of CC and CM led to decreases in the frequency of subsequent ED visits or significant improvements in other secondary outcomes measured.

These results are consistent with several other studies. Zorc et al<sup>7</sup> used a linkage intervention similar to ours, with a significant improvement in subsequent primary care visits after the ED visit but no difference in rates of controller-medication use, missed school days, or ED relapse at 4 weeks. Similarly, Smith et al,<sup>17</sup> in a study conducted from 1999 to 2001, were able to increase post-ED follow-up rates for children with asthma two-fold but without any difference in subsequent ED visits. Although we did not measure the rate of post-ED primary care follow-up in the control group, our rate of follow-up in the intervention groups was  $>70\%$ . This is higher than that reported by other groups attempting to improve follow-up in similar patient populations.<sup>8,19</sup>

Therefore, it is difficult to attribute the lack of effectiveness of this intervention to failure to achieve the desired follow-up; rather, it suggests that primary care follow-up alone is insufficient to produce improvements in longer-term outcomes and that the effectiveness of primary care may be an important factor.

Several recent studies have examined different provider interventions to improve the quality of primary asthma care, with variable results. In a study by Halterman et al,<sup>20</sup> who used school-based asthma screening and PCP notification regarding asthma severity, no differences were found in controller-medication use, environmental recommendations, referrals to specialty care, or symptom severity. Homer et al<sup>21</sup> performed a randomized trial of primary care practice improvement, with no effect on prescribing practices. An interactive physician asthma care education seminar had significant impact on prescribing and communications behavior of physicians and follow-up visits after an exacerbation but made no difference in ED visits and hospitalizations.<sup>22</sup> In contrast, the Pediatric Asthma Care Patient Outcomes Research Team II Study, using 2 approaches to process improvement (a physician education program and an organizational change intervention) found improvement in both process and clinical measures for children with asthma in a primary care setting.<sup>23</sup> These studies suggest that simple efforts are unlikely to be effective, but intensive, multilevel interventions may be beneficial.

We also were unable to show that that an alternative approach, supplementing primary care linkage with home-based CC/CM, had a positive impact on asthma-related QoL or ED visits. Again, this is consistent with some other studies, although the results of previous investigations have been mixed. Hughes et al<sup>24</sup> enrolled 95 children in a comprehensive home and ambulatory program for pediatric asthma and compared those children with a control group of children cared for in usual primary care. Study subjects had improvement in lung function, missed school, and self-management skills, but there were no differences in medical visits or recorded asthma symptoms. Moreover, 1 year after discontinuing the intervention, no differences between the groups were observed. In another study, a 1-year home care intervention for infants with wheezing produced increases in asthma-related knowledge and decreases in allergen levels but no difference in symptoms or frequency of exacerbations requiring medical care.<sup>25</sup> Conversely, subjects in the National Cooperative Inner-City Asthma Study showed improvement in symptom-free days using an individually tailored, multifaceted intervention provided by a trained asthma counselor.<sup>26</sup> This improvement persisted for 1 year after the end of the intervention. There was also a trend toward fewer ED visits and hospitalizations in the intervention group, although it was not statistically significant. Similarly, in their study of the effectiveness of an asthma education

and outreach program among Medicaid-insured children, Kelly et al<sup>27</sup> found decreased ED visits and hospitalizations compared with controls.

There are several possible reasons for the failure of our intervention to show a benefit. Our subjects had relatively high rates of controller-medication use at baseline, suggesting that primary asthma care in our community is already reasonably consistent with guidelines. In some of the previous studies, outcomes other than health care utilization (eg, symptom-free days or allergen exposure) were more amenable to improvement. The fact that there was a substantial, albeit not statistically significant, improvement in having non-smoking caregivers in our CC/CM group suggests that some outcomes may be more sensitive to change than ED visits. We assumed that patients coming to the ED for an asthma exacerbation would constitute a relatively high-risk group. Although our 36.6% rate of subsequent ED visits during the 6-month follow-up is similar to the 31% rate reported by Smith et al,<sup>19</sup> some of the other studies targeted more selected populations that might be more likely to benefit from these kinds of interventions. Selection bias is not likely to be an important factor; although only 57% of eligible patients who were approached agreed to participate in the study, nonparticipants were similar to those enrolled with regard to demographics and markers of asthma severity.

Our results may not be generalizable to other, more at-risk populations of children with asthma. However, we did not find an effect of the interventions even in higher-risk subgroups defined by greater past ED utilization. We also acknowledge the possibility of a Hawthorne effect, by which all groups may have improved because of the improvements in ED follow-up care associated with conduct of a clinical trial and knowledge by study participants that they were under observation. Finally, because our interventions were additive, we cannot exclude the possibility that our usual asthma care, which includes asthma education and care plans at discharge, may be benefiting patients.

## CONCLUSIONS

ED-based attempts to improve linkage of patients back to primary care or to initiate CC and CM are no more effective in improving subsequent asthma outcomes for children than standard ED care that incorporates patient education.

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## REFERENCES

1. National Center for Health Statistics. Asthma prevalence, health care use and mortality, 2002. Available at: [www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm](http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm). Accessed February 27, 2006
2. Stevens MW, Gorelick MH. Short-term outcomes after acute treatment of pediatric asthma. *Pediatrics*. 2001;107:1357-1362
3. Newacheck PW, Halfon N. Prevalence, impact, and trends in childhood disability due to asthma. *Arch Pediatr Adolesc Med*. 2000;154:287-293
4. Singer AJ, Camargo CA Jr, Lampell M, et al. A call for expanding the role of the emergency physician in the care of patients with asthma. *Ann Emerg Med*. 2005;45:295-301
5. Lara M, Rosenbaum S, Rachelefsky G, et al. Improving childhood asthma outcomes in the United States: a blueprint for policy action. *Pediatrics*. 2002;109:919-930
6. National Heart, Blood, and Lung Institute; National Asthma Education and Prevention Program. *Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD: National Institutes of Health; 1997. NIH publication No. 97-4051
7. Zorc JJ, Scarfone RJ, Li Y, et al. Scheduled follow-up after a pediatric emergency department visit for asthma: a randomized trial. *Pediatrics*. 2003;111:495-502
8. Leickly FE, Wade SL, Crain E, Kruszon-Moran D, Wright EC, Evans R 3rd. Self-reported adherence, management behavior, and barriers to care after an emergency department visit by inner city children with asthma. *Pediatrics*. 1998;101(5). Available at: [www.pediatrics.org/cgi/content/full/101/5/e8](http://www.pediatrics.org/cgi/content/full/101/5/e8)
9. Komorowski EM, Graham CJ, Kirby RS. A comparison of interventions to improve clinical follow-up compliance after a pediatric emergency department visit. *Pediatr Emerg Care*. 1996;12:87-90
10. Kallis JM, Gonzalez del Rey JA, Ruddy RM, Schubert CJ. Linking emergency department patients to primary care: phone vs face-to-face interaction. *Acad Emerg Med*. 1999;6:817-822
11. Nelson EW, Van Cleve S, Swartz MK, Kessen W, McCarthy PL. Improving the use of early follow-up care after emergency department visits: a randomized trial. *Am J Dis Child*. 1991;145:440-444
12. Emerman CL, Cydulka RK. Factors associated with relapse after emergency department treatment for acute asthma. *Ann Emerg Med*. 1995;26:6-11
13. Greineder DK, Loane KC, Parks P. A randomized controlled trial of a pediatric asthma outreach program. *J Allergy Clin Immunol*. 1999;103:436-440
14. Schulte A, Musolf J, Meurer JR, Cohn JH, Kelly KJ. Pediatric asthma case management: a review of evidence and an experimental study design. *J Pediatr Nurs*. 2004;19:304-309
15. Nemours Foundation, American Academy of Pediatrics. *Mastering Asthma*. Wilmington, DE: Nemours Center for Children's Health Media; 1998
16. Kelly KJ, Walsh-Kelly CM, Christenson P, et al. Emergency Department Allies: a Web-based multihospital pediatric asthma tracking system. *Pediatrics*. 2006;117(4 suppl):S63-S70
17. Fight Asthma Milwaukee Allies. *Asthma Tool Kit*. Milwaukee, WI: Children's Hospital and Health System; 2004
18. Gorelick MH, Brousseau DC, Stevens MW. Validity and responsiveness of a brief, asthma-specific quality-of-life instrument in children with acute asthma. *Ann Allergy Asthma Immunol*. 2004;92:47-51
19. Smith SR, Jaffe DM, Fisher EB Jr, Trinkhaus KM, Highstein G, Strunk RC. Improving follow-up for children with asthma after an acute emergency department visit. *J Pediatr*. 2004;145:772-777

20. Halterman JS, McConnochie KM, Conn KM, et al. A randomized trial of primary care provider prompting to enhance preventive asthma therapy. *Arch Pediatr Adolesc Med.* 2005;159:422-427
21. Homer CJ, Forbes P, Horvitz L, Peterson LE, Wypij D, Heinrich P. Impact of a quality improvement program on care and outcomes for children with asthma. *Arch Pediatr Adolesc Med.* 2005;159:464-469
22. Clark NM, Gong M, Schork MA, et al. Impact of education for physicians on patient outcomes. *Pediatrics.* 1998;101:831-836
23. Sullivan SD, Lee TA, Blough DK, et al. A multisite randomized trial of the effects of physician education and organizational change in chronic asthma care: cost-effectiveness analysis of the Pediatric Asthma Care Patient Outcomes Research Team II (PAC-PORT II). *Arch Pediatr Adolesc Med.* 2005;159:428-434
24. Hughes DM, McLeod M, Garner B, Goldbloom RB. Controlled trial of a home and ambulatory program for asthmatic children. *Pediatrics.* 1991;87:54-61
25. Klinnert MD, Liu AH, Pearson MR, Ellison MC, Budhiraja N, Robinson JL. Short-term impact of a randomized multifaceted intervention for wheezing infants in low-income families. *Arch Pediatr Adolesc Med.* 2005;159:75-82
26. Evans R III, Gergen, PJ, Mitchell H, et al. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. *J Pediatr.* 1999;135:332-338
27. Kelly CS, Morrow AL, Shults J, Nakas N, Strobe GL, Adelman RD. Outcomes evaluation of a comprehensive intervention program for asthmatic children enrolled in Medicaid. *Pediatrics.* 2000;105:1029-1035

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