

Improving Asthma Care in Emergency Departments:

Results of a Multihospital Collaborative Quality Initiative in Rural Western North Carolina

Steven Crane, Douglas Sailer, Steven C. Patch

BACKGROUND In North Carolina, nearly one-fourth of persons with asthma visit an emergency department (ED) or urgent care center at least once a year because of an exacerbation of asthma symptoms. The Emergency Department Asthma Program was a quality-improvement initiative designed to better understand the population of patients who use the ED for asthma care in rural western North Carolina and to demonstrate whether EDs at small hospitals could, by implementing National Asthma Education and Prevention Program treatment guidelines, improve asthma care and reduce subsequent asthma-related ED visits.

METHODS Eight hospitals in western North Carolina participated in the project, which lasted from November 2003 through December 2007. The intervention consisted of a series of individual and structured continuing medical education events directed at ED physicians and staff. Additionally, patients presenting to EDs for asthma-related problems were selected to receive a short patient questionnaire, to determine their basic understanding of asthma and barriers to asthma care; to undergo asthma staging by the treating physician; to receive focused bedside asthma education by a respiratory therapist; and, finally, at the treating physician's discretion, to receive a free packet of asthma medications, including rescue therapy with a beta-agonist and corticosteroid therapy delivered via a metered-dose inhaler, before discharge.

RESULTS During the 37-month project, a total of 1,739 patients presented to the participating EDs for 2,481 asthma-related episodes of care; at 11% of these visits, patients received the intervention, with nearly 100 ED physicians referring patients to the program. Most of the patients using the ED for asthma treatment were judged to have the mildest stages, and nearly half were uninsured or were covered by Medicaid. For only 20% of the visits was a primary care physician or practice identified. The patient intervention did not appear to lessen the rate of return visits for asthma-related symptoms at 30 and 60 days.

LIMITATIONS Selection bias is likely, as patients enrolled in the study were more likely than patients in the target sample to be adults and insured. Because we did not measure ED staff attendance at educational sessions or their knowledge of and attitudes about asthma care before and after the educational program, we cannot draw conclusions about the effectiveness of the program to change their knowledge, attitudes, or behavior.

CONCLUSIONS Many patients who use the ED for care appear to have mild, intermittent asthma and do not identify a regular source of primary care. Efforts to improve asthma care on a communitywide basis and to reduce preventable exacerbations should include care provided in EDs, as this may be the only source of asthma care for many asthma patients. The project demonstrated that regional, collaborative performance improvement efforts in EDs are possible but that many barriers exist to this approach.

More than 22 million Americans have asthma, including an estimated 6 million children. The burden of asthma affects patients, their families, and society in terms of lost workdays and school attendance, decreased quality of life, and avoidable emergency department (ED) visits, hospitalizations, and deaths [1]. The prevalence of childhood asthma in North Carolina is greater than the national average. Although asthma is a chronic condition with effective preventive treatments available, nearly 25% of adults and children with asthma visit an ED or urgent care center at least once per year because of an asthma-related illness, with two-thirds of these individuals making 3 or more visits during the year [2].

For a number of years, primary care professionals have been encouraged to improve asthma staging and education and to provide asthma action plans to patients, to reduce the number of preventable asthma exacerbations leading to

an ED visit [2]. Community Care of North Carolina (CCNC) has included asthma care as part of its regular quality audits for primary care practices participating in the Medicaid program [3].

Many asthma patients appear to use the ED as their usual source of health care, in part because of a number of perceived and real barriers to primary care access in a community. Low income, difficulty making or keeping an appointment, and the perception that an ED visit has lower out-of-pocket expenses than an office visit all appear to con-

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tribute to use of the ED for routine asthma care [4]. Among children with asthma, lower rates of continuity with primary care professionals are associated with higher risks of ED use [5]. If substantial numbers of asthma patients bypass primary care altogether, then attempts to improve asthma care in the community and to reduce preventable ED visits should include input from EDs.

Asthma care in EDs may differ substantially from National Institutes of Health guidelines, with considerable variation by type of hospital [6]. We observed in our hospital that patients were rarely discharged with a prescription for asthma controller medication, such as an inhaled corticosteroid (ICS), and that asthma staging and education about recognition and treatment of early symptoms were not routinely part of the ED treatment protocol.

Performance improvement programs instituted in a single ED have been shown to produce sustained improvement in asthma care [7]. Providing asthma medication at discharge and reminding patients to follow up with a primary care professional increase the likelihood that patients will reestablish contact with a primary care professional for additional asthma education [8]. During a pilot performance improvement project, we observed that many patients who presented to the ED appeared not to have a primary care professional and had mild forms of asthma, with rare or infrequent exacerbations. If this observation is true in other communities, the ED may be the sole source of asthma care for many patients in our region. We further observed that ED staff were amenable to changing treatment protocols if they were provided with data suggesting that changes might reduce subsequent ED visits. If the EDs in a region could work collaboratively to implement guidelines-based asthma care in their departments, it might be possible to achieve substantial improvements in care for a population of asthma patients previously not served by programs aimed at improving asthma care in primary care practices.

With support from The Duke Endowment and the

Western North Carolina Health Network (WNCHN), we conducted a multihospital, collaborative quality-improvement initiative to create a standardized clinical pathway for ED-based asthma care that adhered more closely to National Asthma Education and Prevention Program (NAEPP) guidelines. We sought to improve our knowledge of the patients in the region who use the ED for asthma care, including their understanding of asthma control and barriers to care. Because a previous pilot project determined that many patients either left the ED without a prescription for an ICS metered-dose inhaler (MDI) or failed to fill the prescription after leaving, the intervention included issuance of controller medications to patients at discharge to see whether this would reduce subsequent asthma-related ED visits.

Methods

The Emergency Department Asthma Program (EDAP) was a collaborative quality-improvement project conducted by the WNCHN, a consortium of 16 hospitals in western North Carolina, as part of a larger initiative funded by The Duke Endowment to improve asthma care. Three of the 16 hospitals in the WNCHN agreed to participate in the pilot project that began in November 2003, with 5 additional hospitals enrolled over the subsequent months. All of the hospitals were small or moderate sized not-for-profit facilities that serve largely rural communities in western North Carolina (Table 1). Each participating hospital's chief executive officer and ED medical director provided administrative approval and signed a business associate agreement to allow performance data to be collected, analyzed, and shared by the collaborating hospitals and the WNCHN. There were no financial incentives provided to the hospitals to participate, other than in-kind educational programs, patient-education materials, and sample medications that EDs could distribute to patients as part of the EDAP discharge packet. A participating hospital's institutional review board reviewed the proposal and deemed this a quality-improvement initiative

TABLE 1.
Collaborative Site Size and Enrollment of Asthma Patients During Emergency Department (ED) Visits

Site	Beds, no.	Staff type	Asthma-related visits, no.	Visits involving enrollment, no. (%)	ED physicians with >1 enrollment, no.
Hospital A	59	Contract	47	1 (2)	1
Hospital B	26	HE	29	28 (97)	2
Hospital C	222	Contract	948	121 (13)	40
Hospital D	65	HE	428	9 (2)	7
Hospital E	103	HE	46	45 (98)	21
Hospital F	85	HE	159	0	0
Hospital G	94	Contract	266	44 (17)	17
Hospital H	86	HE	558	25 (4)	10
Overall	740	...	2,481	273 (11)	98

Note. HE, hospital employee.

limited to promoting the implementation of a national treatment and staging guideline study and, therefore, exempt from guidelines addressing human experimentation.

Each participating hospital selected a project team that consisted of an ED physician champion, a respiratory therapist, an ED nurse, and representatives from the medical records department and administration. The EDAP coordinating team included the project coordinator, a primary care physician, and pulmonary and allergy specialists, who assisted in developing an evidence-based ED clinical pathway for asthma patients on the basis of NAEPP guidelines for asthma staging and treatment; the clinical pathway at each hospital was reviewed and adopted by the hospital's project team. Standardized patient questionnaires, educational materials, staging forms, and asthma medication packets were prepared by the coordinating team and distributed to each participating ED (Appendix, available only in the online edition of the NCMJ). Staging questions included whether the patient used more than 1 MDI canister per month, whether they had nightly symptoms, or whether their asthma routinely affected daily activities such as work or school. Patients' self-management skills were assessed by asking whether they had an asthma rescue plan and whether they possessed and used a peak-flow meter at home. Finally, we assessed barriers to outpatient asthma care by asking patients whether they had a primary care professional and whether they had difficulty paying for their asthma medications.

The project sponsored a well-attended kickoff continuing medical education event directed at ED physicians and featured a nationally recognized ED physician champion for improving asthma in the ED setting. The coordinating team provided continuing in-service educational sessions on the care guidelines at each hospital, by means of academic detailing by asthma specialists who practiced in those communities; sessions were attended by more than 100 regional ED physicians. The coordinating team also provided short educational updates at departmental meetings for respiratory therapists and registered nurses at each participating hospital. The project coordinator made regular visits to each hospital during the study period, provided personal reminders to staff about the hospital's asthma care guidelines, and prominently posted a number of visual reminders in staff work areas in the participating EDs. Enrollment numbers for each hospital were provided to project teams at least quarterly, and modest enrollment incentives were provided to respiratory therapists at various times during the initiative, to encourage regular use of the pathway. Staff knowledge and attitudes about asthma were not specifically measured before and after the educational program, as champions at each hospital felt that such a survey would be off-putting to staff. But the project coordinator solicited feedback from nursing, RT, and physician staff at each regular visit, to assess perceptions of the impact of the program on ED asthma care at each hospital during the study period.

All patients aged 4 years or older who presented to the ED with an asthma-related diagnosis (determined on the basis of *International Classification of Diseases, Ninth Revision* [ICD-9] diagnosis codes), regardless of payer source, were eligible for enrollment. The clinical pathway included 5 steps, and documentation for each step was contained on 1 sheet attached to the patient's ED medical record.

For step 1, if the triage nurse believed the patient's chief complaint was asthma related, an asthma assessment sheet was attached to the chart. The triage nurse filled out the patient's basic demographic information; asthma-related history, including current asthma medication; whether the patient used a spacer; and whether the patient had a current primary care and/or pulmonary or asthma specialist.

For step 2, if the evaluating ED physician agreed that the primary presenting problem was asthma related, the physician completed a simple asthma staging form on the basis of NAEPP clinical staging criteria. The patient then received usual asthma care, as deemed appropriate by the treating physician.

For step 3, the respiratory therapist assigned to administer nebulizer treatments to the patient recorded the patient's pretreatment and posttreatment peak flows; administered a short survey on asthma knowledge and barriers to asthma care; and provided a short, focused, and structured educational intervention that emphasized use of the short-acting "rescue inhaler" versus the long-acting "controller," the importance of recognizing asthma "triggers," and the need for an asthma action plan to improve asthma self-care.

For step 4, when the patient's health had improved sufficiently to be discharged from the ED, the physician was encouraged to dispense an asthma medication "prepack," if deemed appropriate. This contained an albuterol MDI, a steroid inhaler, written instructions about proper MDI use, and a brochure describing local resources for outpatient care. The prepacks were dispensed to all patients, regardless of payer status.

For step 5, the completed asthma assessment sheet was placed in a box and collected weekly by project staff, for data entry and analysis. Sample data collection forms and educational materials are available in the Appendix.

Data were collected from participating hospitals as they joined the project, which lasted from November 2003 through December 2007. Data from the asthma assessment sheets were collected and entered in an Access 2007 database (Microsoft). Additional information, about each patient's other hospital visits, as well as payer source and charge information, was obtained from each hospital's medical records system. ED visits coded as asthma-related visits by use of the ICD-9 codes were included in the database as the denominator. The records were then deidentified of any unique patient identifiers and aggregated. No patient-specific information was shared with any other facility. Data were reported back to each hospital on at least a quarterly basis during the period in which they participated in the

project. At the end of the project, each hospital was provided with a copy of the database containing only their data, as well as with instructions about how to continue using the software to track their asthma care performance.

Demographic characteristics of enrolled patients were compared with those who did not enroll, by use of a 2-sided likelihood ratio χ^2 test. Revisit occurrences were compared using the Fisher exact test. Use of a 2-sided test revealed that a sample size of 82 in each group would be required to have a 90% chance of finding a statistically significant difference in the revisit rate between the 2 groups, if one group had a 10% revisit rate and the other had a 30% revisit rate. SAS, version 9.1.3 (SAS Institute), was used to calculate P values, and the threshold for statistical significance was defined as a P value of $<.05$.

Results

All 8 of the participating hospitals contributed their data on asthma-related ED visits, and 7 of the hospitals enrolled at least 1 patient into the intervention. During the 37-month project, 1,739 patients presented to participating EDs, for a total of 2,481 asthma-related visits. Characteristics of the participating hospitals and asthma-related ED visits and the proportion of patient visits in which the patient was enrolled into the intervention are summarized in Table 1.

More than half of the visits for asthma among enrolled patients involved individuals who either were covered by Medicaid or had no insurance. Only 273 (11%) of the total visits by asthma patients were by patients enrolled in the intervention. The enrolled population was less likely to include children and more likely to include insured patients (Table 2). Additionally, for 1,988 (80%) of the 2,481 ED-related asthma visits, either the patient or the ED staff did not acknowledge that the patient had a primary care physician.

The surveys returned by patients regarding asthma stage, the control of their asthma symptoms, and the barriers to this care varied from hospital to hospital. The most common asthma stage diagnosed during visits by enrolled patients (117 [43%] of 273) was mild, intermittent (Table 3). Even though the enrolled population from which these survey data were derived was more likely to have private insurance, nearly 50% of participants reported difficulty affording their asthma medication, a finding that appeared across the region (Table 4). Finally, whether the patient was enrolled in the intervention did not appear to affect the rate of return asthma-related visits at 30 or 60 days (Table 5).

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Discussion

The EDAP was designed to provide information associated with the following questions: (1) What are the characteristics of the asthma patients using the ED in the region? (2) Could quality improvement across hospitals in a region be successful? (3) Could providing a basic bedside asthma education in the ED and providing patients with controller medications at discharge reduce subsequent visits to the ED for asthma care?

The project appeared to support our earlier observations that most patients using the ED for asthma care had intermittent or rare symptoms and did not identify a source of routine primary care. The majority of patients had the mildest stages of asthma, which should be the stages that are most amenable to prevention or self management. Even though our enrolled sample of visits were more likely to include insured patients, we found that 80% of visits were from patients who did not identify a primary care professional. Only one-third of patients identified an asthma rescue plan other than visiting the ED, and only 13% reported having a peak-flow meter, which would form the basis of a self-management plan. More than one-quarter of patients reported poorly controlled symptoms, gauging by the number of quick-action MDIs they used in 1 month, the presence of nocturnal symptoms, or asthma symptom-related limita-

TABLE 2.
Characteristics of Asthma-Related Visits to the Emergency Department, by Patient Enrollment Status

Characteristic	Enrolled, no. (%)	Not enrolled, no. (%)	Likelihood ratio	P
Age, years			19.9	<.001
4-19	49 (18)	574 (26)		
20-46	167 (61)	1,038 (47)		
>46	57 (21)	596 (27)		
Sex		0.38	.54	
Male	109 (40)	839 (38)		
Female	164 (60)	1,369 (62)		
Insurance status			45.8	<.001
Medicaid/Medicare	22 (8)	508 (23)		
Commercial	213 (78)	1,325 (60)		
Uninsured	38 (14)	375 (17)		

TABLE 3.
Asthma Stages Diagnosed Among
Enrolled Patients During the
Emergency Department Visit

Asthma stage	Patients, no. (%)
Mild intermittent	117 (43)
Mild persistent	29 (11)
Moderate persistent	62 (23)
Severe	22 (8)
Not staged	43 (16)
Total	273 (101)

Note. Because of rounding, percentages do not sum to 100.

tions to their daily activities. Affordable asthma medications were an important barrier to care, reported by nearly 50% of patients. Approximately three-fourths of such patients were younger than 46 years, and 50% were either uninsured or covered by Medicaid. These are not surprising findings, given that asthma tends to be a disease of younger patients and that younger patients (particularly children) are less likely to have insurance and are more likely to be covered by Medicaid. The survey data suggest that barriers to care and no regular primary care professional are region-wide problems among asthma patients in western North Carolina, even though the communities served varied widely with respect to primary care options available to those without insurance.

Although many of these patients, perhaps, do access a primary care professional for other medical problems, the fact that one was not recorded prevented the primary care professional from being notified of the ED visit and prevented the ED from arranging an appropriate follow-up plan

for the patient. We did not ask whether patients first tried contacting their primary care professionals before visiting the ED or whether an outpatient visit occurred between the first and the subsequent ED visit, which occurred within 60 days for 7% of patients. Although both factors could represent additional barriers to early asthma care, neither change our key finding that a substantial number of patients in our sample appear not to use primary care as a source of care for their asthma exacerbation. This would bolster our contention that asthma care in the ED should include elements of prevention and of recognition and management of early symptoms, if we expect to have a major impact on reducing preventable asthma ED visits.

With respect to collaborative quality-improvement efforts in the ED, EDAP was the first such effort in our region. Although it was a relatively simple intervention and focused on 1 disease, because of the way hospitals are structured it turned out to be a rather complicated project, involving more than 100 ED physicians, as well as the administration, ED nurses, respiratory therapists, and finance and information technology departments at each of the 8 hospitals. Although each hospital had official buy-in from the chief executive officer and physician champion, there was a wide variation in enrollment rates, from 0% to 98%, between the hospitals (Table 1). Most of the participating hospitals demonstrated a willingness and an ability to adopt an evidence-based clinical pathway for asthma care; however, almost none were able to maintain a level of consistent performance, despite frequent reminders. Anecdotally, we encountered a number of barriers to getting changes to “stick” in the ED. These included turnover of physician, nurse, and respiratory therapist champions at the participating hospitals; competing quality initiatives in the various departments; and a frequently voiced attitude among ED staff that it was their role

TABLE 4.
Barriers Reported by Enrolled Patients to Controlling Asthma Symptoms Before the Emergency
Department Visit

Site	Patients enrolled, no.	Barrier, no. (%) of enrolled patients					
		Use of >1 MDI per month	No rescue-therapy plan	No peak-flow meter at home	Nightly symptoms	Adverse affects on daily activity	Difficulty affording medication
Hospital A	1	1 (100)	0	1 (100)	0	0	0
Hospital B	28	7 (25)	10 (36)	4 (14)	15 (54)	13 (46)	5 (18)
Hospital C	121	30 (25)	61 (50)	17 (14)	77 (64)	57 (47)	53 (44)
Hospital D	9	5 (56)	3 (33)	1 (11)	2 (22)	1 (11)	5 (56)
Hospital E	45	13 (29)	5 (11)	5 (11)	0	0	24 (53)
Hospital F	0	0	0	0	0	0	0
Hospital G	44	7 (16)	3 (7)	3 (7)	2 (5)	3 (7)	20 (45)
Hospital H	25	3 (12)	5 (20)	5 (20)	3 (12)	3 (12)	12 (48)
Overall	273	66 (24)	87 (32)	36 (13)	99 (36)	77 (28)	119 (44)

Note. MDI, metered-dose inhaler.

TABLE 5.
Rates of Hospital Revisitation for
Asthma Treatment at 30 and 60 Days,
by Enrollment Status

Interval	Patients, no. (%)		P ^a
	Enrolled	Not enrolled	
30 days	13 (4.8)	103 (4.7)	.88
60 days	19 (7.0)	148 (6.7)	.7

^aBy the Fisher exact test.

was to treat the presenting symptoms and that primary care professionals were responsible for providing education on prevention and self-management.

Nevertheless, the project demonstrated that quality-improvement collaboration across hospitals in a region can be an efficient means to develop evidence-based clinical pathways, patient-education materials, and programs for educating primary care professionals. Sharing processes and tools across a network can reduce the cost of quality-improvement efforts, which may be particularly important for small hospitals, which typically have fewer resources to expend in these areas. Even some staff from hospitals that enrolled few, if any, patients in the program believed the regular reminders yielded increased awareness of NAEPP guidelines among ED staff and that more patients left the ED with prescriptions for steroid inhalers as a result of the intervention. The observation that more than 100 different ED physicians in the region enrolled at least 1 asthma patient during the intervention suggests that a substantial number of ED physicians had received at least a portion of the education, resulting in performance of at least 2 recommended asthma care steps (ie, staging the patient's asthma episode and providing the patient with controller MDIs at discharge from the ED).

The patient intervention did not appear to decrease the rate of return visits for asthma-related symptoms at 30 and 60 days. Although, given the relatively small number of patients enrolled in the intervention and the small number of patients returning because of symptoms within 60 days, this study was not sufficiently powered to detect anything other than a large difference. Furthermore, if the educational intervention changed the behavior of some physicians, as was reported to us anecdotally, and if it resulted in more steroid-inhaler prescriptions written for patients not enrolled in the program, the difference in return visits between the 2 groups would be reduced. On the basis of extensive documentation in the literature that controller medications for persistent asthma reduce exacerbations, we would expect that any intervention that increased the use of these medications by asthma patients would ultimately reduce ED visits.

Finally, our experience with EDAP not only underscores the need for coordination across the continuum of care in a community, it also highlights how difficult that is to achieve in our fragmented health system. Follow-up from ED care to

primary care is a key step, but it is missing in most asthma care provided in the ED, and primary care appears to need improvement in providing asthma patients with better self-management strategies and tools. Because many asthma patients may not fully recognize that their symptoms are poorly controlled, we need community strategies that aim to inform the public about how to control asthma symptoms, reduce preventable use of the ED, and decrease job or school absences due to asthma exacerbations. But until there are better incentives to provide coordination at every step of the care process, these efforts will be difficult to initiate and maintain.

Emerging use of electronic medical records in EDs may present a method to implement system-wide care changes in the ED that incorporate more evidence-based care choices, such as those attempted in EDAP, and would facilitate monitoring the effectiveness of interventions to improve care. Given that our experience demonstrated that 25% of all asthma-related ED visits were by patients covered by Medicaid, CCNC networks could use real-time data on ED visits for enrolled patients to better identify which patients might benefit from additional asthma self-management trainings and tools.

EDAP was undertaken as a voluntary, regional, collaborative performance improvement project in EDs. Enrollment of patients in the intervention was not random, but at the discretion of the ED staff, so caution should be used in applying the results of the barrier and staging surveys to the entire population. Because our sample had more insured patients, one would expect that the barriers to affordable asthma medication and the prevalence of no regular primary care professional would be worse for the overall population of asthma patients who use the ED for treatment of symptom exacerbation. If confirmed, this finding would substantiate the importance of increasing the number of ICS prescriptions by ED physicians as a community intervention to reduce the frequency of acute exacerbations in this population. A further limitation is that these are observational data, and patients enrolled in the intervention may differ significantly from those not enrolled. Because we could not collect detailed prognostic factors from the unenrolled group, we are not able to adjust or control for these factors. We have concluded that there was not a significant difference in the asthma revisit rates between the enrolled and the unenrolled patients, but it is possible that there may have been differences, stratified by asthma stage, between the groups had we been able to perform a subgroup analysis.

EDAP did not collect formal data on educational outcomes for the various ED staff affected by the intervention, in accordance with customary standards for in-service education at each participating hospital. There is no reason to expect, though, that the continuing medical education kick-off event for physicians, the professional detailing, or the regular reminders and handouts at departmental meetings were any less effective than usual means to educate pri-

mary care staff about guideline-based care. And given the frequent reminders, the methods in this project were more likely to be effective than usual methods. Anecdotal reports appeared to support the impression that knowledge and awareness of NAEPP treatment guidelines among ED staff increased as a result of the project. Further studies would be helpful to specifically measure which method is the most effective in improving knowledge and changing behavior.

EDAP was the first multihospital, collaborative clinical-improvement project attempted in our region. Although no significant reduction in the number of ED revisits resulted from this collaborative intervention, this project proved that collaborative interventions can be implemented in this region. Valuable asthma-related data were captured, which can be used in further studies and to provide effective primary asthma care. Although the project focused on asthma care provided in the ED, our findings suggest that continued efforts are needed to improve communication with primary care professionals and referral back to primary care settings, where much of this care should be provided. NCMJ

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