ORIGINAL INVESTIGATION

Patient Factors That Physicians Use to Assign Asthma Treatment

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Background: Asthma guidelines recommend severity assessment to assign treatment, often quantified as current control. It is unknown how strongly control assessment affects clinician treatment decisions, nor if control is sufficient.

Methods: To determine patient factors used by physicians to assign treatment, we surveyed pulmonary specialists (PSs) and family physicians (FPs) using vignettes. We tested whether recent acute care (hospitalization 6 months ago), bother (patient bothered by asthma), control (symptom or reliever medication frequency), and direction (change since last visit) influence treatment decisions. Factors used for stepping up and stepping down were assessed.

Results: A total of 461 physicians participated (236 PSs and 225 FPs). As expected, physicians indicated a greater likelihood of stepping up treatment for persistent (4-5 times per week) than for intermittent (1 time per 2 weeks) symptoms (PSs 97% vs 24%, $P < .001$; FPs 97% vs 33%, $P < .001$). All else being equal, physicians were more likely to step up treatment of a patient with intermittent symptoms if the patient reported recent acute care (PSs 49% vs 24%; FPs 72% vs 33%), was bothered (PSs 81% vs 24%; FPs 80% vs 33%), or was worse since the last visit (PSs 68% vs 24%; FPs 66% vs 33%) (all $P < .001$). These factors were also predictive of stepping down from high-intensity therapy and remained significant in multivariate analyses (all $P < .05$).

Conclusions: Asthma control greatly influences physician decisions about asthma treatments. However, recent acute care, bother, and direction of illness also influence decisions, particularly those that involve increasing the amount of medication prescribed. Further work is needed to determine if use of these additional indicators leads to better asthma outcomes.

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ASTHMA AFFECTS MORE THAN 20 million persons in the United States alone.[1] Treatment guidelines promote ideals of asthma care, incorporating evidence for therapies that have been shown to improve outcomes.[2,3] These widely circulated guidelines recommend treatment based on assessment of asthma severity, which in practice is often interpreted as current control. The guidelines of the National Asthma Education and Prevention Program recommend assessment of symptoms, exacerbations, activity limitation, use of bronchodilators, and lung function to determine appropriate therapy,[2] and the Global Initiative for Asthma guidelines also recommend assessment of the response to treatment.[3]

Recently, there has been great interest in developing tools to systematically assess control, some of which can be used by physicians in the clinical setting.[4-8] Despite the validity of these tools for assessing control, there is little evidence to show whether physicians would use results from these measures to assign treatment. Several studies have reported that physicians infrequently document indicators of control in the medical chart.[9,10] These findings could mean that physicians do not depend on assessment of control for assigning treatment. Moreover, some asthma experts have suggested that physicians often incorporate factors other than current level of disease activity when making treatment decisions, suggesting that tools that only capture control may be insufficient.[11] Surprisingly, there is a lack of published studies examining whether control is useful or sufficient for physician treatment decisions.

Recently, we began development of a new clinical tool (Asthma Control and Communication Instrument) designed to assess asthma status in diverse populations and to aid physicians in assigning asthma treatments.[12] As part of the development process, we conducted focus

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groups with specialist and generalist physicians to learn which indicators of asthma status physicians find most useful when making treatment decisions. Focus groups indicated that assessment of control was necessary but often insufficient for assigning treatment. Other factors reported as critical were recent acute care (such as hospitalization), the extent to which patients are bothered by their asthma, and change in status since the most recent visit (direction).[13]

Because there is little published evidence regarding which factors physicians use to make treatment decisions in clinical care, we sought to determine the relative importance of acute care, bother, control, and direction on decision making regarding asthma treatment. To address this question, we conducted a national survey of practicing specialist and generalist physicians, using case-based vignettes.[14] We hypothesized that acute care (hospitalization in the past 6 months), bother (patient was bothered by his or her asthma), control (current level of symptom frequency and reliever use), and direction (change of illness since last visit) would each independently influence treatment decisions.

METHODS

SAMPLE

Eight hundred members each from the American College of Chest Physicians and the American Academy of Family Physicians were randomly selected from membership lists as a means to identify pulmonary specialists (PSs) and family physicians (FPs), respectively. We estimated sample size requirements to demonstrate absolute differences of 20% in treatment tendency within each specialty group by each of the 4 study factors, with $\alpha = .05$ and power = 0.80. We expected a response rate of less than 50%, given that physician study subjects typically have modest response rates.[15] Eligibility criteria included (1) living in the United States or its territories and (2) active clinical practice. Exclusions included pediatricians and physicians-in-training.

QUESTIONNAIRE

Standardized vignettes were used, as a vignette-based approach has been shown to be a valid method for determining physician practices.[14] Vignettes also have advantages over studies of actual practice in that study conditions can be controlled and the number of confounding variables can be limited. We used 9 vignettes for these analyses (**Figure 1** and **Table 1**) with either low-intensity treatment (low-dose inhaled corticosteroid [ICS] and as-needed albuterol) or high-intensity treatment (high-dose ICS, long-acting inhaled β-agonist [LABA], leukotriene modifier [LTM], and as-needed albuterol) to test whether each of the following factors affects stepping therapy up or down: (1) acute care, defined as asthma hospitalization 6 months ago vs no emergency department visits or hospitalization or intubation in the past 6 months; (2) bother, defined as patient bothered by asthma vs not bothered; (3) control, defined as wheeze or albuterol use 1 time in the past 2 weeks vs wheeze or albuterol use 4 to 5 times per week in the past 2 weeks, reflecting mild intermittent and mild persistent status, respectively[2]; and (4) direction, defined as doing worse vs the same since the last visit.

The vignettes involved patients returning for a 3-month follow-up visit. On examination, all patients had good air movement, faint wheeze, forced expiratory volume in the first second of expiration 90% predicted, and no other remarkable findings. For each vignette, physicians were asked (1) if they would increase (step up), decrease (step down), or leave medications unchanged and (2) for specific medication changes. Physician demographic and practice information was collected. As part of their development, vignettes and survey questions were reviewed by practicing PSs, allergists, FPs, and internists for clarity and comprehensibility.

A 25-year-old high school teacher with asthma returns to your office for a follow-up appointment 3 months after the last visit. The following information is elicited at the current visit:

Interval history:
- Wheezing 1 time in the past 2 wk
- Albuterol use 1 time in the past 2 wk
- Symptoms unchanged since last visit
- Patient reports full adherence to prescribed medication
- Patient says she is not bothered by these symptoms

Past medical history:
- No history of emergency department visits, hospitalizations, or intubations within the past 6 mo
- No gastroesophageal reflux disease, rhinosinusitis, or other comorbidities

Environment:

Patient is a nonsmoker, has little second-hand smoke exposure, and owns no pets

Current medications (stable past 6 mo)
- Albuterol as needed
- Low-dose ICS (eg, fluticasone, 44 μg, 2 puffs twice daily)

Examination:
- Good air movement, with faint wheeze
- Results of remainder of examination unremarkable
- FEV_1, 90% predicted

Based on this information, what medication changes would you make at this visit? (Fill in all that apply)

❍ No medication change
❍ Increase/add medication
  ❍ Increase ICS dose
  ❍ Add LTM (eg, montelukast)
  ❍ Add LABA (eg, salmeterol or replace with combined salmeterol/fluticasone)
  ❍ Add theophylline
❍ Decrease/discontinue medication
  ❍ Decrease ICS dose
  ❍ Discontinue ICS
  ❍ Discontinue albuterol
❍ Other medication change (please specify)

Figure 1. An example of 1 of the 9 vignettes. This vignette represents the "floor" for comparison of studied factors. The shaded areas in this vignette highlight where there were variations by vignette (eg, wheezing 1 time in the past 2 weeks vs wheezing 4-5 times per week). ICS indicates inhaled corticosteroid; FEV_1, forced expiratory volume in the first second of expiration; LTM, leukotriene modifier; and LABA, long-acting β-agonist.

PROCEDURES

From August 19, 2004, to December 10, 2004, physicians were mailed a self-administered survey accompanied by a letter explaining the study purpose and a stamped return envelope. Nonrespondents received additional mailings at 2 and 4 weeks. No remuneration was provided. The study was approved by the Western Institutional Review Board, Spokane, Washington.

Each physician received only 4 vignettes, as the burden of a longer survey was expected to reduce the response rate.[16,17] The first 2 vignettes were the same for all respondents and represented baselines for stepping up (mild intermittent symptoms, low-intensity therapy, unchanged from last visit, no emergency department visits or hospitalizations in the past 6 months, and not bothered by asthma) and stepping down treatment (similar patient receiving high-intensity therapy). We expected most respondents not to step up treatment in the first case and most to step down treatment in the second. Two other vignettes were randomly selected.

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Table 1. Concept Map of Vignettes[a]

Vignette No.	Treatment[b]	Acute Care	Bother	Control, Sx/wk	Direction
1[c]	Low-intensity	No	No	1 Time/2	Unchanged
2	Low-intensity	Yes	No	1 Time/2	Unchanged
3	Low-intensity	No	Yes	1 Time/2	Unchanged
4	Low-intensity	No	No	4-5 Times/1	Unchanged
5	Low-intensity	No	No	1 Time/2	Worse
6[d]	High-intensity	No	No	1 Time/2	Unchanged
7	High-intensity	Yes	No	1 Time/2	Unchanged
8	High-intensity	No	Yes	1 Time/2	Unchanged
9	High-intensity	No	No	1 Time/2	Worse

Abbreviation: Sx, symptoms.
[a] For analysis purposes, vignettes 2 through 5 were compared with vignette 1 (stepping-up baseline), and vignettes 7 through 9 were compared with vignette 6 (stepping-down baseline).
[b] Low-intensity treatment consisted of a low-dose inhaled corticosteroid and albuterol as needed; high-intensity treatment consisted of a high-dose inhaled corticosteroid, long-acting inhaled β-agonist, leukotriene modifier, and albuterol as needed.
[c] Stepping-up baseline.
[d] Stepping-down baseline.

Table 2. Physician Demographic and Practice Characteristics

Physician Characteristic, %	Pulmonary Specialists (n = 236)	Family Physicians (n = 225)
Sex		
Male	93.2	69.0
Female	6.8	31.1
Race/ethnicity		
White	82.4	81.3
Asian/Asian American	9.8	5.5
Hispanic/Latino	3.9	5.0
Black/African American	1.7	4.1
Other	2.2	4.0
Practice area		
Urban	52.6	28.8
Suburban	34.9	35.8
Rural	11.6	31.6
Other	0.9	3.7
Primary employer		
Private practice	66.4	54.5
University medical school	13.8	4.7
Community hospital	10.3	15.5
Government	3.9	6.6
Managed care	1.7	4.3
Other	3.9	14.6
Experience treating asthma		
Extensive	79.0	13.7
Moderate	19.7	76.3
Limited	1.3	10.0

STATISTICAL ANALYSIS

Medians and proportions were used as appropriate. A *t* test for differences in proportions was used to examine the effect of acute care, bother, control, and direction on the proportion of physicians who would step up treatment in patients who were receiving low-dose therapy or step down treatment in those who were receiving high-dose therapy. Logistic regression was used to assess independent effects of the 4 factors on stepping treatment up or down. Statistical analyses were performed with Stata SE-8.0 software (Stata Corp, College Station, Texas). $P<.05$ was considered statistically significant.

RESULTS

There were 461 respondents, including 236 practicing physicians from the American College of Chest Physicians (PSs) and 225 practicing physicians from the American Academy of Family Physicians (FPs), representing 34% of potentially eligible respondents. The PSs and FPs resided in 49 and 43 US states and territories, respectively. While we had few data on nonrespondents, there were no significant differences in respondents and nonrespondents by region of the country (FPs, $P=.29$; PSs, $P=.28$). The majority of PSs rated their experience treating asthma as extensive (79%), while the majority of FPs rated their asthma treatment experience as moderate (76%) (**Table 2**). Most physicians were in private practice, and while the PSs tended to practice in urban areas, the FPs were more evenly distributed across urban, suburban, and rural areas. Nearly all respondents (>95%) reported currently treating patients with asthma every week.

TENDENCY TO STEP UP FROM LOW-INTENSITY TREATMENT

As expected for the baseline scenario for stepping up treatment, most physicians would not step up treatment for a patient who was receiving low-intensity therapy and who had symptoms 1 time in the past 2 weeks. However, a substantial minority of physicians would intensify treatment in this situation (PSs 24%; FPs 34%) (**Figure 2**). Not surprisingly, physicians were significantly more likely to step up treatment for a patient receiving low-intensity therapy when the patient had persistent (4-5 times per week) rather than intermittent symptoms (PSs 97% vs 24%, $P<.001$; FPs 97% vs 34%, $P<.001$).

Among patients with intermittent symptoms (1 time in the past 2 weeks) who were receiving low-intensity treatment, a substantially greater proportion of physicians would step up treatment if the patients had been hospitalized 6 months ago (PSs 49% vs 24%, $P<.001$;

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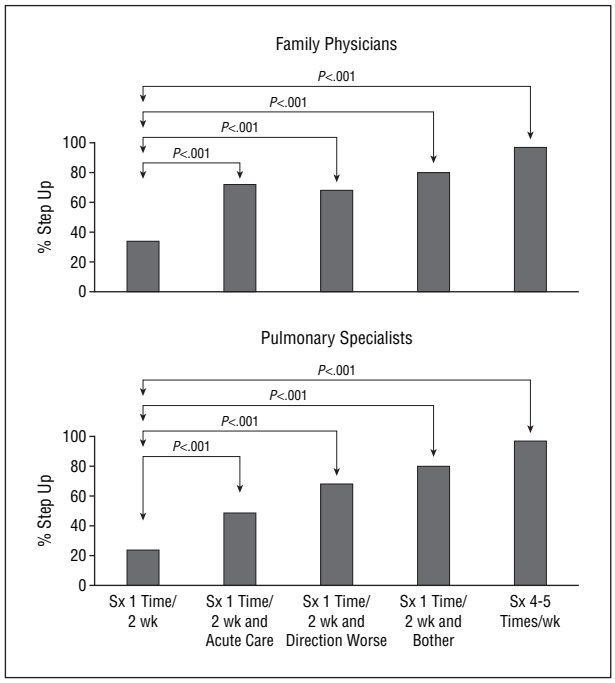

Figure 2. The impact of acute care, bother, control, and direction on the tendency of physicians to step up treatment under each studied vignette. In each case, the patient was already receiving a low-dose inhaled corticosteroid. The first bar represents the proportion of physicians who would step up treatment for patients with mild intermittent symptoms (Sx) (1 time in past 2 weeks). In this case, 33% of family physicians and 24% of pulmonary specialists would step up treatment. The other bars represent the proportion of physicians who would step up treatment of patients with only 1 key factor changed (acute care, direction, bother, or control [persistent symptoms 4-5 times per week]). Each studied factor significantly increased the tendency to step up treatment. For example, the second bar represents the case of symptoms 1 time in the past 2 weeks as well as a history of acute care (hospitalization 6 months ago). In this case, physicians were significantly more likely to step up treatment if the patients had had acute care visits than if they had not (72% of family physicians and 49% of pulmonary specialists, $P<.001$ for both).

FPs 72% vs 34%, $P<.001$), if the patients were bothered by their asthma (PSs 81% vs 24%, $P<.001$; FPs 80% vs 34%, $P<.001$), or if the patients' symptoms were worse than at the previous visit (PSs 68% vs 24%, $P<.001$; FPs 68% vs 34%, $P<.001$). The PSs and FPs made similar medication changes, and regardless of the factor that led to a step-up in treatment, the majority of physicians who would intensify treatment would increase the ICS dose. Of those who would step up treatment, 69% would increase the ICS dose, 52% would add LABA, and 13% would add LTM (sums to more than 100% because some physicians would make more than 1 change).

In a multivariate model (**Table 3**), all studied factors (acute care, bother, control, and direction) remained independent significant predictors of the tendency to step up treatment. When only patients with intermittent symptoms were considered, bother had the greatest odds of stepping up treatment.

Table 3. Multivariate Predictors of Tendency to Step Up Treatment

Predictor	Odds Ratio (95% Confidence Interval): Pulmonary Specialists (n = 236)	Odds Ratio (95% Confidence Interval): Family Physicians (n = 225)
All patients		
Persistent vs intermittent symptoms	42 (15.0-120.0)	29 (8.9-9.6)
Bother	8.7 (4.5-17.0)	4.0 (2.2-7.4)
Direction worse	4.8 (2.7-8.6)	2.3 (1.3-4.0)
Acute care	2.3 (1.3-4.0)	2.8 (1.6-5.0)
Patients with intermittent symptoms only		
Bother	12 (5.8-24.0)	4.5 (2.4-8.3)
Direction worse	6.2 (3.4-11.0)	2.5 (1.4-4.5)
Acute care	2.9 (1.6-5.0)	3.1 (1.8-5.6)

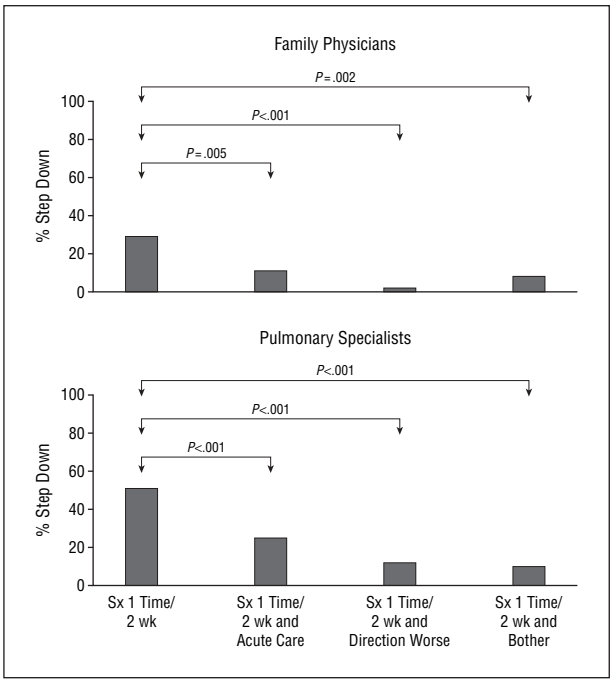

Figure 3. The impact of acute care, bother, control, and direction on the tendency of physicians to step down treatment under each studied vignette. In each case, the patient was already receiving a high-dose inhaled corticosteroid, long-acting inhaled β-agonist, and leukotriene modifier for the past 6 months. The first bar represents the proportion of physicians who would step down treatment of patients with mild intermittent symptoms (Sx) (1 time in past 2 weeks). In this case, 28% of family physicians and 51% of pulmonary specialists would step down treatment. The other bars represent the proportion of physicians who would step down treatment with only 1 key factor changed (acute care, direction, and bother). Each studied factor significantly decreased the tendency to step down treatment. For example, the second bar represents the case of symptoms 1 time in the past 2 weeks as well as a history of acute care (hospitalization 6 months ago). In this case, physicians were significantly less likely to step down treatment if the patients had had acute care visits than if they had not (11% of family physicians and 25% of pulmonary specialists, $P<.001$ for both).

TENDENCY TO STEP DOWN FROM HIGH-INTENSITY TREATMENT

For the patient with intermittent symptoms (1 time in the past 2 weeks) on a stable regimen for the past 6 months of high-dose ICS, LABA, and LTM, only 29% of FPs and 51% of PSs would step down treatment (**Figure 3**). Markedly fewer physicians would step down treatment if a similar patient had been hospitalized in the past 6 months (PSs 25% vs 51%, $P<.001$; FPs 11% vs 29%, $P=.005$), was bothered by his or her asthma (PSs 10% vs 51%, $P<.001$; FPs 8% vs 29%, $P<.002$), or was worse than

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Table 4. Multivariate Predictors of Tendency to Step Down Treatment in Patients With Intermittent Symptoms

Predictor	Odds Ratio (95% Confidence Interval) Pulmonary Specialists (n = 236)	Family Physicians (n = 235)
Bother	0.13 (0.06-0.30)	0.26 (0.10-0.69)
Direction worse	0.15 (0.07-0.36)	0.09 (0.02-0.37)
Acute care	0.36 (0.19-0.70)	0.36 (0.16-0.84)

at the last visit (PSs 12% vs 51%, $P<.001$; FPs 2% vs 29%, $P<.001$). When physicians chose to step down treatment, most (72%) would decrease or discontinue the ICS. Discontinuing the LTM was the next most common change (35%), followed by decreasing or discontinuing the LABA (19%). A multivariate model showed that acute care, bother, and direction would each independently reduce the tendency to step down treatment (**Table 4**). As with stepping up treatment, the strongest of these 3 factors was bother.

TENDENCY TO CHANGE TREATMENT BY PHYSICIAN SPECIALTY

The tendency to step treatment up or down was quite similar and in most cases did not differ significantly between FPs and PSs for the majority of vignettes ($P>.05$). In 2 cases, the differences were statistically significant. The history of hospitalization 6 months ago had a greater impact on FPs' tendency than on PSs' tendency to intensify therapy in a patient with intermittent symptoms (72% vs 49%, $P<.01$). Likewise, for the patient with intermittent symptoms (1 time in the past 2 weeks) on a stable regimen for the past 6 months of high-dose ICS, LABA, and LTM, FPs were significantly less likely than PSs to step down treatment (29% vs 51%, $P<.001$).

COMMENT

The present study shows that treatment decisions of practicing physicians are likely influenced by patient's level of asthma control; however, decisions may also be significantly influenced by other patient factors such as recent acute health care use, patient bother, and the direction of illness. Indeed, this study shows that even in the context of adequate control, physicians may intensify therapy based on additional information. Taken together, these factors could be easily recalled as the *ABCD*s of asthma assessment, reflecting acute care, bother, control, and direction. Our study provides strong support for the clinical importance of indicators of control such as symptom frequency or reliever use as recommended by guidelines, but it also points out that additional dimensions of the illness could weigh importantly on the physician's decision to change therapy. Although guidelines recommend thorough assessment of such factors, most of this other information has not been included operationally into the stepped-care approach to treatment. Since assessment of these additional factors means that clinicians are more likely to intensify treatment or to defer stepping down, even when symptom control is adequate, regular assessment of these factors may lead to care that is even more aggressive than care where control alone is the target. Future studies are needed to learn whether outcomes are optimized with more comprehensive clinical assessment strategies.[18,19] If outcomes are improved, it will also be necessary to consider whether there is an acceptable trade-off with medication costs and adverse effects. We would also emphasize that we do not believe that these factors should reflexively lead to medication changes; instead, we believe that they should lead to further evaluation of the patient, including whether there are issues related to adherence or the environment.

A notable finding is the importance of direction or trajectory of illness in treatment decisions. In previous focus groups, physicians pointed out that a threshold value of symptoms (eg, 2 times weekly) is not sufficiently informative.[13] Indeed, if a patient had improved from daily symptoms on the last visit to 2 times weekly, physicians were inclined to leave the regimen alone, whereas they might increase therapy for a previously asymptomatic patient who was now wheezing twice per week. In a recent editorial, Stoloff and Boushey[11] articulated the need for a more comprehensive approach to asthma assessment that not only includes measurement of current symptoms but also addresses future risk and acknowledgment of variation of the illness over time. Our study findings suggest that practicing physicians would use a more multidimensional assessment framework for making treatment decisions.

While we were not surprised to see the large effect of persistent symptoms on prescribing, we were impressed to see that a patient report of being bothered also had a substantial impact on treatment decisions. In a previous qualitative study of patients with asthma, we learned that *bother* can refer to many different problems, including the impact that asthma will have on planned activities, the need to use more medications, or simply the intensity of symptoms.[12] It was clear in that study that the report of bother was a signal that patients wanted to convey something to their physicians other than the frequency of their asthma symptoms. Our study found that physicians appear to be attuned to these patient-centered concerns and that these factors influence treatment decisions even in the absence of conventional evidence of lack of control.[13] These findings therefore suggest that future comprehensive clinical approaches to asthma assessment should consider both quantitative (ie, control) and qualitative (ie, bother) dimensions of asthma status.

This study demonstrated that physicians in the United States report a strong tendency to treat patients with anti-inflammatory medications in a more aggressive manner than is suggested by guidelines. For example, our "floor" scenario had a symptom level of 1 time per 2 weeks, which is well below the guideline classification of mild persistent asthma and a treatment regimen (low-dose ICS and short-acting β-agonist as needed) recommended for the higher mild persistent level. Even so, more than 25% of physicians recommended an increase in treatment, mostly by increasing the dose of ICS. Furthermore, when we provided an opportunity to step down from 6 months of high-

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intensity treatment in a patient with a low frequency of symptoms, a practice recommended by guidelines[2] and supported by evidence,[20,21] only 50% of PSs and fewer than 30% of FPs would decrease treatment. It is important to note that our study was not designed to test for differences between specialty groups in how they treat asthma. We cannot rule out the possibility that other factors, such as regional practice patterns rather than specialty type, were responsible for observed differences. Nevertheless, study findings suggest that overall, specialists and generalists respond similarly to the studied factors and that FPs may place additional emphasis on the history of hospitalization.

A vignette-based approach as a study design feature has been shown to be valid for determining physician practices.[14] We used vignettes to simulate patients in order to control variables that otherwise might confound treatment decisions, such as comorbidities and age. We have demonstrated how physicians would modify their asthma medication recommendations when such information is available. Because a number of studies suggest that physicians may not routinely assess asthma control,[9,10] our findings may not reflect current clinical practice. While some studies show that response to a survey is an imperfect reflection of actual practice,[22] it has also been reported that objective measures of actual practice, such as chart reviews, can also be unreliable, as physicians may perform a practice and fail to record it in the medical records.[23] Because our goal was to learn what factors would be used, rather than what factors are actually used at present, we believe that this design feature was ideal. Because the vignettes were specifically designed to minimize the role of adherence or environmental concerns, we cannot address how these factors might have influenced physician treatment decisions. The findings may not be generalizable to physicians such as allergists, general internists, and pediatricians, as they were not included in the study. The response rate was modest, likely reflecting the impact of increasing demands on physician time and the lack of monetary remuneration. In a sensitivity analysis, we found that, because of the very strong influence of the study factors, nonrespondents would have been unlikely to have changed the study conclusions. Assuming the extreme situation in which each studied factor had no influence on the nonrespondents' tendency to step up treatment, all statistically significant bivariate comparisons would remain significant at $P<.01$, and the effect of acute care on members of the American College of Chest Physicians would have been significant at $P=.02$. Nonresponse bias, even if present, is most likely to affect estimates of prevalence, which were not the focus of this study. Fortunately, studies of association are far less likely to be distorted by low response rates.[15] Finally, replication of the study findings in 2 separate professional groups adds credence to the study results.

In summary, our study demonstrated that in addition to asthma control, physicians are likely to use information about acute care, bother, and direction of illness to assign treatment. As the ideal assessment strategy for assigning treatment is unknown, future research should compare outcomes of patients who are treated using different assessment schemes. In the meantime, these findings suggest that future guidelines that incorporate these factors into the treatment algorithm may be more acceptable to practicing physicians, as they are likely to fit into an acceptable decision-making strategy. They also provide a framework for physicians who are developing office-based assessment tools and suggest that the most useful tools for practicing physicians should include other information in addition to traditional indicators of control. Simple control tools have conceptual appeal, but they may be inadequate to capture all of the key information that physicians would like to have at hand when deciding whether or not to modify treatment.

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