Lower Physician Estimate of Underlying Asthma Severity Leads to Undertreatment

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Background: Asthma undertreatment has been linked to poor outcomes. National guidelines recommend that physicians classify asthma severity based on pretreatment symptoms and titrate care as the disease changes in the individual patient. This study evaluated the extent to which the physician estimate of underlying severity affects a patient's asthma care.

Methods: Data used were collected from a cohort of adults with asthma enrolled in managed care. Eligible patients were adults enrolled in managed care with medical encounters coded for asthma. Physicians were eligible if they were main asthma providers. The patient survey covered demographics, symptoms, asthma treatment, and self-management knowledge. Physicians were asked to assess the underlying severity of their patients' asthma.

Results: There were 4005 patients with asthma with physician estimates of underlying severity. Of the patients, 70.1% were female (mean age, 44.8 years) and 83.5% were white. Most patients' current asthma symptoms were moderate (39.4%) and severe (50.1%). Most physician estimates of underlying severity were mild (44.6%) and moderate (44.5%). Among those patients reporting moderate symptoms, daily inhaled corticosteroid use was reported in 35.2% when physician estimates were mild, 53.0% when moderate, and 68.1% when severe ($P = .001$). Rates of peak flowmeter ownership, allergy testing, and self-management knowledge tracked similarly with physician estimates of underlying severity.

Conclusions: Physician estimates of underlying asthma severity appear to determine asthma care. For patients with inadequate symptom control, lower physician estimates of underlying severity were associated with care that is less consistent with national guidelines. To improve the quality of asthma care, physicians need to update treatment based on their patients' current symptoms and adapt care accordingly.

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ASTHMA, CHARACTERIZED by intermittent, reversible airway obstruction, is a chronic disease that leads to considerable morbidity and health care utilization. There is substantial evidence that undertreatment of asthma is common,[1-6] despite the availability of national treatment guidelines since 1991.[7-10] There are many causes of asthma undertreatment, including patients' nonadherence to prescribed asthma treatment.[11] However, physicians' nonadherence to national guidelines recommendations may also play an important role.[12-14]

Asthma care that is not consistent with national guidelines has been linked to poor patient outcomes.[15] Examples include underuse of long-term controller medications and of nonpharmacologic measures such as periodic monitoring and self-management education. Underuse of inhaled anti-inflammatory agents has been associated with more frequent asthma-related emergency department visits and hospitalizations.[16] Adherence to national guidelines (ie, peak flowmeter use, a written action plan, and regular use of an inhaled corticosteroid) has been shown to be protective against poor outcomes.[17,18]

The National Asthma Education and Prevention Project (NAEPP) released the first Expert Panel Report (EPR) in 1991, which included national guidelines for the diagnosis and treatment of asthma.[19] Treatment recommendations were based on the clinician's estimate of underlying severity. The EPR stated that severity should be assessed based on pretreatment symptoms, that severity classification may change over time, and that asthma therapy must adapt as the disease changes in the individual. The severity estimates of mild, moderate, and severe were based on frequency of day and nighttime symptoms, exercise tolerance, the degree to which

Table 1. National Asthma Education and Prevention Program Severity Levels

Severity Level	Symptom Frequency	Noctural symptoms	Symptom Chronicity
Mild	Mild symptoms, not more than once a week	Not more than once a month	Asymptomatic between exacerbations
Moderate	Exacerbations 2-5 times a week	2-7 Times a month	Some symptoms on most days, requiring inhaler for relief
Severe	Frequent exacerbations, >5 times a week	Frequent nocturnal symptoms, >7 times a month	Symptoms most of the time

asthma interfered with a patient's normal activities, and results of pulmonary function testing. Treatment recommendations included both pharmacologic and nonpharmacologic measures. To our knowledge, there have been no studies of whether this anchoring of treatment on underlying severity leads to appropriate care.

The purpose of this study was to examine the relationship of physicians' estimates of underlying asthma severity to asthma care. We hypothesized that physician estimates of underlying severity may anchor their treatment decisions and that when physician estimates of severity are lower, patients are less likely to receive care recommended by national guidelines. To test this, we examined the care of patients with similar current asthma symptoms but with different physician estimates of underlying severity.

METHODS

This study used patient-reported and physician-reported data from surveys in a cohort study of adults with asthma enrolled in managed care. The Managed Health Care Association Outcomes Management System Consortium Asthma Study was undertaken by 11 large employers and their managed care partners to test the feasibility and usefulness of patient-reported information to improve the quality of patient care.[2,20] Fifteen managed care organizations (MCOs) participated in a prospective longitudinal study that included an initial patient baseline survey and 2 annual patient follow-up surveys. Study participants were selected from the pool of enrollees in each MCO by means of claims data or other central information sources. Three inclusion criteria were applied: (1) age 18 years or older on September 1, 1993; (2) enrollment in the MCO at the time of sampling; and (3) 2 or more medical care encounters (outpatient visits or hospitalizations) with a diagnosis of asthma (*International Classification of Diseases, Ninth Revision*, code 493.xx) from September 1991 through August 1993. Individuals were excluded from the baseline assessment if they stated that they did not have asthma or had disenrolled or expected to disenroll before January 1, 1994. The study design has been described in detail previously.[20]

In August 1993, 10 539 patients were sampled, 8640 of whom were eligible for the study. From September 1 through December 31, 1993, data were collected from patients by mail survey with telephone follow-up of nonresponders. The completion rate for the baseline survey was 76.9%, with 6612 usable baseline questionnaires available for analysis. Physicians were eligible if they were identified as being the main asthma provider by the patients on the initial survey.

Asthma symptom questions were based on the symptom types and frequencies used by national and international guidelines and included cough, sputum, chest tightness, wheeze, and shortness of breath (never, once a week or less, 2 to 3 times per week, 4 to 5 times per week, or daily). Respondents were also asked about nocturnal symptoms, frequency of asthma

flares, and asthma symptoms between flares. Responses to asthma symptom questions, nocturnal symptoms, and symptoms between flares were then converted in to mild, moderate, and severe categories based on the NAEPP 1991 guidelines.[19]

We compared asthma care with that recommended the NAEPP, including indicators of assessment and monitoring, allergy history and treatment, pharmacologic therapy, and self-management asthma education. Indicators of assessment and monitoring were examined by asking whether a patient possessed a peak flowmeter and used it regularly. Allergy history and treatment was assessed through questions on allergy testing and knowledge of how to avoid known allergy triggers. Pharmacologic therapy was assessed through questions about frequency of use of medications recommended by the guidelines, including inhaled corticosteroids. Education measures were assessed through questions on self-management knowledge, knowledge of how to adjust medications for asthma flares, and how to prepare for exposures to a known trigger.

Physicians were given a table (**Table 1**) derived from the NAEPP guidelines' characterization of severity levels and the level of symptoms for each severity category with instructions to "Please evaluate the severity of this patient's asthma, considering the underlying disease, not the patient's current status. Using the descriptions of symptom frequency, nocturnal symptoms, and symptom chronicity in the chart below, rate the severity of this patient's asthma as 'mild,' 'moderate,' or 'severe.' If a patient meets any of the criteria for a severity level (with regard to symptom frequency, nocturnal symptoms, or symptom chronicity), then patient qualifies for that level."[19] Physician estimates of underlying severity were completed between 1 and 6 months after the initial patient baseline survey.

Variables were examined using descriptive frequencies and cross-tabulations. Each indicator of care was examined using the χ^2 test for trend to determine whether there was a significant difference when the physician estimate was mild, moderate, or severe. A significance level of $P<.05$ was used. Multivariable analyses for each care indicator used logistic regression, with results reported as odds ratios (ORs) with 95% confidence intervals (CIs). The multivariable models accounted for physician estimate of underlying severity and patient current symptom level. Separate analyses were performed to adjust for patient age, race, sex, and education. Statistical computations were performed with SAS version 6.12 statistical software (SAS Institute, Cary, NC).

RESULTS

A total of 6612 adults completed the baseline survey, 4005 (60.6%) of whom had physicians who returned estimates of underlying severity. Compared with patients without physician estimates, patients with estimates were slightly older (mean age, 44.8 vs 43.5 years), less likely to be African American (12.5% vs 15.5%), less likely to be working full-time (61.1% vs 64.0%), and more likely

to have allergies (74.0% vs 70.8%) (all $P<.05$ by χ^2 test). There were no significant differences between patients with and without physician estimates with regard to current asthma symptom severity, sex, education, and smoking history.

Most patients were white (83.5%) and female (70.1%), with a mean age of 44.8 years. Most were working full-time (61.1%), while 12.8% were primarily keeping house and 8.6% were working part-time. Only a third (36.3%) rated their general health status as very good or excellent. Patients' self-reported current symptoms were mostly moderate (39.4%) or severe (50.1%). Most physicians classified their patients' underlying severity as mild (44.6%) or moderate (44.5%).

We examined the relationship between physician estimates of underlying severity and pharmacologic and nonpharmacologic asthma care reported by their patients. Indicators of asthma care were increasingly likely as physician estimate of underlying severity changed from mild to moderate to severe. Daily use of inhaled corticosteroids, having a peak flowmeter, ever being tested for allergies, and adequate self-management knowledge were all significantly greater among patients with moderate or severe physician estimates compared with those with mild physician estimates of severity (**Table 2**).

We examined asthma care indicators by strata of symptom severity (mild, moderate, or severe), further stratified by their physicians' estimates of underlying severity (mild, moderate, or severe) (**Table 3**). Among patients with similar symptom severity, guideline-consistent care was more likely with greater physician estimate of severity. For example, among all patients with moderate symptoms, inhaled corticosteroid use increased as the physician estimate changed from mild (58.3%) to moderate (74.8%) to severe (88.1%) ($P=.001$). Daily use of an inhaled corticosteroid was more common in patients whose physicians' estimates were moderate (53.0%) and severe (68.1%) compared with mild (35.2%; $P=.001$). For nonpharmacologic care, physicians' estimates of severity also tracked with the prevalence of peak flowmeter ownership, allergy testing, and treatment and self-management education.

We estimated the independent effects of physicians' estimates of underlying severity and patients' current symptoms on the likelihood of receiving each care indicator (eg, inhaled corticosteroid use and daily inhaled corticosteroids use). A physician estimate of mild underlying severity was used as the reference group (OR, 1.00). After adjusting for patients' current symptoms, the odds of receiving each care indicator were consistently greater when the physician estimate of severity was higher. For example, after adjusting for patient current symptoms, the odds of reporting inhaled corticosteroid use were greater when the physician estimate was moderate (OR, 1.92; 95% CI, 1.65-2.22) or severe (OR, 4.97; 95% CI, 3.58-6.89) compared with a physician estimate of mild (**Table 4**).

Examination of the effect of a patient's symptom level on the likelihood of receiving each care indicator revealed a somewhat different relationship. In some instances, the odds of favorable care indicators increased in patients with moderate and severe symptoms compared with those with mild symptoms. For example, after adjusting for physician estimates of underlying severity, the odds of inhaled corticosteroid use were increased in patients with moderate symptoms (OR, 1.84; 95% CI, 1.47-2.31) and severe symptoms (OR, 2.38; 95% CI, 1.90-2.98). However, the odds of certain nonpharmacologic care indicators actually decreased in patients with moderate and severe symptoms compared with those with mild symptoms. For example, after adjustment for physician estimate of severity, the odds of reporting knowledge about how to adjust medication for a severe asthma flare decreased in patients with moderate symptoms (OR, 0.64; 95% CI, 0.51-0.81) and severe symptoms (OR, 0.51; 95% CI, 0.41-0.64) compared with those with mild symptoms (Table 4).

The physician estimate appeared to be a stronger determinant of care than the patient current symptoms. In both pharmacologic and nonpharmacologic realms of care, physician estimates conferred higher ORs than patient symptom levels. For example, when the physician estimate of underlying severity was severe, the odds of reporting inhaled corticosteroid use was almost 5 times greater (OR, 4.97) than when the physician estimate was mild. However, when the patient symptom level was severe, the odds of reporting inhaled corticosteroid use was only 2.38 times greater than when the patient symptom level was mild (**Figure**).

We repeated the multivariable analyses, adjusting for patient race, age, sex, and educational level. The relationships between physician estimate, patient symptom level, and each of the 9 care variables were unchanged (data not shown).

COMMENT

The major finding in our study was that patients with moderate to severe asthma received less asthma care when their

Table 2. Care Indicators for 4005 Patients With Asthma by Physician Classification of Underlying Severity*

Aspects of Care	Physician Classification		
	Mild	Moderate	Severe
Pharmacologic care			
Inhaled corticosteroid (ICS) use	59.5	75.0	89.3
Daily ICS use (among those who reported ICS use)	39.6	56.7	71.2
Nonpharmacologic care monitoring			
Has peak flowmeter	17.5	31.1	56.0
Allergy testing and treatment (among those who report allergy symptoms)			
Avoids allergens	78.0	82.2	85.4
Ever allergy testing	58.8	64.0	73.1
Self-management education			
Adjusting medication for severe flare	49.8	56.5	69.9
Adjusting medication when asthma worse	48.5	52.9	66.3
Avoiding things that make asthma worse	50.1	56.0	68.5
Excellent knowledge about what to do in severe asthma attack	18.2	23.4	32.0

*Data are given as percentage. $P<.001$ for all comparisons.

Table 3. Care Indicators for 4005 Patients With Asthma by Physician Classification of Underlying Severity and Patient Current Symptoms

	Patient Current Symptoms								
	Mild (n = 424)			Moderate (n = 1565)			Severe (n = 2016)		
	Physician Classification			Physician Classification			Physician Classification		
Aspects of Care	Mild (n = 252)	Moderate (n = 156)	Severe (n = 16)	Mild (n = 824)	Moderate (n = 629)	Severe (n = 112)	Mild (n = 719)	Moderate (n = 993)	Severe (n = 304)
Pharmacologic care									
Inhaled corticosteroid (ICS) use	45.6	58.3	80.0	58.3	74.8	88.1	65.9	77.7	90.2
Daily ICS use	37.4	55.7	75.0	35.2	53.0	68.1	44.6	59.2	72.1
Nonpharmacologic care monitoring									
Has peak flowmeter	12.0	20.9	50.0	16.9	34.3	55.9	20.2	30.7	56.4
Allergy testing and treatment (among those who report allergy symptoms)									
Avoids allergens	84.2	84.3	90.9	80.1	86.0	90.1	73.6	79.5	83.4
Ever allergy testing	54.7	48.4	68.8	59.8	66.7	74.1	59.1	64.9	73.0
Self-management education									
Adjusting medication for severe flare	62.7	68.4	68.8	49.8	59.0	77.3	45.4	52.9	67.1
Adjusting medication when asthma worse	64.0	65.8	60.0	48.2	57.4	75.7	43.4	47.9	63.0
Avoiding things that make asthma worse	61.7	70.2	66.7	50.7	59.0	74.1	45.6	51.9	66.4
Excellent knowledge about what to do in severe attack	22.2	29.4	68.8	19.2	22.7	29.1	15.7	23.0	31.1

*Data are given as percentage. For example, among patients with moderate symptoms, 58.3% of those with mild physician estimates reported ICS use, 74.8% of those with moderate estimates and 88.1% of those with severe physician estimates reported ICS use. All $P<.01$ by χ^2 test for trend.

Table 4. Multivariable Models of Physician Estimates of Asthma Severity and Patient Symptom Levels*

	Odds Ratio (95% Confidence Interval)			
	Physician Estimate		Patient Symptom Level	
Aspects of Care	Moderate	Severe	Moderate	Severe
Inhaled corticosteroid (ICS) use	1.92 (1.65-2.22)	4.97 (3.58-6.89)	1.84 (1.47-2.31)	2.38 (1.90-2.98)
Daily ICS use	1.93 (1.63-2.29)	3.51 (2.70-4.56)	0.91 (0.67-1.23)	1.23 (0.91-1.66)
Has peak flowmeter	2.08 (1.77-2.44)	5.73 (4.55-7.22)	1.71 (1.29-2.28)	1.70 (1.29-2.26)
Avoids allergens	1.41 (1.16-1.70)	1.89 (1.36-2.63)	0.87 (0.61-1.23)	0.57 (0.41-0.81)
Ever allergy testing	1.23 (1.07-1.41)	1.85 (1.45-2.35)	1.52 (1.22-1.89)	1.45 (1.17-1.81)
Adjusting medication for severe flare	1.39 (1.22-1.60)	2.63 (2.08-3.32)	0.64 (0.51-0.81)	0.51 (0.41-0.64)
Adjusting medication when asthma worse	1.29 (1.13-1.48)	2.43 (1.93-3.05)	0.62 (0.49-0.78)	0.45 (0.36-0.57)
Avoiding things that make asthma worse	1.35 (1.18-1.55)	2.44 (1.94-3.09)	0.66 (0.52-0.82)	0.51 (0.41-0.64)
Excellent knowledge about what to do in severe asthma attack	1.42 (1.20-1.68)	2.25 (1.77-2.87)	0.73 (0.56-0.93)	0.67 (0.52-0.85)

*Models adjusted for patient symptom level or physician estimate of severity. Reference group is mild (odds ratio = 1) for both physician estimate and patient symptom level.

physician estimated their underlying severity to be mild. This suggests that for some patients, severity needed to be updated to be congruent with the their current level of symptoms. Physicians' estimates of underlying severity appeared to drive the care that was reported. While this finding may not be surprising, it is not consistent with guideline recommendations. Notably, we found deficiencies in asthma care across all levels of physician estimates and patient symptom levels. Even patients with moderate and severe symptoms reported care that was less than optimal in both pharmacologic (inhaled corticosteroid use) and nonpharmacologic realms (peak flowmeter ownership, allergy treatment, and self-management education).

There is debate in the medical literature about the role of patients vs physicians in assessing asthma severity. One study demonstrated the superiority of physicians' assessments over patients' symptoms in determining asthma severity.[21] Other studies have shown that patients' assessments of their asthma are superior to those of their physicians in predicting health care utilization (physician's visits, emergency department visits, and hospitalizations) as well as the degree of airflow obstruction as measured by spirometry.[22-24] To our knowledge, this is the first study to demonstrate a relationship of these assessments to asthma care indicators such as daily use of inhaled corticosteroids, ownership of a peak flowmeter, avoiding allergens, and adequate asthma self-management knowledge.

This study highlights the many opportunities to improve asthma care, particularly for those with inadequate symptom control. Our study echoes other work that demonstrated undertreatment of asthma in a managed care population.[7] Sin and colleagues[25] noted that for patients recently hospitalized for asthma, 40% did not
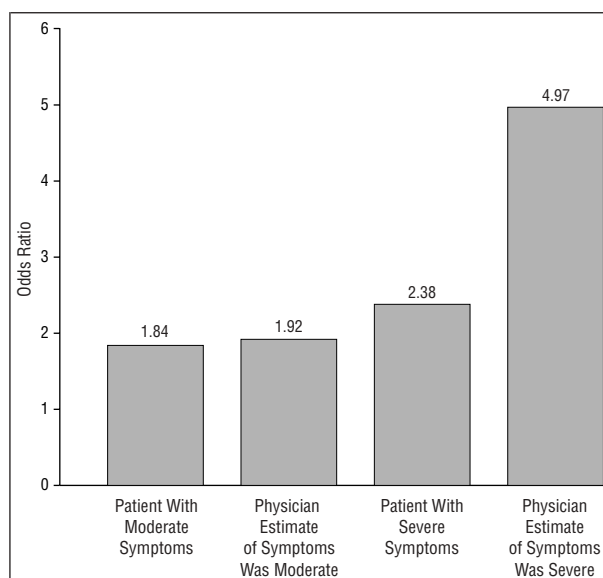
receive an inhaled corticosteroid within 90 days of discharge. In a study of older adults seen in an emergency department or hospitalized for asthma, Hartert et al[16] found that 79% of patients were not taking any anti-inflammatory agent at the time of their asthma attack. National guidelines for the treatment of asthma have been available since 1991. It is clear, however, that adherence to these guidelines is suboptimal. Techniques to improve both physician and patient adherence to these guidelines warrant further investigation.

Interestingly, we found an inverse relationship between asthma self-management knowledge and current asthma symptom severity. After adjusting for physician estimate of underlying severity, patients with moderate and severe symptoms were significantly less likely to report adequate self-management knowledge compared with patients with mild symptoms. This suggests a deficiency in their asthma care and implies that insufficient education about asthma management may have contributed to their inadequate symptom control. While we believe this is the first study to demonstrate a relationship between poor symptom control and inadequate asthma knowledge, other studies have shown a beneficial effect of adherence to nonpharmacologic recommendations. Abramson et al[17] demonstrated a protective effect against asthma death of using a peak flowmeter and having a written action plan.

Another notable finding is the disparity between the distribution of mild, moderate, and severe classifications between patients' symptoms and physicians' estimates. Most patients had moderate and severe symptoms, while most physicians' estimates of severity were mild and moderate. This disparity may explain the undertreatment of asthma previously discussed. If physicians consistently underassess their patients' asthma severity, they are more likely to undertreat them as well. In their study of guideline knowledge, Doerschug et al[26] tested physicians' asthma knowledge using a 31-question multiple-choice examination based on the NAEPP guidelines. They found that all physician groups, regardless of training, scored lowest in questions regarding the classification of chronic disease severity, with an overall score of less than 50% on these questions. Most errors led to an underestimation of disease severity.

There are limitations to this study. First, the data regarding asthma care were from patient report, a source of data that can be affected by recall. Another limitation is the lack of objective pulmonary function data (such as spirometry results) to supplement the patient symptom report in assessing asthma severity. Because the data were cross-sectional, we could not demonstrate an association of the level of asthma care with patient outcomes. Our study was conducted in 1993-1994, more than 2 years after the first iteration of the national guidelines was released. There may not have been sufficient time for physicians to adapt their practices to the guidelines. However, it has been shown that even 7 years after the guidelines were published, physician adherence was poor,[2] suggesting that waiting longer to do this study would not have altered our findings. A high percentage of patients in this study were women (70.1%), and the results may not be applicable to male patients. However, recent data[27] indicate that asthma in adults is almost twice as prevalent among women compared with men.

Odds ratios for inhaled corticosteroid use.

While physician estimates were completed within 6 months of the patients' surveys, it is unknown how much time elapsed between the most recent patients' visits and the physician estimates. Infrequent physician contact may explain the discrepancy between physician estimates and patient symptoms reported in this study. However, all patients were enrolled in managed care and had adequate access to medical care when needed. Finally, because the study was conducted exclusively in managed care, the findings may not be generalizable to other health care delivery settings.

Using national guidelines as a standard, this study suggests that physicians are underestimating the severity of their patients' asthma and are basing their treatment plans on this assessment rather than the patients' current symptoms. There is room to improve the quality of asthma care for adults in managed care, particularly for those with inadequate control of asthma symptoms. For those patients with moderate and severe symptoms, lower physician estimates of severity were associated with asthma care that was less consistent with national guidelines. Physicians should update their assessments based on patients' current symptoms and calibrate care accordingly.

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