

Specialty Differences in the Management of Asthma

A Cross-sectional Assessment of Allergists' Patients and Generalists' Patients in a Large HMO

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Objective: To examine the differences in medical management and quality of life between patients with asthma who receive their primary asthma care from allergists and those who receive their care from generalists in a large health maintenance organization (HMO).

Methods: We conducted a cross-sectional study of patients with asthma in a large HMO (Kaiser Permanente, Northwest Region, Portland, Ore). Participants were 392 individuals aged 15 through 55 years with physician-diagnosed asthma, taking antiasthma medications, reporting current asthma symptoms, and receiving asthma care from an allergist or from a generalist. Primary outcomes include characteristics of asthma, health care utilization, and quality of life.

Results: Patients cared for by allergists tended to have more severe asthma than those cared for by generalists ($P < .01$). The allergists' patients tended to be older (38.6 ± 9.6 years vs 35.7 ± 12.6 years, $P < .01$), more atopic (91% vs 78%, $P < .01$), and more likely to report perennial (rather than

seasonal) asthma (26% vs 36%, $P < .04$) than the generalists' patients. Patients receiving their primary asthma care from an allergist were considerably more likely than generalists' patients to report using inhaled anti-inflammatory agents ($P < .01$), oral steroids ($P < .01$), and regular (daily) breathing medications to control their asthma ($P < .01$). Allergists' patients were more likely to have asthma exacerbations treated in a clinic setting rather than an emergency department ($P < .01$). Furthermore, allergists' patients reported significantly improved quality of life as measured by several dimensions of the SF-36 scale (physical functioning, role emotional, bodily pain, and general health; $P < .05$).

Conclusions: These findings suggest that specialist care of asthma is of benefit for patients with asthma in a large HMO. Specifically, the allergists' patients conformed more closely to national asthma management guidelines and reported better quality of life than did the generalists' patients.

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ASTHMA IS a chronic disease that has significant impacts both on the affected patients and on the health care system itself.

Among chronic diseases, it is the most common cause of lost work time in adults and lost school time in children.¹ The direct and indirect cost of asthma in the United States totals approximately \$6.3 billion per year.¹ Approximately half of the direct costs for asthma care results from hospitalization, which may reflect failed or inadequate medical care, and these costs are increasing steadily.¹ Given our finite resources for health care, increasing attention is being paid to cost-effectiveness and appropriateness of care, as well as to quality of life (QOL). Managed care is attempting to address some of these issues, and in the process has placed an increasing emphasis on care by primary care physicians.^{2,3} Given finite resources and the

increasing economic impact of asthma on our health care system, appropriate identification of patients who should receive care by an asthma specialist is very important.

Two thirds of patients with asthma obtain care from a primary care physician (internist, family practitioner, or pediatrician).¹ A recent survey⁴ of primary care physician referral practices revealed that no routine referral was the most common management strategy for asthma, in contrast to more than 20% patient referral for diabetes and congenital heart disease. However, surveys⁵ have shown that many patients with asthma remain poorly controlled even in well-organized general practices that take an active interest in asthma care. One possible explanation for these findings is that treatment plans for the high-risk patient may be too simplistic. For example, in a study⁶ of pediatric emergency department visits for acute

PATIENTS AND METHODS

DESIGN

We report cross-sectional, baseline data collected as part of a longitudinal study to characterize risk factors for episodes of hospital-based asthma care. The baseline assessment included standardized questionnaires to obtain information about characteristics of the participants and their asthma, spirometry before and 5 minutes after administration of 2 puffs of isoproterenol, and skin prick testing to inhalant allergens.

A total of 914 participants aged 3 through 55 years were enrolled in the longitudinal study. For this analysis we restricted attention only to the 626 individuals aged 15 through 55 years. Further restrictions based on provider type (discussed below) resulted in a final sample size of 392 (181 allergists' patients and 211 generalists' patients). We excluded children aged 3 through 14 years because the methods used with this age group were somewhat different and also because the information on provider type is not comparable with the older group.

RESEARCH SETTING

Participants are members of a large HMO (Kaiser Permanente, Northwest Region, Portland, Ore). All were either hospitalized for asthma during the 4 years before recruitment or had at least 2 dispensings of asthma medications in the year before recruitment. All reported physician-diagnosed asthma and current symptoms of asthma at the time of recruitment. Kaiser Permanente provides comprehensive, prepaid coverage to about 20% of the Portland population, and subscribers are known to be similar to the area population as a whole.¹¹ We believe our sample, which includes a large number of patients with mild asthma, is broadly representative of patients with asthma within the region.

QUESTIONNAIRES

The study questionnaire incorporated relevant sections of the American Thoracic Society–Division of Lung Disease 1978 Respiratory Symptom Questionnaire and the International Union Against Tuberculosis and Lung Disease Bronchial Symptoms Questionnaire.^{12,13} It included data on respiratory symptoms, characteristics of asthma, demographic factors, tobacco use, allergen exposures, and medication

use. The medication questions included a review of respiratory medications used during the previous 12 months, as well as all daily respiratory medications. For the latter, participants were asked to bring in their medications to the visit. While 278 of the 626 subjects reported taking daily medications for their breathing only, 267 were actually taking asthma medications; the remaining 11 were taking allergy (rather than asthma) medications. The figures on daily asthma medications in this text refer only to use of therapeutic class asthma medications, which include inhaled β -agonists, anticholinergics, inhaled steroids, cromolyn, and theophylline.

We included 2 QOL measures in our questionnaire: an asthma-specific instrument developed by Marks et al¹⁴ and the SF-36 health status questionnaire.¹⁵ The latter is a generic instrument that has been previously validated for use in individuals with asthma.¹⁶

PROVIDER CLASSIFICATION AND SAMPLE SELECTION

To obtain information about type of provider, we asked the name of the respondent's primary asthma care provider. We then classified these providers based on their specialty. To minimize misclassification and to avoid the potentially confounding effects of other specialist care on our analyses, we excluded 108 subjects for whom no provider name was listed or the specialty could not be confirmed. We also excluded anyone whose primary asthma care provider was a pulmonologist ($n=20$) or who had seen a pulmonologist in the past and was not currently under the care of an allergist ($n=9$).

This information allowed us to divide respondents into those who receive their primary asthma care from an allergist ($n=181$) and those who receive their primary asthma care from a generalist (ie, not an allergist or pulmonologist). To provide the clearest contrast between the 2 groups, we further excluded 97 individuals who indicated that, although they did not receive their primary care from a specialist, they had seen an asthma specialist at some time in the past. This exclusion left 211 individuals in the generalist group. This latter group consisted primarily of internal medicine, family practice, and pediatric physicians, but also included physician assistants, nurse practitioners, and a handful of other providers.

ASTHMA SEVERITY

To adjust for asthma severity in our analyses, we used National Asthma Educational Program guidelines¹⁷ to de-

exacerbations of asthma for patients followed up by primary care physicians, "come to the emergency department" was part of the management plan in 33% and the complete plan in 20%. Also, a survey evaluating asthma knowledge of hospitalized patients showed that patients lacked understanding of their disease, underused peak flow meters, and were underprescribed corticosteroids (relative to national guidelines) by their physicians.⁷ Furthermore, most asthma deaths in children are related to undertreatment and lack of recognition of the disease severity by both the patient and the physician.⁸ Two recent studies^{9,10} demonstrate that facilitated refer-

ral to asthma specialists reduces asthma emergency department visits.

This study examines, within the context of a large health maintenance organization (HMO), differences in medical management and QOL between patients with asthma who receive their primary asthma care from allergists and those who receive such care from generalists. The data for the analyses are derived from the baseline information collected on 626 individuals aged 15 through 55 years with physician-diagnosed asthma who are being followed up as part of a separate longitudinal study evaluating risk factors for emergency asthma care.

velop a severity index based on frequency of oral corticosteroid use (eg, never, occasionally for exacerbations, and daily) and lung function at the baseline evaluation (<60% predicted forced expiratory volume in 1 second, 60%-80% predicted, and >80% predicted). We then dichotomized the resulting scores as mild vs moderate-severe and conducted blinded chart reviews in a subset of our participants to validate this rating. The blinded physician ratings were not based on formal criteria, but rather reflect physician judgment based on the available information in the chart. The physicians doing the assessments rated each patient as having either mild, moderate, or severe asthma. While our scoring system appears to underestimate severity when compared with physician judgment, it does have content validity and does separate subjects into more and less severe groups.¹⁸

SPIROMETRY

Spirometry was performed using standardized methods^{19,20} with equipment that met or exceeded American Thoracic Society requirements (Spirotech S-550 dry rolling seal spirometer using a digital shaft encoder with 10-mL volume resolution). We used the spirometry system software developed for the National Institutes of Health Lung Health Study.^{19,20} This software determines the acceptability and reproducibility of each maneuver during the testing session and prompts the technician about possible problems, such as slow initiation of the maneuver, early cessation of airflow, and coughing. The best forced expiratory volume in 1 second was chosen for analysis and expressed as a percentage of predicted forced expiratory volume in 1 second.²¹

SKIN TESTING

We conducted skin prick testing using 13 inhalant allergens appropriate for the Pacific Northwest: Alder, Birch, Juniper, grass, western weed, cat, dog, mite (*Dermatophagoides pteronyssinus* and *Dermatophagoides farinac*), alternaria, cladosporium, aspergillus, and penicillium (Hollister-Stier). We also included a positive control (histamine) and 2 negative controls (saline and a dry prick control). The allergens were applied using standard prick test techniques. Twenty minutes after the last prick, the technician carefully circled each wheal with an ink pen, placed cello tape over the mark, removed the tape, and placed it onto the data entry form. Two wheal diameter measurements were made from the tape record—the widest diameter and the diameter at a right angle to the widest diameter.

Of those for whom skin prick test data are available, 99.5% had positive reactions (at least 1 diameter >3 mm) to the histamine control. Only 1% of subjects responded to the dry prick control, which was applied following the final allergen (western weed mix). Responses to the saline control varied. Initially this was applied immediately following the dust mite (*D pteronyssinus*) allergen. Following unusually high response rates, a second saline was added following the western weed mix. Response rates to these 2 saline controls were 27% and 8%, respectively.

We summarized the skin test data in 2 ways for this report. Participants are classified as atopic if they had a positive reaction to 1 or more of the 13 test allergens (excluding histamine). Using a method analogous to that of Barbee et al,²² we also computed a continuous skin test score. To compute this score we first summed the 2 diameters for each allergen and tabulated the distribution of responses in the population. For each individual we then assigned a score from 0 to 5 for each allergen based on his or her placement within this distribution, with 5 being the greatest response. The overall skin test score was then computed as the sum of the 13 allergen-specific scores. Participants exhibited a full range of responses, from 0 to 63 of a possible 65. Skin prick test results are available for 385 of the 392 participants in this study.

HEALTH CARE UTILIZATION

The baseline survey contained limited data on health care utilization. We include self-reported hospitalizations in the 12 months before recruitment and the recency and place of service of the most recent episode of acute asthma care.

STATISTICAL METHODS

All analyses were performed using the SAS statistical software package (SAS Institute Inc, Cary, NC). We used standard methods for analyzing contingency tables. For 2×2 tables, *P* values are based on the continuity-adjusted χ^2 statistic. Where appropriate, we used the Mantel-Haenszel χ^2 statistic²³ to test for trends in contingency tables, and adjustment for asthma severity was performed using the method of Cochran-Mantel-Haenszel.²⁴ Univariate comparisons involving continuous measurements were evaluated using the 2-sample *t* test. Logistic regression analysis and multiple linear regression analysis were used to simultaneously control for the effects of multiple variables on discrete and continuous outcomes, respectively. Unless otherwise stated, all *P* values are 2-sided and the term *significant* implies a *P* < .05.

RESULTS

Our analysis was divided into 3 phases. Initially, we compared the characteristics of the allergists' patients with those of the generalists' patients. These comparisons are summarized in **Table 1**, **Table 2**, and **Table 3**. The next phase of the analysis compared patterns of medical management, which was assessed in terms of medication use. These data are summarized in **Table 4**. Finally, the last set of analyses addresses patient outcomes, both in terms of health care utilization and QOL measurements. These data are summarized in **Table 5** and **Table 6**.

PATIENT CHARACTERISTICS

Table 1 presents standard demographic characteristics of the sample. The allergists' patients were significantly older than the generalists' patients and were less likely to be current smokers. The allergists' patients also reported significantly fewer pack-years of smoking, and this difference held even when looked at separately for current and former smokers. The 2 patient groups did not differ in terms of gender or racial composition. The relatively low proportion of minority subjects reflects the demographics of the Portland metropolitan area, from which

Table 1. Demographic Characteristics of Study Population

Variable	Allergists' Patients, % (n=181)	Generalists' Patients, % (n=211)	P*
Mean (SD) age, y	38.6 (9.6)	35.7 (12.6)	<.01
Gender			
Male	38	40	.74
Female	62	60	
Race			
White	91	93	.53
Other	9	7	
Socioeconomic status			
Upper middle, upper	18	27	.10
Middle	62	55	
Working, lower	20	18	
Smoking status			
Never	67	58	<.01
Former	26	24	
Current	7	18	
Pack-years (ever smokers only), mean (SD)	12.9 (18.4)	21.2 (22.8)	.02

*Two-sided P value based on χ^2 statistic (categorical variables) or 2-sample t test (continuous variables) comparing the 2 groups.

most of the Kaiser Permanente membership is drawn. Socioeconomic status reflects self-reported placement into these categories and is not computed as a function of income, education, or occupation.

Tables 2 and 3 describe the asthma and allergy history of the patients. The allergists' patients had significantly more severe asthma than the generalists' patients and were more likely to report that their asthma symptoms persisted throughout the year, rather than occurring on a seasonal basis. The allergists' patients also indicated a greater duration of asthma symptoms than the generalists' patients, although this appeared to reflect the age differences between the 2 groups rather than an earlier onset among the allergists' patients. Age at onset did not differ between the groups, either when expressed as a categorical or as a continuous variable.

In terms of allergy characteristics, the allergists' patients exhibited a pattern suggesting a more allergic phenotype than the generalists' patients. Allergists' patients were significantly more atopic and had significantly higher skin test responsiveness. The allergists' patients were also significantly more likely to report a history of receiving immunotherapy, although this does not reflect differences in patient characteristics as much as it does the delivery of care within the health plan.

MEDICATION USE

Table 4 compares patterns of medication use between the physician groups and is stratified by asthma severity as defined in the "Patients and Methods" section. The table presents data on medication use in the past 12 months for the following categories of medications: β -agonist, inhaled anti-inflammatory agents (inhaled corticosteroids or cromolyn), oral steroids, anticholinergics, and theophylline. Table 4 also presents data on the self-reported use of daily asthma medications (see the "Patients and Methods" section). The number of general-

Table 2. Asthma Characteristics of Study Population*

Variable	Allergists' Patients, % (n=181)	Generalists' Patients, % (n=211)	P†
Mean (SD) age at onset, y	19.2 (14.0)	19.3 (14.9)	.94
Mean (SD) duration, y	20.4 (13.4)	17.0 (14.4)	.02
Perennial asthma			
Yes	74	64	.04
No	26	36	
Frequency of night symptoms			
≤ 1 /wk	65	67	.08
2-6/wk	29	21	
Daily	7	12	
Family history of asthma			
No	3	9	.05
Yes	97	91	
Mean (SD) BD response (% increment in FEV ₁)	9.9 (12.4)	10.1 (18.1)	.90
Severity			
Mild	70	82	<.01
Moderate-severe	30	18	

*BD indicates bronchodilator; FEV₁, forced expiratory volume in 1 second.

†Two-sided P value based on Pearson χ^2 statistic (categorical variables) or 2-sample t test (continuous variables) comparing the 2 groups.

Table 3. Allergy Characteristics of Study Population

Variable	Allergists' Patients, % (n=181)	Generalists' Patients, % (n=211)	P*
Allergy injections ever			
No	25	77	<.01
Yes	75	23	
Allergy injections in last 12 mo			
No	65	99	<.01
Yes	35	1	
Mean (SD) skin test score	16.8 (14.0)	13.9 (13.3)	.03
Atopy†			
No	9	22	<.01
Yes	91	78	

*Two-sided P value based on continuity-adjusted χ^2 statistic (categorical variables) or 2-sample t test (continuous variables) comparing the 2 groups.

†Atopy is defined as a positive reaction to at least 1 of the 13 skin prick test allergens.

ists' patients in the moderate-severe category is small and limits statistical power.

The allergists' patients were more likely than the generalists' patients to report having used inhaled anti-inflammatory agents and oral steroids in the past year. They were also more likely to report taking daily asthma medications. These differences were sizable. For example, about two thirds of allergists' patients in the mild group reported using inhaled anti-inflammatory agents at some time during the last year vs 43% for the generalists' patients. Among moderate-severe patients, 92% of the allergists' patients reported using inhaled anti-inflammatory agents vs only 42% for the generalists' patients. The use of β -agonists, anticholinergics, and theophylline preparations did not differ between the

Table 4. Comparison of Medication Use Patterns

Variable	Mild, %		Moderate-Severe, %		P*
	Allergist (n=121)	Generalist (n=168)	Allergist (n=53)	Generalist (n=36)	
β-Agonists†					
No	9	6	6	6	.36
Yes	91	94	94	94	
Inhaled anti-inflammatory agents†					
No	31	57	8	58	<.01
Yes	69	43	92	42	
Oral steroids†					
No	82	88	34	78	<.01
Yes	18	12	66	22	
Anticholinergics†					
No	99	97	92	92	.33
Yes	1	3	8	8	
Theophylline†					
No	88	83	62	53	.13
Yes	12	17	38	47	
>8 Puffs of β-agonists daily					
No	97	97	91	78	.25
Yes	3	3	9	22	
Take asthma medications daily					
No	56	74	17	44	<.01
Yes	44	26	83	56	

*Two-sided, overall P value for comparing the 2 provider groups based on Cochran-Mantel-Haenszel statistic stratifying for severity.

†Positive response reflects usage at any time in the last 12 months.

physician groups. Overall, the proportion of high β-agonist use (5.8%) is similar to that seen in other managed care settings.²³

Although not shown in the table, patients in the 2 provider groups did not differ in their frequency of reported use of either β-agonist inhalers or taking medications as circumstances may require during an attack (ie, at the onset of symptoms vs only when the attack is severe). Sixty-five percent of patients with mild disease and 70% of patients with moderate-severe disease reported taking medications as circumstances may require at the onset of symptoms.

Although not statistically significant, a greater proportion of the generalists' patients reported coexisting chronic obstructive pulmonary disease than did the allergists' patients (17% vs 12%, data not shown) and were more likely than the allergists' patients to report taking nonasthma medications (33% vs 20%), including 14% vs 9% taking 2 or more different classes of medications.

Allergists' patients were significantly more likely than generalists' patients to report using anti-inflammatory agents, oral steroids, and daily breathing medications after adjusting (via logistic regression) for age, sex, current smoking status (never, former, or current), chronic obstructive pulmonary disease, severity, and skin test responsiveness. Subjects with moderate-severe disease and older subjects were also more likely to report these medication patterns. We included interactions of provider type

Table 5. Comparison of Self-Reported Health Care Utilization*

Variable	Mild, %		Moderate-Severe, %		P*
	Allergist (n=121)	Generalist (n=168)	Allergist (n=53)	Generalist (n=36)	
When last saw physician for breathing problems, mo					
≤1	7	11	13	14	.56
2-12	51	50	43	44	
>12	42	39	43	42	
Where last saw physician for breathing problems					
UCC or ED					<.01
or hospital†	14	29	23	33	
Clinic	86	71	77	67	
Times hospitalized in the past 12 mo for breathing problems					
None	100	100	100	97	.23
≥1	0	0	0	3	

*Two-sided, overall P value for comparing the 2 provider groups based on Cochran-Mantel-Haenszel statistic stratifying for severity.

†UCC indicates urgent care clinic; ED, emergency department.

with both patient gender and asthma severity in our logistic models to account for possible effect modification from these variables. The difference in use of anti-inflammatory agents and oral steroids between the provider groups appeared to differ by level of patient severity. Generalists' patients with mild and moderate-severe disease did not differ in their reported use of anti-inflammatory agents (odds ratio [OR], 0.6; 95% confidence interval [CI], 0.3-1.3), whereas severity was strongly associated with anti-inflammatory medication use among the allergists' patients (OR, 5.2; 95% CI, 1.7-15.7). While severity was associated with reported use of oral steroids regardless of provider group, the association was much stronger among the allergists' patients (OR, 9.2; 95% CI, 4.3-19.4) relative to the generalists' patients (OR, 3.0; 95% CI, 1.0-9.2).

COMPARISON OF PATIENT OUTCOMES: HEALTH CARE UTILIZATION

Table 5 presents the health care utilization data. The initial item in Table 5 is the response to the question, "When was the last time you were seen by a doctor because of breathing problems or because of shortness of breath?" The question was meant to refer to acute care contacts and hence serve as a rough surrogate for level of asthma control, with a longer gap implying better asthma control. It is possible, however, that some participants viewed the question as including regularly scheduled care. The responses were similar for the 2 groups and did not differ significantly.

The second item in this table refers to where this last, presumably acute care, visit took place. We are unsure of the usefulness of this variable, but presume that outpatient clinic-based care is preferable. Certainly such usage patterns would be consistent both with increased confidence on the part of the provider to deal with the

Table 6. Comparison of Quality of Life (QOL) Scores*

Variable	Mild		Moderate-Severe		P†
	Allergist (n=121)	Generalist (n=168)	Allergist (n=53)	Generalist (n=36)	
Asthma-specific QOL scores‡					
Breathlessness	1.9 (1.5)	2.2 (1.6)	2.6 (2.1)	3.2 (2.1)	.24
Mood	2.1 (1.8)	2.3 (1.9)	2.0 (1.6)	2.4 (1.9)	.24
Social	1.3 (1.4)	1.1 (1.6)	1.6 (1.7)	1.6 (1.8)	.18
Concerns	1.4 (1.3)	1.2 (1.5)	2.1 (1.7)	2.1 (2.1)	.16
Total	1.7 (1.2)	1.7 (1.3)	2.2 (1.5)	2.4 (1.7)	.79
SF-36§ scores§					
Physical functioning	84 (16)	79 (19)	80 (17)	65 (27)	<.01
Social functioning	77 (17)	74 (19)	74 (19)	73 (23)	.25
Role physical	68 (38)	69 (38)	68 (40)	67 (41)	.99
Role emotional	80 (34)	71 (40)	82 (32)	82 (30)	.03
Mental health	74 (17)	73 (18)	76 (17)	78 (19)	.41
Vitality	56 (21)	55 (22)	54 (20)	53 (22)	.68
Bodily pain	71 (25)	68 (24)	74 (22)	57 (26)	.02
General health	68 (18)	63 (23)	62 (20)	55 (25)	.04
Change in health	61 (21)	59 (24)	58 (24)	54 (26)	.35

*All data expressed as mean (SD).

†Two-sided, overall P value for comparing the 2 provider groups based on analysis of variance adjusting for severity.

‡Lower value indicates better QOL.

§Higher value indicates better QOL.

exacerbation himself or herself, rather than having the patient go to the hospital, and also with the patient's seeking care earlier on during an exacerbation, before symptoms get out of control. The allergists' patients were significantly more likely than generalists' patients to report having been seen in the outpatient clinic setting, rather than in the urgent care clinic or emergency department, during their last exacerbation.

As expected, hospitalizations in these subjects (based on retrospective patient recall) were rare events and did not differ significantly between the groups.

COMPARISON OF PATIENT OUTCOMES: QOL

Table 6 summarizes the self-reported QOL data. Both the generic SF-36¹³ and the asthma-specific instruments generated a series of subscales and the table presents comparisons for each of them. Interestingly, we observed no significant differences between the physician groups for the asthma-specific QOL subscales, whereas we did find significant differences in several of the SF-36 subscales, even though the SF-36 is not a disease-specific instrument. Examination of the data in Table 6 shows that the QOL differences we observed generally were present in both the mild and moderate to severe groups, and that the trend was consistently higher QOL in the allergists' patients relative to the generalists' patients. Overall, patients with asthma cared for by allergists scored better on 4 subscales: physical functioning ($P<.01$), emotional functioning ($P=.03$), bodily pain ($P=.02$), and general health ($P=.04$). A summary of the various SF-36 subscales is included in **Table 7**.

To determine if the associations we observed for the SF-36 scales could be explained by differences in medication use between the provider groups, we conducted multiple linear regression analyses for each of the sig-

nificant SF-36 subscales. We included the same adjustment variables as used for the medication analyses and also added use of inhaled anti-inflammatories, oral steroids, and daily asthma medications. Overall, significant provider-group differences persisted for the physical functioning and bodily pain subscales. Allergists' patients continued to report higher QOL in these dimensions. After adjusting for disease severity, asthma medication was typically not associated with QOL.

COMMENT

Our study examined differences in medical management, health care utilization, and QOL between patients with asthma who receive their primary asthma care from allergists and those who receive such care from generalists. All patients were members of a large HMO and ranged in age from 15 through 55 years. Consistent with our a priori expectations, the allergists' patients tended to have more severe asthma than the generalists' patients. The allergists' patients also tended to be older, more atopic, and more likely to report perennial (rather than seasonal) asthma than the generalists' patients.

The most striking differences between the 2 groups of patients were in their self-reported use of medications and QOL. Even after adjustment for differences in patient severity and other potentially confounding variables, the patients receiving their primary asthma care from an allergist were considerably more likely than generalists' patients to report using inhaled anti-inflammatory agents and oral corticosteroids during the previous 12 months and to report regular (daily) use of asthma medications. Furthermore, allergists' patients reported significantly improved QOL as measured by several dimensions of the SF-36 scale, which is a widely used, validated instrument for assessing general QOL. Although presumably one of the factors that explains

Table 7. Health Concepts, Abbreviated Content, and Number of Questionnaire Items (k) for 8 SF-36 Scales and the Change in Health Item*

Health Concept	Abbreviated Content	k
Physical functioning	Extent to which health limits physical activities such as self-care, walking, climbing stairs, bending, lifting, and moderate and vigorous activities	10
Role functioning—physical	Extent to which physical health interferes with work or other daily activities, including accomplished less than wanted, limitations in the kind of activities, had difficulty	4
Role functioning—emotional	Extent to which emotional problems interfere with work or other daily activities, including decreased time spent, accomplished less than wanted, did not work as carefully as usual	3
Social functioning	Extent to which physical health or emotional problems interfere with normal social activities	2
Bodily pain	Intensity of pain and effect of pain on normal work, both inside and outside the house	2
Mental health	General mental health, including depression, anxiety, behavioral-emotional control, general positive affect	5
Vitality	Feeling energetic and full of pep vs tired and worn out	4
General health perceptions	Personal evaluations of health, including current health, health outlook, resistance to illness	5
Change in health	Evaluation of current health compared with 1 year ago	1

*For additional information see Ware and Sherbourne.³²

the improved QOL reported by allergists' patients is their increased use of inhaled corticosteroids, such medication use was not associated with improved QOL in our multivariate regression models. It may be that our measure of disease severity, which we recognize is imperfect, fails to fully account for the known association between need for such medications and disease severity. In this case the unaccounted for variation in severity could be confounding the association. We did not find significant differences in QOL for the asthma-specific instrument developed by Marks et al.¹⁴

Interpretation of these findings is limited by both the self-reported nature of the data and the cross-sectional design of this analysis. In particular, cross-sectional data cannot be used to infer causality. Nonetheless, these data are consistent with the hypothesis that allergists are considerably more likely than generalists to follow current prescribing guidelines for asthma¹⁷ and that their patients tend to experience a better QOL. The 2 dimensions of QOL with reported improvement were physical functioning and bodily pain. High scores on these dimensions reflect (1) performing all types of physical activities, including the most vigorous without limitations due to health, and (2) no pain or limitations because of pain, past 4 weeks, respectively. The estimated differences in SD units (0.39 and 0.20, respectively) represent reasonable effect sizes for both dimensions of QOL. Ware et al²⁷ note that absolute differ-

ences of 5 points on these subscales reflect differences that are clinically and socially relevant.

Other hypotheses could also explain these differences, however. For example, since the allergists are treating a much higher percentage of patients with allergy injections, the improvement in general well-being reflected in the improved SF-36 scores could be secondary to improvement in allergic symptoms. Such a hypothesis might also explain why the major index of asthma severity, the asthma-specific breathlessness scale, did not differ significantly between the provider groups. Again, the nature of our design does not let us distinguish between these hypotheses.

Some of the differences we observed could also reflect a differential case mix between allergists' patients and generalists' patients. While generalists' patients tended to report more chronic obstructive pulmonary disease and used medications suggesting greater comorbidity, these differences were not statistically significant. Further, because differences in QOL persisted even after adjustment for severity, medication use, and other patient factors, these data suggest that the differences in QOL are due not just to differences in patient mix or pharmacological management. In addition to the obvious and acknowledged differences in knowledge of asthma pathophysiology and management between allergists and generalists, the structure of health care delivery within Kaiser Permanente, Northwest Region, could also contribute to these apparent effects. For example, allergists are allocated an initial 40-minute consult appointment for new referrals. No similar analogy exists for pediatricians, family practice, and internal medicine providers.

All their appointments are booked standard 15-minute slots. In addition, the nursing staff assigned to the allergy departments has a much greater knowledge of asthma pathophysiology and management than does the nursing staff in the general outpatient clinics. Our current study design is unable to sort out these potentially confounding effects.

Our cross-sectional data on health care utilization are limited in scope. The ongoing longitudinal evaluation of this cohort should yield more useful data comparing the impact of allergist care vs generalist care on health care utilization, although the same confounders noted above will exist and will not permit us to ascribe any observed differences to a specific aspect of allergist care.

Our findings are consistent with a growing body of literature^{9,10,27,28} supporting the concept that specialist care is of benefit for patients with moderate and severe asthma. A study⁹ comparing specialist to generalist care in a similar HMO demonstrated that specialist care following an emergency department visit decreased nocturnal awakenings by 75%, work or school absences by 39%, subsequent emergency department visits by 50%, and hospitalizations by 58%. Preliminary reports^{27,28} of a cross-sectional study comparing allergist care with generalist care in 455 patients in an HMO in Minnesota during 1988 also suggest that patients cared for by allergists had better functional status, improved QOL, and 55% fewer days lost from school or work, although total direct costs were not different between the 2 groups.

One explanation for the benefit of specialist care seen in this study is that the allergists were more likely to follow

the guidelines of the National Heart, Lung, and Blood Institute, as well as guidelines issued by other authoritative groups.^{17,20} Specifically, these guidelines suggest assessment of allergic triggers of asthma, institution of relevant antigen control measures, patient education about the disease and therapy, use of topical anti-inflammatory drug therapy, plans for prevention and management of exacerbations, and allergen immunotherapy when appropriate. In our study, patients cared for by allergists were considerably more likely than generalists' patients to report using anti-inflammatory drug therapy and to be using asthma medications on a preventive basis (ie, taking daily asthma medications). In addition, the health care utilization data suggest that the allergists' patients may also be more likely to use outpatient clinic-based care rather than emergency or urgent care for exacerbations. These patterns are all consistent with the use of plans for prevention or management of exacerbations. The observed differences in immunotherapy (allergy injections) may be misleading, as it reflects both the organization of care within the health plan and also our conscious decision to exclude from the generalist group those individuals who had seen a specialist for their asthma at some point in the past (presumably for a consult). Also, although we saw a marked difference in medication use profiles, adjustment for medication use did not explain the differences in QOL.

Other studies indicate that care that follows the National Heart, Lung, and Blood Institute guidelines can significantly reduce morbidity and the economic impact of asthma. Results demonstrating that such medical care decreases morbidity and costs for asthma are consistent across diverse populations from patients in the United States (with only emergency department access to medical care)³⁰ as well as previously hospitalized Canadian children.³¹

Kaiser Permanente, Northwest Region, the setting for this study, is currently in the process of developing and implementing guidelines for the diagnosis and management of asthma. This effort, spurred in part by the growing prevalence of asthma in the community and the publication of the National Asthma Educational Program guidelines,¹⁷ mirrors similar work being done in managed care organizations across the country and may well lead to fundamental changes in the types of statistics we presented here. Two key issues that must be addressed in such processes are how best to use specialist services for asthma care and how best to educate nonasthma specialists and other allied health care providers about current guidelines for asthma. A study such as ours can raise important issues for consideration in such a process, but cannot offer solutions.

In conclusion, specialist care of asthma appears to be of benefit for patients with asthma in a large HMO. Patients cared for by allergists were more likely to receive treatment consistent with national expert panel guidelines and to report better QOL. These findings should be kept in mind when structuring access to specialty referrals in an increasingly managed health care environment.

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- Weiss KB, Gergen PJ, Hodgson TA. An economic evaluation of asthma in the United States. *N Engl J Med*. 1992;326:862-866.
- Weiner J-P, Md. Forecasting the effects of health reform on US physician work-force requirement: evidence from HMO staffing patterns source. *JAMA*. 1994; 272:222-230.
- Billi JE, Wise CG, Bills EA, Mitchell RL. Potential effects of managed care on specialty practice at a university medical center. *N Engl J Med*. 1995;333:979-983.
- Blancaquaert IR, Zvagulis I, Gray-Donald K, Pless IB. Referral patterns for children with asthma. *Pediatrics*. 1992;90:71-74.
- Keeley D. How to achieve better outcome in treatment of asthma in general practice. *BMJ*. 1993;307:1261-1263.
- Davidson AE, Klein DE, Settipane GA, Alario AJ. Access to care among children visiting the emergency room with acute exacerbations of asthma. *Ann Allergy*. 1994;72:469-473.
- Gibson PG, Talbot PI, Hensley MJ. A prospective audit of asthma management following emergency asthma treatment at a teaching hospital. *Med J Aust*. 1993;158:775-778.
- Barach EM. Asthma in ambulatory care: use of objective diagnostic criteria. *J Fam Med*. 1994;38:161-165.
- Zeiger RS, Heller S, Mellon MH, Wald J, Falkoff R, Schatz M. Facilitated referral to asthma specialist reduces relapses in asthma emergency room visits. *J Allergy Clin Immunol*. 1991;87:1160-1168.
- Mahr TA, Evans R. Allergist influence on asthma care. *Ann Allergy*. 1993;71: 115-120.
- Greenlick MR, Freeborn DK, Pope CR. *Health Care Research in an HMO: Two Decades of Discovery*. Baltimore, Md: Johns Hopkins University Press; 1988.
- Burney PGJ, Chinn S, Britton JR, Tattersfield AE, Papacosta AO. What symptoms predict the bronchial response to histamine? evaluation in a community survey of the bronchial symptoms questionnaire (1984) of the international union against tuberculosis and lung disease (IUATLD). *Int J Epidemiol*. 1989; 18:165-173.
- Burney PGJ, Lateen LA, Perdrizet S, et al. Validity and repeatability of the IUATLD (1984) bronchial symptoms questionnaire: an international comparison. *Eur Respir J*. 1989;2:940-945.
- Marks GB, Dunn SM, Woolcock AJ. A scale for the measurement of quality of life in adults with asthma. *J Clin Epidemiol*. 1992;45:461-472.
- Ware JE, Sherbourne CA, Davies AR. *A Short-Form General Health Survey*. Santa Monica, Calif: RAND; 1988. No. P-7444.
- Bousquet J, Knani J, Dhivert H, et al. Quality of life in asthma. I: internal consistency and validity of the SF-36 questionnaire. *Am J Respir Crit Care Med*. 1994;149:371-375.
- National Asthma Education Program. *Guidelines for the Diagnosis and Management of Asthma*. Bethesda, Md: National Institutes of Health; 1991. No. 91-3042.
- Last JM, ed. *A Dictionary of Epidemiology*. New York, NY: Oxford University Press Inc; 1988.
- Becklake M, Crapo RO. Lung function testing: selection of reference values and interpretive strategies. *Am Rev Respir Dis*. 1991;144:1202-1218.
- Enright PL, Johnson LF, Connett JE, et al. Spirometry in the Lung Health Study. I: methods and quality control. *Am Rev Respir Dis*. 1991;143:1215-1223.
- Knudson RJ, Lebowitz MD, Holberg CJ, Burrows B. Changes in the normal maximal expiratory flow-volume curve with growth and aging. *Am Rev Respir Dis*. 1983;127:725-734.
- Barbee RA, Lebowitz MD, Thompson HC, Burrows B. Immediate skin-test reactivity in a general population sample. *Ann Intern Med*. 1976;84:129-133.
- Mantel N, Haenszel W. Statistical aspects of the analysis of data from retrospective studies of disease. *J Natl Cancer Inst*. 1959;22:719-748.
- Landis RJ, Heyman ER, Koch GG. Average partial association in three-way contingency tables: a review and discussion of alternative tests. *Int Stat Rev*. 1978; 46:237-254.
- Stempel DA, Durcannin-Robbins JF, Hedblom EC, Woolf R, Sturm LL, Stempel AB. Drug utilization evaluation identifies costs associated with high use of beta-adrenergic agonists. *Ann Allergy*. 1996;76:153-158.
- Ware JE, Snow KK, Kosinski M, Gandek B. *SF-36 Health Survey, Manual and Interpretation Guide*. Boston, Mass: The Health Institute, New England Medical Center; 1993.
- Fowles J, Schoenwetter W, Phaley A, McCoy C, Engel W, Lurie N. Measuring the severity and outcomes of asthma care by generalists and allergists. *J Allergy Clin Immunol*. 1990;85:195.
- Schoenwetter W, Phaley A, McCoy C, Engel W, Lurie N. Comparing utilization and charges for asthma care by generalists (G) and allergists (A). *J Allergy Clin Immunol*. 1990;85:236.
- British Thoracic Society. Guidelines on the management of asthma. *Thorax*. 1993;48(suppl):S1-S24.
- Mayo PH, Richman J, Harris HW. Results of a program to reduce admissions for adult asthma. *Ann Intern Med*. 1990;112:864-871.
- Hughes DM, McLeon M, Garner B, Goldbloom RB. Controlled trial of a home and ambulatory program for asthmatic children. *Pediatrics*. 1991;87:54-61.
- Ware JE, Sherbourne CA. The MOS 36 item Short-Form Health Survey (SF-36). 1: conceptual framework and item selection. *Med Care*. 1992;30:473-483.