Impact of the national asthma guidelines on internal medicine primary care and specialty practice

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Objective: To evaluate documentation of compliance with the National Asthma Education and Prevention Program publication *Guidelines for the Diagnosis and Management of Asthma*.

Design: A retrospective review of 114 charts coded as asthma. Fourteen chart evaluation questions were developed based on the 4 management components in the guidelines: assessment and monitoring of asthma, control of asthma factors, pharmacotherapy, and patient education.

Setting: A hospital-based asthma clinic, a private pulmonary group, and a general internal medicine group in Dallas, Texas.

Results: Nearly all physicians documented inquiries about daytime asthma symptoms, but only 64% of pulmonary group and 58% of internal medicine physicians documented inquiries about nighttime symptoms. In addition, in 14% of pulmonary group charts and 74% of internal medicine charts, no spirometry or peak flow data were documented. Most asthma clinic and pulmonary group charts (98% and 78%, respec-

tively) included a history of triggers, but the pulmonary group and internal medicine group were more likely to document administration of the influenza vaccine than the asthma clinic (25% and 26% vs 13%). Of 38 patients with ≥ 1 recorded forced expiratory volume in 1 second $< 60\%$, all but 1 were on inhaled steroids. However, many charts lacked adequate documentation to match drug selection to asthma severity. The asthma clinic group documented the 4 educational interventions 65% to 83% of the time, compared with the pulmonary group, at 17% to 50%, and the internal medicine group, at 5% to 18%.

Conclusions: Results showed significant variation with the recommendations. Areas in particular need of improvement were objective diagnosis and assessment, control of asthma-associated factors, and patient education. Furthermore, the study demonstrated significant variation between specialists and primary care physicians, with the more specialized clinics demonstrating better guideline compliance.

Asthma is a chronic inflammatory airways disease with significant morbidity and mortality. In the USA alone, > 15 million people are affected by the disease (1). The responsibility of caring for these patients extends from primary care pediatricians, family medicine practitioners, and internal medicine physicians to allergists and pulmonologists. The wide range of asthma caregivers coupled with the spectrum of asthma severity has yielded diverse asthma care practices. To help standardize asthmatic care, in 1991 the National Asthma Education and Prevention Program (NAEPP) Expert Panel published *Guidelines for the Diagnosis and Management of Asthma* (2). Six years later the report was updated (3). These guidelines attempted to simplify asthma care by breaking it into 4 major components: assessment and monitoring, control of factors, pharmacotherapy, and patient education (3).

Over recent years, several studies have attempted to determine the impact of the NAEPP guidelines on asthma management (4–8). These studies have most often used patient and physician questionnaires to assess guideline compliance, with few studies giving attention to chart content. We designed this study to determine whether there was chart documentation of guideline compliance.

METHODS

Study sample

Our study was designed to determine whether NAEPP guidelines were reflected in patient records. After obtaining institutional review board approval, we used the 4 components

emphasized in the Expert Panel Report 2 to retrospectively review outpatient medical records in a hospital-based asthma subspecialty clinic, a private pulmonology group, and a general internal medicine group. Charts were selected using the International Classification of Diseases (ICD)-9 codes 493.00, 493.10, 493.01, and 493.90. Chart lists were generated in a consecutive fashion from billing files of the most recent patient encounters with these ICD-9 codes. Patients who had been in physician practices < 5 months were excluded from the study. Additionally, any patient who did not appear to have received primary asthma care from the clinic in review was excluded.

Chart review

Chart review was accomplished using a multipoint evaluation scheme generated from Expert Panel Report 2. Each component in this report was represented by several patient care issues (Table 1). The reviewer had access to the entire outpatient chart, including physician notes, laboratory values, questionnaires, and diagnostic study results.

Analysis

All analyses were performed using the Statistical Program for the Social Sciences 9.0 statistical software package (SPSS Inc,

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Table 1. Chart evaluation questions used to determine compliance with *Guidelines for the Diagnosis and Management of Asthma*

Component	Questions
1. Assessment and monitoring	<ul style="list-style-type: none"> • Did the physician <i>inquire</i> about asthma day symptoms? (Credit was given if there was any reference to wheezing, dyspnea, chest tightness, or cough.) • Did the physician <i>inquire</i> about nocturnal asthma symptoms? • Were full spirometric data, including forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV₁), present on the chart? • Were peak flow data present on the chart? (This variable was designed to evaluate for peak flow values followed by hand-held peak flow meters and was credited independently of full spirometric data.) • Was frequency of beta-agonist use recorded? • Did the physician attempt to relate his or her assessment of asthma severity?
2. Control of factors	<ul style="list-style-type: none"> • Did the physician inquire about asthma triggers (particularly allergic triggers)? • Was the patient given the influenza vaccine for the 1998 to 1999 season?
3. Pharmacotherapy	<ul style="list-style-type: none"> • Was the patient on inhaled steroids? • How many patients with severe asthma (FEV₁ <60% predicted) were on inhaled steroids?
4. Education	<ul style="list-style-type: none"> • Was there documentation of instruction on metered-dose inhaler technique? • Was there documentation of spacer use? • Was there an exacerbation plan? (Credit was given if the physician either provided a written exacerbation plan or instructed the patient to follow up in any other way if problems occurred.) • Was there any attempt to control the environment? (Credit was given if any suggestion was made to improve the patient's surroundings.)

Chicago, Ill). We used nonparametric tests to analyze our data. The chi-square test was used to compare categorical data, and the Mann-Whitney *U* statistic was used to compare ordinal data. All *P* values are 2-sided and are reported as significant if *P* < 0.05.

RESULTS

A total of 114 charts were reviewed, including 40 from a hospital-based asthma specialty clinic, 36 from a private pulmonary group, and 38 from a private internal medicine group.

Demographics

There was a significant difference when comparing patient age between the pulmonary group and internal medicine group (Table 2). Additionally, years followed at the clinic showed a statistically significant difference, with the internal medicine group having the longest patient follow-up (6.2 ± 6.5 years), compared with 4.0 ± 4.9 years for the pulmonary group and 2.5 ± 2.3 years for the asthma clinic.

Assessment and monitoring

While nearly all physicians documented inquiries about daytime asthma symptoms, nighttime symptoms were documented in 98% of asthma clinic charts, 64% of pulmonary group charts, and 58% of internal medicine charts (Table 3). Spirometry, also vital in diagnosing asthma and assessing degree of severity, was present in all asthma clinic charts and 86% of pulmonary group charts, but only 26% of internal medicine charts. Likewise, peak flow data were present in <30% of pulmonary group and internal medicine charts. The presence of documentation for rescue beta-agonist requirements ranged from 93% of asthma clinic charts to 55% of internal medicine charts, and the presence of comments on asthma severity ranged from 68% of asthma clinic charts to 29% of internal medicine charts.

Control of factors

While inquiries about asthma triggers were documented in 98% of asthma clinic charts, the frequency was significantly lower in the other groups, with 75% in the pulmonary group and 42% in the internal medicine group (Table 4). However, internal medicine and pulmonary group charts were more likely than asthma clinic charts to document administration of the influenza vaccine.

Pharmacotherapy

All asthma clinic patients were on inhaled steroids as of their last recorded visit, compared with 94% of pulmonary group patients and 66% of internal medicine patients (Table 5). We also reviewed the dosage given to the subgroup of patients with severe, persistent asthma, defined as spirometry showing ≥ 1 forced expiratory volume in 1 second (FEV₁) <60%. Twenty-three of the patients in the asthma clinic group fit this description: 17 were on high-dose and 6 on moderate-dose inhaled steroids. In the pulmonary group, 12 of 32 patients were in the severe subgroup: 3 were on high-dose therapy, 5 on moderate-dose therapy, and 2 on low-dose therapy; 1 patient's dose was not recorded, and 1 was not on inhaled steroids. In the internal medicine group, 3 patients were in the severe subgroup: 1 was on moderate-dose therapy, and 2 were on low-dose therapy. (See p. 88 of reference 3 for definitions of high, medium, and low doses of inhaled steroids.)

Education

For all evaluation points, the asthma clinic group had better documentation of patient education issues (Table 6). The asthma clinic group documented the 4 educational interventions 65% to 83% of the time, compared with the pulmonary group, at 17% to 50%, and the internal medicine group, at 5% to 18%. The pulmonary group did significantly better than the internal medi-

Table 2. Patient demographics in the asthma clinic group, pulmonary group, and internal medicine group

	AC	PG	IM	P values		
				AC vs PG	AC vs IM	PG vs IM
Number of patients	40	36	38	<i>P</i> = 0.79	<i>P</i> = 0.89	<i>P</i> = 0.89
Mean age in years ($\pm$ SD)	50.5 ($\pm$ 19.5)	58.4 ($\pm$ 16.3)	48.3 ($\pm$ 16.6)	<i>P</i> = 0.06	<i>P</i> = 0.59	<i>P</i> = 0.01
Mean follow-up in years ($\pm$ SD)	2.5 ($\pm$ 2.3)	4.0 ($\pm$ 4.9)	6.2 ($\pm$ 6.5)	<i>P</i> = 0.08	<i>P</i> < 0.01	<i>P</i> < 0.05
Sex:				<i>P</i> = 1.0	<i>P</i> = 0.48	<i>P</i> = 0.48
Male	13 (32.5%)	12 (33%)	16 (42%)			
Female	27 (67.5%)	24 (67%)	22 (58%)			
Race:				<i>P</i> = 0.81	<i>P</i> = 0.35	<i>P</i> = 0.50
Caucasian	32 (80%)	28 (78%)	27 (71%)			
African American	6 (15%)	5 (14%)	7 (18%)			
Hispanic	0 (0%)	3 (8%)	2 (5%)			
Other	2 (5%)	0 (0%)	2 (5%)			

AC indicates asthma clinic group; PG, pulmonary group; IM, internal medicine group.

Table 3. Chart documentation of asthma assessment and monitoring in the asthma clinic group, pulmonary group, and internal medicine group

	AC	PG	IM	P values		
	n = 40	n = 36	n = 38	AC vs PG	AC vs IM	PG vs IM
Inquiry of day symptoms	40 (100%)	35 (97%)	36 (95%)	<i>P</i> = 0.47	<i>P</i> = 0.23	<i>P</i> = 1.0
Inquiry of nocturnal symptoms	39 (98%)	23 (64%)	22 (58%)	<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> = 0.64
Presence of spirometry	40 (100%)	31 (86%)	10 (26%)	<i>P</i> = 0.05	<i>P</i> < 0.0005	<i>P</i> = 0.001
Peak flow data	35 (88%)	10 (28%)	5 (13%)	<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> = 1.0
No spirometry or peak flow data	0 (0%)	5 (14%)	28 (74%)	<i>P</i> < 0.05	<i>P</i> < 0.01	<i>P</i> < 0.01
Inquiry of frequency of beta-agonist use	37 (93%)	29 (81%)	21 (55%)	<i>P</i> = 0.18	<i>P</i> < 0.0001	<i>P</i> < 0.05
Classification of severity	27 (68%)	14 (39%)	11 (29%)	<i>P</i> < 0.05	<i>P</i> = 0.001	<i>P</i> = 0.46

AC indicates asthma clinic group; PG, pulmonary group; IM, internal medicine group.

Table 4. Chart documentation of control of asthma factors in the asthma clinic group, pulmonary group, and internal medicine group

	AC	PG	IM	P values		
	n = 40	n = 36	n = 38	AC vs PG	AC vs IM	PG vs IM
Inquiry of asthma triggers	39 (98%)	27 (75%)	16 (42%)	<i>P</i> < 0.01	<i>P</i> < 0.0001	<i>P</i> < 0.01
Influenza vaccine	5 (13%)	9 (25%)	10 (26%)	<i>P</i> = 0.24	<i>P</i> = 0.16	<i>P</i> = 1.0

AC indicates asthma clinic group; PG, pulmonary group; IM, internal medicine group.

cine group in documenting an exacerbation plan and in suggesting ways to control the environment. Suggestions included washing linens in hot water to decrease dust mite load, exterminating cockroaches, or removing pets from indoors.

DISCUSSION

Our study showed that the asthma clinic group tended to be most compliant with the guidelines in terms of documentation of symptom assessment, use of objective measures to diagnose and monitor asthma, and assignment of severity level. Patient education issues were most frequently documented in the asthma clinic group as well.

Possible explanations for the above findings include the use of a chart checklist and nonphysician case managers by the asthma clinic group. Chart checklists specifically addressed action plans, spacing device use, metered-dose inhaler instruction, environmental control, and medication teaching and served as a reminder to perform these aspects of asthma care each visit. Interestingly, the influenza vaccine was not on the visit checklist. This may explain why the asthma clinic performed poorly in that area.

The results for each component of the study are telling. Regarding component 1, assessment and monitoring, the recording of day symptoms and the lack of spirometry or peak flow data

Table 5. Chart documentation of asthma pharmacotherapy in the asthma clinic group, pulmonary group, and internal medicine group

	AC	PG	IM	P values		
	n = 40	n = 36	n = 38	AC vs PG	AC vs IM	PG vs IM
*Criteria to classify severity on chart:				<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> < 0.05
0/5 criteria	0	1	7			
1/5 criteria	0	4	11			
2/5 criteria	2	5	8			
3/5 criteria	1	10	5			
4/5 criteria	11	13	7			
5/5 criteria	26	3	0			
Total patients on inhaled steroids	40 (100%)	34 (94%)	25 (66%)	<i>P</i> = 0.22	<i>P</i> < 0.0001	<i>P</i> < 0.01
Out of charts with spirometry:	40 (100%)	31 (86%)	10 (26%)	<i>P</i> = 0.05	<i>P</i> < 0.0005	<i>P</i> = 0.001
Charts with FEV ₁ <60% predicted	23 (58%)	12 (39%)	3 (30%)	<i>P</i> = 0.48	<i>P</i> = 0.77	<i>P</i> = 0.70
Out of charts with FEV ₁ <60%:						
Patients on inhaled steroids	23 (100%)	11 (92%)	3 (100%)	<i>P</i> = 0.83	NA	<i>P</i> = 0.40

*The 5 criteria examined to classify severity included inquiry of frequency of day symptoms, inquiry of frequency of night symptoms, inquiry of frequency of beta-agonist use, whether spirometry was on chart, and whether peak flow data were recorded.

AC indicates asthma clinic group; PG, pulmonary group; IM, internal medicine group; NA, not applicable.

Table 6. Chart documentation of asthma education in the asthma clinic group, pulmonary group, and internal medicine group

	AC	PG	IM	P values		
	n = 40	n = 36	n = 38	AC vs PG	AC vs IM	PG vs IM
MDI technique taught	26 (65%)	6 (17%)	5 (13%)	<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> = 0.75
Use of spacers	33 (83%)	10 (28%)	6 (16%)	<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> = 0.26
Exacerbation plan	32 (80%)	18 (50%)	7 (18%)	<i>P</i> < 0.01	<i>P</i> < 0.0001	<i>P</i> < 0.01
Environmental control attempts	28 (70%)	9 (25%)	2 (5%)	<i>P</i> < 0.0001	<i>P</i> < 0.0001	<i>P</i> < 0.05

AC indicates asthma clinic group; PG, pulmonary group; IM, internal medicine group; MDI, metered-dose inhaler.

suggest that some physicians may be using symptomatology as a guide to diagnosing asthma. The 1997 NAEPP guidelines report, "Objective assessments of pulmonary function are necessary for the diagnosis of asthma because medical history and physical exam are not reliable means of excluding other diagnoses or of characterizing the status of lung impairment" (3). Russel et al suggested that physicians, without objective spirometric data, were able to correctly assess a lung abnormality as obstructive but poorly assessed whether the obstruction was reversible (9).

Furthermore, FEV₁ or peak flow data, like nocturnal symptoms, are key information in assessing degree of asthma severity. Shim and Williams reported that physicians have a poor ability to assess the degree of airflow obstruction using only history and physical exam (10). Therefore, the NAEPP expert panel felt that it was necessary to include FEV₁ and peak flow data, in addition to symptomatology, in the assessment of asthma severity. Degree of severity is, in turn, a cornerstone to determining proper pharmacotherapy, as suggested in the guidelines. Using day symptoms alone, many physicians are employing only 1 of 3 recommended data elements to determine asthma severity. Possible explanations to these findings include lack of physician familiarity with the 1997 NAEPP guidelines, lack of accessibility of spirometry

equipment, increasing restraints on physician time, or a feeling among physicians that the guidelines are overly intensive and impractical.

The second component of asthma care involves an attempt to control factors contributing to asthma severity. A key factor in determining what asthma patients should avoid is a detailed history of triggers. Most asthma clinic and pulmonary group charts (98% and 75%, respectively) contained this history, while less than half of internal medicine charts contained a trigger history. Another factor known to incite an exacerbation of asthma is viral upper respiratory illness (11). The NAEPP guidelines recommend that patients with persistent asthma receive yearly influenza vaccinations (3). Approximately one quarter of pulmonary group and internal medicine charts documented the influenza vaccine for the 1998 to 1999 season, while 13% of asthma clinic charts contained this data. (Note that follow-up for some patients in the study was not long enough to show administration of the influenza vaccine, since the study took place in September 1999 and included some patients who had been seen by the physician for only 5 months.)

In component 3, the 1997 NAEPP guidelines classify asthma severity and match medication selection and dose to degree of

severity. For example, a patient with moderate persistent asthma (FEV₁ 60% to 80% predicted) would be on at least a low or medium dose of inhaled steroids. We reviewed charts that documented spirometry to determine the lowest FEV₁ recorded in the chart. Of 38 patients with ≥ 1 recorded FEV₁ <60% predicted, all but 1 were on inhaled steroids. Twenty of the 38 patients were on high-dose inhaled steroids. These data suggest that most physicians are aware of the need for anti-inflammatory drugs when choosing pharmacotherapy for patients with objective measures of asthma severity. However, the issue remains that 33 of 114 charts labeled as "asthma" did not contain full spirometric data, therefore making proper choice of pharmacotherapy extremely difficult.

The final component of asthma care suggested by Expert Panel Report 2 is patient education. The report states, "Patient education should begin at the time of diagnosis and be integrated into every step of clinical asthma care" (3). Additionally, all members of the health care team are encouraged to participate in asthma education. One of the simplest and most important aspects of asthma education concerns proper administration of medicines (3, 12). Correct use of inhalers and spacers ensures delivery of medication to the airways. Proper technique and spacer use documentation were seen most frequently in the asthma clinic group, followed by the pulmonary group and internal medicine group.

The expert panel has also recommended that exacerbation plans be provided to patients in written form (3). This provides the patient with more independence in asthma management and can quickly attenuate any decompensation in function. Even though substandard to the asthma guidelines, credit was given for an exacerbation plan if the physician documented so much as an instruction for the patient to call for asthma problems. Despite this more liberal approach, exacerbation plans were noted in 80% of asthma clinic charts, 50% of pulmonary group charts, and 18% of internal medicine charts.

The guidelines on patient education place a significant burden on physicians treating asthma. Since primary care physicians treat such a broad spectrum of diseases, it may be unreasonable to ask these physicians to equip their practice with such an intensive education program. In fact, case managers under the supervision of a physician accomplished much of the patient education performed in the asthma clinic group. Perhaps asthma—like diabetes mellitus in chronicity, varying severity, and need for long-term management—will become a disease for which education centers are available.

Our study specifically did not address patient outcomes, nor were we attempting to prove that patients who have been managed according to the guidelines have better outcomes. To directly correlate quality of care to documented guideline compliance would not be appropriate. Determining whether patient management based on the guidelines would improve patient outcome would be an interesting study but would require a very different approach than the one we have chosen. Certainly, significant debate exists about whether clinical guidelines actually improve patient care. As referenced in the guidelines (p. 2), many of the recommendations are evidenced based and have demonstrated patient benefit; however, other suggestions are "based on the opinion of the Expert Panel" and lack randomized clinical trials

(3). The issue of clinical practice guideline utilization has been reviewed in the recent literature (13).

One potential limitation of this study is failure of our assessment tool (chart abstraction) to accurately reflect guideline compliance. Multiple approaches have been reviewed in an attempt to define the best evaluation of physician practices. A recent article examined the pros and cons of vignettes, standardized patients, and chart abstraction (14). One of the cons of chart abstraction is the failure of physicians to document care that was provided. This could apply to some of our evaluation points, such as teaching of correct metered-dose inhaler use or inquiry about nocturnal symptoms. However, other evaluation points, such as spirometry measurements, peak flow data, and vaccination records, would certainly be expected to have been recorded if performed. The issue of careful documentation is an important aspect of patient care, which has been previously reviewed (15).

Another potential limitation is the classification of severity by FEV₁ measurement. Although these charts did contain at least one FEV₁ <60% predicted, the measurement could have fallen during an exacerbation period, therefore making the degree of asthma severity appear worse than it usually was. However, this variable was chosen because it would suggest that such a patient, at the very least, would have severe asthma exacerbations, making anti-inflammatory therapy appropriate. Indeed, the data supported that almost all patients in this category were on inhaled steroids.

Finally, it should be noted that we did not stratify patients according to risk when comparing the 3 clinic groups. An attempt was made to exclude those patients who appeared to receive their primary asthma care from a referral clinic. This could have led to some selection bias in that the patients of the primary care group with more severe asthma were referred to a specialist. In turn, we would be left with a population in the primary care group that had less severe asthma and, perhaps, less intensive care for less severe disease. However, it was felt that this approach was necessary since a patient who received asthma care from a referral clinic could not be accurately evaluated in the referring clinic. Furthermore, we did not feel that comparing documentation of these process of care measures required risk stratification. The guideline recommendations we included in the study generally applied to asthma patients across the spectrum of severity. However, if a study were undertaken that evaluated patient outcome in these clinics, risk stratification would be necessary (16).

Asthma is a complex disease that carries significant morbidity and mortality. Since 1991, physicians have had a powerful resource available through the *Guidelines for the Diagnosis and Management of Asthma* (2, 3). However, as demonstrated now in several types of studies (4–8), uniform application of these guidelines has yet to be accomplished. Potential techniques to implement these standards of asthma care need to be explored. Possibilities include continuing medical education to familiarize physicians with the guidelines (17), chart flow sheets and checklists to remind physicians of recommendations, and the establishment of education centers where patients and their families could be taught principles of asthma care. Furthermore, the general usefulness of clinical practice guidelines needs to be examined more closely.

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1. Centers for Disease Control. Asthma—United States, 1989–1992. *MMWR CDC Surveill Summ* 1995;43:952–955.
2. National Asthma Education and Prevention Program. *Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, Md: National Institutes of Health, 1991.
3. National Heart, Lung, and Blood Institute. *Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, Md: National Institutes of Health, 1997.
4. Lang DM, Sherman MS, Polansky M. Guidelines and realities of asthma management. The Philadelphia story. *Arch Intern Med* 1997;157:1193–1200.
5. Legorreta AP, Christian-Herman J, O'Connor RD, Hasan MM, Evans R, Leung KM. Compliance with national asthma management guidelines and specialty care: a health maintenance organization experience. *Arch Intern Med* 1998;158:457–464.
6. Vollmer WM, O'Hollaren M, Ettinger KM, Stibolt T, Wilkins J, Buist AS, Linton KL, Osborne ML. Specialty differences in the management of asthma. A cross-sectional assessment of allergists' patients and generalists' patients in a large HMO. *Arch Intern Med* 1997;157:1201–1208.
7. Laumann JM, Bjornson DC. Treatment of Medicaid patients with asthma: comparison with treatment guidelines using disease-based drug utilization review methodology. *Ann Pharmacother* 1998;32:1290–1294.
8. Doerschug KC, Peterson MW, Dayton CS, Kline JN. Asthma guidelines: an assessment of physician understanding and practice. *Am J Respir Crit Care Med* 1999;159:1735–1741.
9. Russell NJ, Crichton NJ, Emerson PA, Morgan AD. Quantitative assessment of the value of spirometry. *Thorax* 1986;41:360–363.
10. Shim CS, Williams MH Jr. Evaluation of the severity of asthma: patients versus physicians. *Am J Med* 1980;68:11–13.
11. Busse WW, Lemanske RF Jr, Stark JM, Calhoun WJ. The role of respiratory infections in asthma. In Holgate ST, Austen KF, Lichtenstein LM, Kay AB, eds. *Asthma: Physiology, Immunopharmacology, and Treatment*. London: Academic Press, 1993:345–353.
12. Shim C, Williams MH Jr. The adequacy of inhalation of aerosol from canister nebulizers. *Am J Med* 1980;69:891–894.
13. Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA, Rubin HR. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999;282:1458–1465.
14. Peabody JW, Luck J, Glassman P, Dresselhaus TR, Lee M. Comparison of vignettes, standardized patients, and chart abstraction: a prospective validation study of 3 methods for measuring quality. *JAMA* 2000;283:1715–1722.
15. Rigby M, Roberts R, Williams J, Clark J, Savill A, Lervy B, Mooney G. Integrated record keeping as an essential aspect of a primary care led health service. *BMJ* 1998;317:579–582.
16. Iezzoni LI, ed. *Risk Adjustment for Measuring Health Care Outcomes*. Ann Arbor, Mich: Health Administration Press, 1994.
17. Gorton TA, Cranford CO, Golden WE, Walls RC, Pawelak JE. Primary care physicians' response to dissemination of practice guidelines. *Arch Fam Med* 1995;4:135–142.

Asthma guidelines: invited commentaries

It has now been nearly a decade since the National Heart, Lung, and Blood Institute of the National Institutes of Health published recommendations for the diagnosis and treatment of asthma (1). While these guidelines underwent a modest updating in the late 1990s (2), their message has been consistent and clear. Asthma should be viewed as an inflammation of the airways rather than just a problem of airway hyper-responsiveness. Standardized routine assessment of the airways and clear disease classification of severity should be the foundation for planning. Early use of anti-inflammatory medications should be the treatment of choice for all but the mildest intermittent expression of the disease. Finally, a solid patient-provider partnership is needed to ensure appropriate asthma education, written action plans, and eventual self-management skills.

The national guidelines have been widely disseminated, and a number of recent studies suggest that the vast majority of surveyed health care providers are aware of them (3–5). However, regardless of the widespread knowledge of these guidelines, mounting evidence indicates that physicians have not fully adopted them into practice (6–8). The article by Gipson et al provides additional evidence of the gap between the availability and use of asthma clinical care guidelines (9). The authors conducted chart audits to determine whether key processes related to asthma care were documented during routine patient visits. The authors report that many of the key elements of care were not routinely documented. They also note that although these

performance measures appeared more frequently in the charts of asthma specialty clinics, even within that environment, there were clear opportunities to improve care. These findings, while interesting, are not all that unexpected. Several countries with well-established asthma care guidelines have documented (via chart audit) deficiencies in care for persons with asthma (10–12).

While there is some merit to further characterizing the lack of guideline adherence and variations in physician practices, the clear challenge for those concerned with improving asthma care lies in changing physician behavior and practice performance. The information obtained from the audit process provides a valuable foundation for discussing ways to improve care. It is critical to search for opportunities to use audit information to provide feedback that will lead to improvements in practice performance and, ultimately, better patient outcomes.

It is difficult to identify the most efficient mechanisms for achieving improvements in asthma care. There have been many attempts to encourage the adoption of practice guidelines and practice improvements; few have met the rigors of formal science. Yet there has been some demonstrated success in changing physician behavior through use of academic detailing, opinion leaders, physician feedback systems, and clinical decision support systems. These types of interventions, while useful to the individual physician, are perhaps best introduced through social learning networks such as community collaborations of providers focused on improving care (13).