Randomized Controlled Trial of Emergency Department Interventions To Improve Primary Care Follow-up for Patients With Acute Asthma*

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Objective: **Emergency department (ED) visits for asthma are frequent and may indicate increased morbidity and poor primary care access. Our objective was to compare the effect of two interventions on primary care follow-up after ED treatment for asthma exacerbations.**

Methods: **We performed a randomized controlled trial of patients 2 to 54 years old who were judged safe for discharge receiving prednisone, and who were available for contact at 2 days and 30 days. Patients were excluded if they were previously enrolled or did not speak English. Patients received usual discharge care (group A); free prednisone, vouchers for transport to and from a primary care visit, and either a telephone reminder to schedule a visit (group B); or a prior scheduled appointment (group C). Follow-up with a primary care provider for asthma within 30 days was the main outcome. Secondary outcomes were recurrent ED visits, subsequent hospitalizations, quality of life, and use of inhaled corticosteroids 1 year later.**

. *Results:* **Three hundred eighty-four patients were enrolled. Baseline demographics, chronic asthma severity, and access to care were similar across groups. Primary care follow-up was higher in group C (65%) vs group A (42%) or group B (48%) [p = 0.002]. Group C intervention remained significant (odds ratio, 2.8; 95% confidence interval, 1.5 to 5.1) when adjusted for other factors influencing follow-up (prior primary care relationship, insurance status). There were no differences in ED, hospitalizations, quality of life, or inhaled corticosteroid use at 1 year after the index ED visit.**

Conclusion: **An intervention including free medication, transportation vouchers, and appointment assistance significantly increased the likelihood that discharged asthma patients obtained primary care follow-up but did not impact long-term outcomes.**

(CHEST 2006; 129:257–265)

Key words: asthma; emergency department; follow-up; primary care

Abbreviations: CI = confidence interval; ED = emergency department; IQR = interquartile range; OR = odds ratio; PCP = primary care provider

There are approximately two million emergency department (ED) visits each year in the United States for asthma.[1] ED visits can be a marker for increased asthma morbidity related to poor management, poor compliance, and poor access to care.[2–5] In a large, prospective observational study[6] of asthma patients interviewed in 77 EDs, 91% of children and 65% of adults reported having a primary care provider (PCP); nonetheless, 63% of the children and 74% of the adults reported going directly to the ED when having a problem with their asthma.

Effective primary care reduces adverse outcomes from asthma.[4,7–9] The National Asthma Education and Prevention Program Expert Panel Report[10] recommends close primary care follow-up after an ED visit; however, primary care follow-up after discharge with an acute asthma presentation is surprisingly

low. ED interventions are needed to link patients with PCPs and to measure the effect of linkage on long-term outcomes such as ED visits, hospitalizations, and patient quality of life. Strategies for linkage between ED care and primary care may have important implications for other chronic health conditions as well.

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The primary objective of this trial was to compare the effect of two ED interventions on the rates of primary care follow-up for patients receiving either telephone reminders to make primary care appointments vs those receiving a telephone contact to give them an actual appointment. Secondary objectives were to determine the effect of these interventions on recurrent ED visits, quality of life, and the use of inhaled corticosteroids.

Materials and Methods

Setting and Study Design

We performed a randomized controlled trial from October 2000 to March 2002. Investigators at nine EDs chosen for geographic and patient diversity screened and enrolled patients for a median of 6 weeks. Enrollment periods were not simultaneous across sites. Each site chose a convenient time to begin the trial; once targeted enrollment was reached, no new patients were recruited. However, follow-up procedures continued for each enrolled patient for 12 months. The majority of sites were tertiary care teaching hospitals serving poor urban populations, but there were several that served suburban or rural populations (Appendix 1). Patients were managed at the discretion of the treating physician. The Institutional Review Board at each hospital approved the study, and informed consent and assent were obtained for all participants.

Selection of Participants

Patients who presented with a chief complaint consistent with acute asthma were eligible if they met the following criteria: (1) current asthma exacerbation including a new diagnosis of asthma made by the emergency physician; (2) age 2 to 54 years; (3) decision by the emergency physician to discharge the patient receiving prednisone; (4) ability to give informed consent; and (5) access to a telephone, cellular telephone, or pager with availability 2 days and 30 days after the visit. Patients were excluded if they were previously enrolled or did not speak English. Enrollment did not take place until the treating physician made the disposition decision. Therefore, patients received treatment without delay. Research assistants were present in the ED at each site during the hours of 7 AM to midnight, and therefore only patients who presented during this time were eligible for study participation.

The records of patients refusing enrollment or who were otherwise ineligible were reviewed for comparison, consistent with published guidelines.[11] Prior to the start of the trial, it was expected that some patients who were otherwise eligible would report no access to a PCP. These patients were included since a prior relationship with a PCP was considered an important variable, and they were referred to a PCP according to local practice. By default, the study protocol uses the term *primary care provider* to refer to follow-up providers working in an office or clinic based primary care setting. This included pediatricians, family physicians, internists, or nurse practitioners.

Data Collection, ED

The ED interview assessed demographics, chronic asthma severity, and access to care. Enrolled patients or caretakers of children were administered an ED questionnaire by research personnel. The questionnaire was a 51-item structured closed-question tool to ascertain demographic information, details of chronic asthma severity, and access to care. Participants also completed the Mini Asthma Quality of Life Questionnaire adapted with permission from previous work.[12,13] Administration of both questionnaires took approximately 15 to 20 min, and the questionnaires were administered only when the patient was clinically stable. At the completion of the interview, the patient was asked to provide at least two telephone numbers including cellular phones and pagers, and to indicate a preferred time for contact.

Randomization Procedure

Patients were randomly assigned to one of three groups based on consecutive study packets in stock at participating sites. Packets were prepared by a nonclinical investigator at the data-coordinating center using blocked randomization. They were sealed, coded, and mailed to all sites. Each packet was numbered with a three-digit code on the outside. The same three-digit code was also located on the inside and followed by a letter "A," "B," or "C" indicating the group assignment. Group A patients served as control subjects and received usual discharge care from the treating physician. This might have included medications, prescriptions, and instructions. No attempt was made to standardize usual discharge care.

For groups B and C (interventions), site investigators provided a 5-day course of prednisone and two transportation vouchers prearranged through a local taxi service and valued at $15.00 each. Investigators emphasized that the vouchers were to be used

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Presented in abstract form at the Annual Meeting of The Society for Academic Emergency Medicine, St. Louis, MO, May 2002.
This project was supported by an Emergency Medicine Foundation Center of Excellence Award (Dallas, TX).
Dr. Rowe is supported by the CIHR as a Canada Research Chair (Ottawa, ON). Ms. Clark is supported by grant T32 ES07069, and Dr. Camargo by grant R01 HL63841 from the National Institutes of Health (Bethesda, MD).
Manuscript received April 14, 2005; revision accepted August 11, 2005.

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for travel to and from the PCP and instructed the patient on how to fill out the voucher. The proper dose of prednisone was determined by the patient's weight and provided either as tablets in blister packs or liquid prednisone for pediatric patients. All patients received 2 mg/kg/d of prednisone up to a maximum of 50 mg/d.

All packets contained a general information sheet for patients and a permission for release of information to allow study personnel to contact the PCP for follow-up information. Only group C patients completed a preference-for-appointment form to assist in arranging their follow-up. Because of the nature of the intervention, it was neither desirable nor possible to blind patients to the study intervention.

Data Collection, Telephone Follow-up

Follow-up data were collected by telephone interview 2 days, 30 days, and 12 months following the ED visit. Telephone interviews were scripted and asked for verbal consent. Patients randomized to groups B and C were contacted 2 days after the initial ED visit. Group B patients were advised to make a follow-up appointment if they had not already done so. Group C patients were given a scheduled appointment made by a research assistant who had contacted primary care offices during the same or next business day. Patients in all three groups underwent a 10-min telephone interview approximately 30 days after the initial ED visit by another group of trained research assistants blinded to group assignment. Five attempts were made within a 5-day window. On contact, patients were encouraged to find the general information sheet given at discharge and to refer to the response options for the Mini Asthma Quality of Life questions. The purpose of the 30-day interview was to ascertain if the patient had experienced a relapse since the initial visit and the outcome of that visit.

PCPs were also contacted by telephone at 30 days to verify if the patient had obtained follow-up. For patients who were referred to a source of primary care on enrollment, this referral site was the primary care source contacted for follow-up verification. Only appointments that were kept were considered true visits. No attempt was made to ascertain if the visit was specifically for asthma.

Approximately 12 months after the index ED visit, patients were contacted by telephone by callers blinded to group assignment. Information obtained during this interview included how many times the patient sought care for asthma in the ED and in their physician's office, how many times the patient was hospitalized for asthma, the use of asthma medications in the past 24 h, and functional limitation due to asthma in the past 2 weeks.

Outcome Measures

The primary outcome for the study was whether patients presented to their PCP for asthma follow-up within 30 days of the index ED visit. Research assistants or investigators blinded to group assignment contacted each patient's PCP at 30 days to confirm appointments. Release of information forms were made available to the PCP's office if requested.

ED logs were reviewed daily during the study and for 1 month after termination to ascertain if any patient had a relapse that was not self-reported. Relapse was defined as any ED revisit for asthma prompted by a failure of symptoms to improve or resolve within 30 days after the index visit. No attempt was made to monitor ED visits of study patients to hospitals in the surrounding geographic area. Hospital information systems were also used to determine hospitalization of study patients after the index ED visit.

Data Analysis

Sample-size determination was based on an expected overall 30-day follow-up rate of 45%. For an absolute improvement in this rate of 20%, we calculated a required sample size of 70 patients with complete 30-day follow-up per group ($\alpha = 0.05$, $\beta = 0.20$). We anticipated a refusal/withdrawal rate of $< 10\%$ and therefore targeted a total study sample of 233 patients from all study sites combined.

Data were analyzed on an intention-to-treat basis. All analyses were performed using statistical software (STATA 7.0; StataCorp; College Station, TX). Data are presented as proportions (with 95% confidence intervals [CIs]), means (with SD), or medians (with interquartile range [IQR]). The baseline comparability of the two major comparison groups (group A vs groups B and C) and between intervention groups (group B vs group C) was determined by comparing variables from the ED questionnaire.

The association between intervention groups and other factors was examined using χ^2 test and Wilcoxon and Kruskal-Wallis rank tests, as appropriate. Age and sex were included in multivariate logistic regression models because of their potential clinical significance. Other variables associated with the outcome of interest at $p < 0.10$ in univariate analysis were evaluated for inclusion in multivariate logistic regression models. Based on prior studies,[16] we hypothesized that a prior relationship with a PCP would influence outcome and planned an *a priori* subgroup analysis of the relationship between PCP status and follow-up.

A manual stepwise process was used for variable selection in the multivariate model. Factors were entered into the model and assessed as confounders based on a 10% change in the point estimate. Factors that were not considered to be confounders were removed from the model. Age was assessed as a categorical variable (2 to 19 years, 20 to 35 years, and 36 to 54 years). Race/ethnicity was included in the model as a categorical variable with three groups: white, black, and Hispanic. Insurance status was dichotomized into two groups: having private insurance, and not having private insurance. History of smoking was defined if the patient reported being a current smoker or a former smoker. Although individual observations across sites are independent, they may not have been independent within a site. Accordingly, multivariate models were performed by clustering the results based on the site where each patient was enrolled. Clustering does not affect the point estimates but adjusts the SEs (CIs and p values) so that they are appropriate given the potential lack of independence. Results from the clustered and unclustered analyses were nearly identical, so only the clustered analysis results are shown.

Odds ratios (ORs) are presented with 95% CIs. The area under the receiver operator curve was calculated for the final multivariate logistic regression model and was further evaluated using the Hosmer-Lemeshow test.[14,15] All p values are two tailed, with $p < 0.05$ considered statistically significant.

Results

During the study, 1,067 patients were evaluated for acute asthma. A review of the logs identified 75 patients who were ineligible. Of the remaining 992 patients, 91 refused to participate and 517 were missed, leaving 384 patients who were eligible and enrolled (126 patients in group A, 126 patients in group B, and 132 patients in group C) [Fig 1]. Although eligible patients who were not enrolled were slightly older than those who were enrolled (25

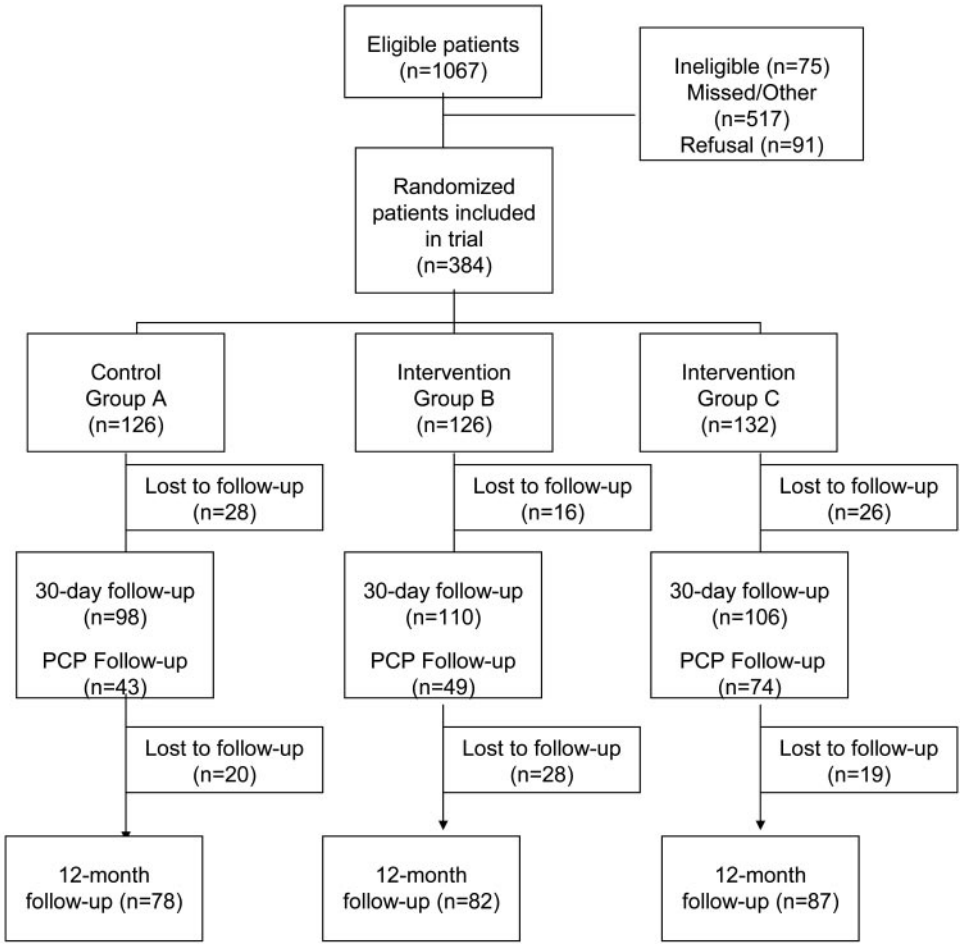

FIGURE 1. Patient flow diagram.

years vs 23 years) and were more likely to be black (57% vs 48%), these groups were similar with respect to sex and other demographic characteristics (insurance status, education, household income) and chronic asthma severity (data not shown). The two groups did not differ according to history of systemic steroid use (77% vs 78%) or history of hospitalization for asthma (61% vs 63%). While the two groups reported similar duration of symptoms (*eg*, symptoms < 24 h, 46% vs 44%) and use of pre-ED treatments (*eg*, β-agonists treatment within 3 h of ED arrival, 16% vs 15%), patients who were not enrolled were less likely to received steroid treatment in the ED (71% vs 86%).

Our main outcome, follow-up with a PCP at 30 days, was more common in group C patients compared to groups A or B. We were able to verify follow-up in 314 of 384 patients (82%). One hundred sixty-six of 314 patients (53%) visited their PCP. Subjects in group C were most likely to have a follow-up visit (group A, n = 43 [49%]; group B, n = 49 [49%]; group C, n = 74 [73%]; $p < 0.001$). Baseline asthma characteristics of patients according to intervention group are shown in Table 1. The groups were compared statistically at baseline to make sure randomization was appropriate. The three groups were similar with respect to demographic characteristics, chronic asthma severity, and severity of the current asthma exacerbation. We successfully contacted 89% of group B patients and 89% of group C patients at 2 days for telephone reminders. During the study period, 67 patients (21%) revisited the ED (mean, 14 days). The three groups did not differ according to relapse events (group A, n = 20; 20%; group B, n = 20; 18%; group C, n = 27; 25%; $p = 0.41$) or median number of days to relapse (group A, 19 days [IQR, 9 to 23 days]; group B, n = 15; IQR, 8 to 25; group C, n = 8; IQR, 3 to 20 days; $p = 0.13$).

Adjusting for other important factors influencing the likelihood of primary care follow-up, we performed a multivariate logistic regression. Factors included were age, sex, race, insurance status, prior relationship with a PCP, and history of smoking. The

Table 1—*Baseline Asthma Characteristics of Patients According to Intervention Group

Characteristics	Group A, Control (n = 126)	Group B, Intervention (n = 126)	Group C, Intervention (n = 132)
Demographic factors			
Age, yr	28 (11–39)	23 (9–37)	25 (10–39)
Female gender	68 (54)	66 (52)	78 (59)
Race			
White	23 (19)	36 (29)	37 (28)
Black	77 (62)	70 (56)	70 (53)
Hispanic	19 (15)	18 (14)	22 (17)
Other	5 (4)	2 (2)	3 (2)
High school graduate	94 (75)	95 (76)	101 (77)
Estimated household income, US	28,778 (21,346–37,250)	29,274 (22,889–37,769)	28,073 (22,830–33,410)
Insurance status			
Private	33 (27)	33 (27)	36 (27)
Medicaid	50 (41)	45 (37)	50 (38)
Other public	11 (9)	14 (11)	13 (10)
None	29 (24)	30 (25)	31 (24)
Has PCP	96 (76)	97 (77)	102 (77)
Chronic asthma factors			
Ever taken steroid medicine for asthma	85 (75)	88 (75)	104 (83)
Ever hospitalized for asthma	77 (62)	68 (54)	95 (73)
Ever intubated for asthma	11 (9)	15 (12)	19 (15)
Urgent clinic visits in past year	0 (0–2)	0 (0–2)	1 (0–3)
ED visits in past year	2 (0–4)	2 (0–4)	2 (0–4)
Admitted for asthma in past year	38 (30)	23 (18)	35 (27)
Ever smoked	51 (57)	38 (43)	50 (53)
Inhaled β-agonists during past 4 wk	105 (84)	106 (84)	110 (84)
Inhaled corticosteroids during past 4 wk	46 (37)	38 (30)	48 (36)
Other asthma medication during past 4 wk†	42 (33)	32 (25)	35 (27)
ED as usual site for problem asthma care	81 (67)	83 (68)	86 (66)
ED as usual source of asthma prescriptions	53 (45)	46 (39)	41 (33)
Presentation			
Duration of symptoms < 24 h	61 (49)	40 (40)	58 (44)
Inhaled β-agonist puffs within 6 h of ED‡	6 (1–12)	4 (1–12)	4 (0–12)
Severe symptoms§	101 (81)	90 (71)	98 (74)
ED course			
Inhaled β-agonists in first hour	1 (1–2)	1 (1–2)	1 (1–2)
Inhaled β-agonists over ED stay	3 (2–4)	2 (2–3)	3 (2–4)
Received steroid treatment in ED	105 (88)	106 (87)	108 (84)
Received other asthma treatments in ED‖	80 (64)	74 (59)	73 (56)
ED length of stay, min	206 (160–297)	185 (154–248)	198 (140–290)

*Data are presented as No. (%) or median (IQR).
†Other than β-agonist or steroid treatments.
‡Each nebulizer treatment was counted as equivalent to six "puffs" from a metered-dose inhaler.
§See "Materials and Methods" for details.
‖Other than β-agonist, anticholinergic, antibiotic, or steroid treatments.

intervention for group C remained significant (OR, 2.8; 95% CI, 1.5 to 5.1). This model gave a good fit to the data with a Hosmer-Lemeshow test statistic of 12.44 with 8° of freedom (p = 0.13). The area under the receiver operator curve was 0.78. Factors thought to affect follow-up rates (*eg*, prior PCP relationship, race, and insurance status) were used to stratify the cohort and assess the impact of the intervention on follow-up rates in specific subgroups (Table 2). After stratification, the differences remained significant in most subgroups. Among patients with 30-day follow-up who did not have a PCP at enrollment (n = 59), those randomized to group C were more likely to visit a PCP after their ED visit (group A, 3 of 16 patients; 19%; group B, 7 of 23 patients; 30%; group C, 9 of 20 patients; 45%; p = 0.06).

The 70 patients unavailable for follow-up were similar to the 314 patients with verifiable follow-up. Patients who were reached for 30-day follow-up had a similar age distribution to those who were not reached (25 years vs 27 years, respectively). The two groups also did not differ according to sex (56% female vs 50% female) or black race (62% vs 56%). Other demographic characteristics, such as education, estimated median household income, and hav-

Table 2—*Analysis of the Relationships Between Study Group and PCP Follow-up, Stratified by Selected Baseline Demographic Characteristics

Variables	Group A	Group B	Group C
Age, yr			
2–19	1.0 (reference)	1.3 (0.6–3.0)	3.4 (1.4–8.3)†
20–35	1.0 (reference)	2.3 (0.8–6.9)	2.3 (0.8–6.6)
36–54	1.0 (reference)	0.7 (0.3–1.9)	3.0 (1.1–8.2)†
Sex			
Female	1.0 (reference)	1.7 (0.8–3.5)	3.2 (1.6–6.6)†
Male	1.0 (reference)	0.9 (0.4–1.9)	1.8 (0.8–4.0)
Race/ethnicity			
White	1.0 (reference)	0.5 (0.1–1.8)	0.9 (0.3–3.3)
Black	1.0 (reference)	1.6 (0.8–3.2)	3.0 (1.5–6.0)†
Hispanic	1.0 (reference)	1.5 (0.3–7.6)	4.0 (0.8–19.8)
Insurance status			
Private	1.0 (reference)	1.7 (0.6–4.9)	1.7 (0.6–4.6)
No private	1.0 (reference)	1.1 (0.6–2.1)	3.0 (1.6–5.6)†
PCP status			
Has PCP	1.0 (reference)	1.2 (0.6–2.1)	2.4 (1.3–4.4)†
No PCP	1.0 (reference)	2.5 (0.6–11.0)	5.2 (1.2–21.7)†

*Data are presented as OR (95% CI).
†Statistically significant at $p < 0.05$.

ing a PCP, also did not differ according to follow-up (data not shown). The groups were equally likely to report a history of systemic steroid use (78% vs 74%), history of hospitalization for asthma (62% vs 68%), recent use of inhaled corticosteroids (35% vs 30%). With regard to the index ED visit, patients who were reached for 30-day follow-up were similar to patients who were not reached with respect to reporting severe symptoms (75% vs 80%) and steroid treatment in the ED (87% vs 82%). The patient flow diagram (Fig 1) shows the distribution of patients in each study group who completed all study procedures up to and including the 12-month follow-up telephone call.

Twelve months after the index visit, we contacted the patients by telephone. Overall, 247 subjects (65%) were reached, with equal likelihood for each group (group A, 63%; group B, 65%; group C, 66%; $p = 0.88$). Patients who were reached had a similar age distribution to those who were not (25 years vs 26 years, respectively; $p = 0.51$). The two groups also did not differ according to sex (55% female vs 56% female, respectively; $p = 0.93$) or race ($p = 0.78$). Patients who were reached for 12-month follow-up were more likely to have a PCP at study initiation (81% vs 68%, $p = 0.003$) but did not differ according to other demographic characteristics, such as education and estimated median household income (both $p > 0.20$). The groups were equally likely to report a history of systemic steroid use (78% vs 76%, $p = 0.73$), history of hospitalization for asthma (62% vs 65%, $p = 0.46$), and recent use of inhaled corticosteroids (34% vs 36%, $p = 0.66$). With regard to the index ED visit, patients who were reached for 12-month follow-up were similar to patients who were not reached with respect to reporting severe symptoms (76% vs 74%, $p = 0.63$) and steroid treatment in the ED (87% vs 84%, $p = 0.37$).

Group B and group C interventions did not affect long-term asthma outcomes (Table 3). Intervention groups did not differ in urgent clinic visits or ED visits for asthma over 12 months. Risk of asthma hospitalization was also similar, as was the percentage of patients reporting regular use of inhaled corticosteroids.

Discussion

This randomized controlled multicenter trial found that the intervention that included an already

Table 3—*Twelve-Month Follow-up of Patients According to Intervention Group

Variables	Group A, Control (n = 78)	Group B, Intervention (n = 82)	Group C, Intervention (n = 87)	p Value
Urgent clinic visits in past 12 mo	0 (0–2)	1 (0–3)	0 (0–2)	0.39
ED visits in past 12 mo	0 (0–2)	1 (0–3)	1 (0–3)	0.13
Admitted for asthma in past 12 mo	7 (9)	12 (15)	16 (18)	0.23
Inhaled corticosteroids during past 4 wk	34 (44)	42 (51)	37 (44)	0.55
Leukotriene modifiers during past 4 wk	24 (31)	24 (29)	25 (29)	0.97
Acute asthma severity in the preceding 24 h†	25 (32)	23 (28)	28 (33)	0.63
Shortness of breath during past 2 wk				0.47
All the time to a good bit of the time	22 (28)	20 (24)	31 (36)	
Some of the time	14 (18)	16 (20)	11 (13)	
A little of the time to none of the time	42 (54)	46 (56)	43 (51)	
Activity limitation during past 2 wk				0.77
Totally to very limited	9 (12)	9 (11)	8 (9)	
Moderate limitation	6 (8)	9 (11)	12 (14)	
Some to no limitation	63 (81)	64 (78)	65 (76)	

*Data are presented as median (IQR) or No. (%).
†Acute asthma severity same or worse than during index ED visit.

scheduled appointment increased 30-day follow-up visits with a PCP compared to the intervention that only utilized a telephone reminder and compared to usual discharge care. The difference in primary care follow-up between the intervention group given appointments (group C) and the other two groups remained statistically significant even after adjustment for other factors associated with enhanced follow-up. Moreover, there was no difference between patients "advised" to follow-up with their PCP and those who received free prednisone, a taxi voucher, and a reminder telephone call.

Our results differ slightly from those of a prior study[16] that examined a similar ED strategy. Baren et al[16] conducted a randomized controlled trial of adult asthma patients discharged from a single ED. Patients were randomized to usual care vs an intervention identical to group B in the current study. Primary care follow-up 30 days after the ED visit was more common in patients who received the intervention. Forty-six percent of intervention patients and 29% of control patients followed up with their PCP (relative risk, 1.6; 95% CI, 1.1 to 2.4). When adjusted for other variables associated with follow-up, the intervention was still associated with increased follow-up (OR, 3.0; 95% CI, 1.5 to 6.3).[16]

In the current study, this particular intervention (group B) did not increase primary care follow-up. This could be explained by differences in the two study populations. The previous study enrolled patients from one urban academic center caring for adult, mostly African-American patients.[16] Epidemiologic studies[6,7,17] of asthma have shown that African Americans (both adults and children) have greater asthma morbidity as reflected in a number of ways including the frequent utilization of ED services and the failure to obtain access to primary care. The current study population had mixed age, racial, and socioeconomic demographics. Access to a PCP for routine care has been shown to be better for children with asthma than for adults, and better for adult asthma patients who are not frequent users of the ED for asthma care.[6,18] These factors may at least partially explain the observation that the advised control group in this study achieved a much higher rate of primary care follow-up (45%) than the original single-site study (29%).[16] We chose not to perform a *post hoc* analyses of outcomes in patients with and without primary care physician follow-up since such analyses would no longer involve randomized groups and thus the important advantages of randomization (groups balanced for both measured and unmeasured confounders) in enhancing internal validity would be lost

Since multiple components were part of the follow-up interventions, it is not certain which part enhanced follow-up. The time that study personnel spent with patients may have increased compliance with follow-up in all groups via the Hawthorne effect. However, making the follow-up appointment was the distinctive part of intervention group C that resulted in significantly better follow-up. This finding is consistent with observations that ED patients are often noncompliant with appointment making.[19,20] Thomas et al[19] determined that 33% of patients who had been instructed to make a follow-up appointment did not do so. Based on our results and the results from these other studies, it is reasonable to conclude that assistance with making an appointment was responsible for the effectiveness of our intervention.

Other studies[19–22] have also shown increased appointment keeping when personnel are available to assist patients in making such appointments. In a similar study, Zorc et al[23] performed a randomized trial of pediatric asthma patients who were discharged from an urban pediatric ED. Intervention patients were assisted in making a primary care appointment both during and after the ED visit until an appointment date was confirmed. Control subjects were instructed to follow up within 3 to 5 days. Intervention patients were more likely to follow up than control subjects (64% vs 46%; relative risk, 1.4; 95% CI, 1.1 to 1.7).[23] These results are similar, supporting our contention that appointment making is the successful part of the intervention.

To our knowledge, this is the first multicenter study including adults and children to examine long-term asthma outcomes after an ED intervention linking patients to primary care. Although we were successful in increasing the rate of primary care follow-up, we found that this did not translate into improvement in asthma morbidity, quality of life, or use of preventive medications, at least during the year after the index ED visit. Patients in all three groups had similar rates of repeat ED visits, hospitalizations, and use of controller medications, as well as similar reported rates of asthma severity, shortness of breath, and activity limitation. These outcomes, although characterized as secondary in our study, are extremely important in the overall assessment of any intervention targeted to improve the quality of life of patients with asthma. We instead chose to focus on primary care visits as the primary outcome because ED personnel often do not have the time or resources to develop a comprehensive management plan for these patients. A randomized controlled trial[24] of low income urban pediatric asthma patients used an intervention consisting of telephone coaching and monetary incentives to encourage follow-up. The results of this trial were similar to ours. The intervention was associated with significant improve-

ment in short-term outcomes but did not impact long-term outcomes such as ED visits or hospitalizations.[24]

We believe that the most effective way to establish long-term control of the disease of asthma is through regular medical care. From an emergency physician's perspective, this often involves making sure the patient has a regular source of primary care. While it certainly would have been desirable to demonstrate a reduction in the secondary outcomes chosen, we believe that the linkage of patients to PCPs is a more attainable goal for an ED-based intervention.

Patients may derive benefits from primary care follow-up for several reasons. Recidivism among asthmatic patients seen in the ED is common, especially before linkage with a PCP.[21] This occurs despite routine short courses of oral corticosteroids at discharge.[21,25] A number of other studies[17,26–29] also suggest that specialty care may be associated with reduced frequencies of ED visits and/or hospitalizations for asthma. Furthermore, timely care might allow for a more prolonged course of steroids after the ED visit, when needed, and allows providers to be more active participants in overall disease management. Adjustments in long-term controller medications can reduce exacerbation symptoms and morbidity from asthma, reducing the need for recurrent ED visits and improving overall quality of life.[8,30–32]

It is unclear why we failed to detect improvement in long-term asthma disease management despite improvement in short-term primary care follow-up. PCPs provide the vast majority of care to asthma patients, and well-managed patients may be less likely to visit the ED. What happens at the first primary care visit following an asthma exacerbation is likely to vary according to patient and provider factors that require further study. An expanded follow-up visit could provide education, review current medications, recognition of symptoms and asthma triggers, establish an asthma action plan, and teach important skills such as medication administration and peak flow monitoring.

Alternatively, some patients may need more intensive asthma management and could be considered for direct referral to a specialist. Zeiger et al[33] compared facilitated referral to asthma specialists vs referral to generalists in a large health maintenance organization. A blinded review of participants' medical records at 6 months showed that the intervention group had a 75% reduction in the percentage of asthma awakenings at night, a 50% reduction in asthma ED relapse, and a greater use of inhaled corticosteroids compared to control subjects. This study was conducted over a decade ago, when the use of inhaled corticosteroids and general awareness of National Asthma Education and Prevention Program guidelines were lower, so this deserves further examination.

The limitations of this study include selection bias and lack of complete follow-up for all subjects. First, enrollment was nonconsecutive, and it is not known whether missed patients would have been more or less likely to have primary care follow-up. Of note, enrolled and nonenrolled patients did not differ according to numerous demographic and clinical characteristics. Second, it was not possible to blind the group to which subjects were assigned; however, the treatment allocation was concealed and site telephone follow-up interviews were conducted by staff not aware of group assignment. Our lack of 100% PCP verification of follow-up was also a limitation. We were only able to verify follow-up in 82% of patients. If some or all of the remaining 18% of patients did actually follow up, our results may have been different depending on subgroup assignment. Finally, we did not attempt to determine whether patients relapsed and presented for asthma care at any institution outside the participating sites. However, our interviews asked about all urgent clinic or ED visits regardless of where the subject presented for care.

In summary, we found that a three-part intervention, including free medication, transportation vouchers, and 48-h telephone call to relay a scheduled follow-up appointment, significantly increased the likelihood that discharged ED asthma patients obtained primary care follow-up. However, the increase in primary care visits had no effect on long-term clinical outcomes. Additional study should examine the nature of the interaction during the first primary care visit after ED care, explore other potential linkage strategies, and examine cost-effectiveness and the impact of interventions on long-term asthma morbidity.

Appendix

Emergency Medicine Network Steering Committee

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ACKNOWLEDGMENT: We thank the Emergency Medicine Network Investigators for their ongoing dedication to emergency airway research.

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Chest 2006;129;257-265
DOI 10.1378/chest.129.2.257