Perceived control of asthma and quality of life among adults with asthma

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Background: Perceived control of certain chronic conditions influences health status outcomes.

Objective: To explore the impact of perceived control of asthma on asthma-specific and generic health status outcomes among adults with asthma. Perceived control was defined as individuals' perceptions of their ability to deal with asthma and its exacerbations.

Methods: Data were drawn from the baseline and first two followups of a longitudinal study of adults with asthma surveyed by telephone at 18-month intervals. An 11-item questionnaire (Perceived Control of Asthma Questionnaire [PCAQ]) was developed and validated.

Results: The PCAQ demonstrated high internal consistency (Cronbach's $\alpha = 0.79$). Greater perceived control was associated with less severe asthma, greater asthma self-efficacy, lower perceived asthma severity, lower perceived danger from asthma, and greater perceived usefulness of asthma medicines. Greater perceived control was significantly associated with better asthma-specific quality of life concurrently and 18 and 36 months later, after controlling for demographics, smoking, and severity of asthma. Greater perceived control as also significantly associated with generic mental health outcomes concurrently and 18 and 36 months later, after controlling for covariates. Perceived control was associated with physical function concurrently and 18 months later, but not 36 months later.

Conclusions: The PCAQ is a reliable and valid measure of perceived control of asthma. Perceived control of asthma was associated with both asthma-specific and generic health status outcomes, concurrently and predictively. If perceived control could be modified, better outcomes, particularly better psychologic outcomes, might be achieved for individuals with asthma.

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INTRODUCTION

Psychosocial factors may influence the outcomes of individuals with asthma and other respiratory disorders directly by influencing the frequency, severity, or interpretation of symptoms.[1–4] For example, significant correlations have been noted between anxiety and reports of asthma symptoms.[1] Psychosocial factors may also influence asthma-related outcomes indirectly, by influencing self-management behaviors. Self-management of asthma depends on the ability to detect changes in lung function and then take action to avoid an impending asthma attack. Lack of confidence in one's ability to take appropriate actions to avoid an attack may increase anxiety and inhibit appropriate self-management actions or exacerbate an attack.[5,6] Perceived control of asthma is one psychosocial factor that may have both a direct and indirect effect on asthma outcomes.

We define "perceived control of asthma" as individuals' perceptions of their ability to deal with asthma and its exacerbations. Three constructs are relevant to perceived control: self-efficacy, locus of control, and learned helplessness. Self-efficacy refers to the belief that one can perform specific tasks or behaviors in the future.[7] In contrast to perceived control, which is a general perception of the ability to deal with an event, self-efficacy is linked to specific behaviors, often under specific conditions and at specific times. Locus of control refers to the perceived source of control over states or events.[8] Locus of control scales usually measure the extent to which individuals assign control to *internal* sources (ie, how much control they have themselves), *external* sources (how much control someone or something else has), or *chance* (no control, random event). In a sense, perceived control may be viewed as the extent to which individuals assign control to internal sources. According to the theory of learned helplessness, when people are repeatedly exposed to aversive events that they can not predict or control, they may learn to become helpless.[9] Learned helplessness may thus be viewed as a reflection or result of perceived lack of control. Studies among individuals with other health conditions have shown that greater perceived control (or lower perceived helplessness or greater self-efficacy) is associated with more positive health status outcomes and greater engagement in self-management behaviors.[10–13]

We report on the development of a questionnaire to evaluate perceived control of asthma, and the association of perceived control of asthma with both asthma-specific and generic health outcomes. We hypothesized that greater perceived control of asthma would be associated with more positive outcomes both concurrently and longitudinally.

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METHODS

Subjects

Data were obtained from a longitudinal cohort study of adults with asthma surveyed by telephone at approximately 18-month intervals. We used data from the baseline and first two followup interviews. Interviews included demographic characteristics; smoking history; asthma history, symptoms, and treatment; mental and physical health status; and quality of life. Subjects were recruited from physician practices in northern California. Details of the study design have been previously reported.[14–17] In brief, we recruited a random sample of board-certified pulmonary (n = 68) and allergy/immunology specialists (n = 17). Participating physicians maintained a registry of persons aged 18 to 50 years with outpatient visits for asthma over a prospective 4-week period. Each person registered (n = 669) was contacted; 601 (90%) were enrolled and participated in the baseline interview; 539 persons completed the followup 1 (18-month) interview; and 420 persons completed the followup 2 (36-month) interview.

For these analyses, we excluded all interviews potentially compromised by faulty data collection or documentation by a single survey interviewer. We have previously published in detail the data cleaning/exclusion protocol we followed.[15,17] After all exclusions, these analyses use baseline data from 374 individuals, followup 1 data from 242, and followup 2 data from 128.

Variables

Perceived control of asthma. The Perceived Control of Asthma Questionnaire (PCAQ) was administered at baseline and followup 2. The items of the PCAQ were adapted from the Arthritis Helplessness Index, a previously validated 15-item measure for arthritis.[18,19] Of the 15 items in the Arthritis Helplessness Index, 4 were excluded from the asthma version of the scale because of poor item-total correlations. Individuals were asked to respond to each item using a 5-point Likert scale.

Other measures. To evaluate the validity of the PCAQ, we examined the association of PCAQ scores with other psychosocial and clinical measures, as well as demographic characteristics and smoking status. To demonstrate construct validity, a measure of perceived control should be significantly related to variables that are theoretically relevant. Thus, we would expect that lower perceived control would be associated with such factors as more severe asthma, lower levels of education, subject perceptions of greater asthma severity or danger, and subject perceptions that treatment is ineffective. We would also expect perceived control of asthma to influence outcomes such as asthma-specific quality of life and functional status, such that greater perceived control would be associated with more positive evaluations of quality of life and function.

Clinical measures. Severity of asthma was quantified using a validated scoring system based on asthma symptom frequency, previous hospitalization and intubation for asthma, past and current use of systemic corticosteroids, and the use of asthma medications other the systemic steroids.[14,16] Higher scores indicate greater severity. The severity of asthma score was calculated at baseline and both followups.

For 62% of the panel members, we were able to obtain previous laboratory measures of pulmonary function. In total, forced expiratory volume in 1 second (FEV_1) as a percentage of predicted (based on age, sex, and height) was obtained for 231 subjects.

Psychosocial measures. We evaluated the association of PCAQ scores with a subset of items from the Asthma Self-Efficacy Scale, subjects' perceived severity and danger of asthma, and their perceptions of the helpfulness of their asthma medications. These measures were all administered at baseline.

The Asthma Self-Efficacy Scale is an 80-item questionnaire.[20] Respondents indicate the degree of confidence they have in their ability to avoid an asthma attack in specific situations or in response to specific triggers. We chose eight items from this scale (Cronbach's $\alpha = 0.85$), selected a priori to represent a broad spectrum of asthma triggers while at the same time being brief enough to use as part of our interview. Scores on this abbreviated version of the Asthma Self-Efficacy Scale could range from 0 to 16; higher scores indicate greater self-efficacy.

Perceived severity of asthma and perceived danger from asthma were evaluated with one question each ("Do you believe that your asthma is severe, moderate, or mild?" and "Do you believe that you are in high, moderate, or low danger from your asthma?").[21] Both greater perceived danger and greater perceived severity have been found to be associated with poorer psychologic status, lower life satisfaction, and greater clinical severity. The degree to which subjects perceived that their medications helped their asthma was also evaluated with a single question ("Would you say that over the past 12 months the medicines you take for your asthma have reduced your symptoms a lot, a little, or not at all?").

Outcomes

The Marks Asthma Quality of Life Questionnaire (MAQOL)[22,23] was administered at baseline and both followups, with scoring calculated using the modified method reported by Katz et al.[24] The MAQOL is a 20-item scale designed to measure quality of life among adults with asthma. In our sample, the Cronbach's α for the total MAQOL score was 0.93. In addition to a total score, four MAQOL subscale scores can be calculated: Physical, Emotional, Social, and Health Concerns. The Cronbach's alphas for the subscales in our sample were 0.90, 0.79, 0.90, and 0.73, respectively.

Physical and mental functioning were evaluated at baseline and both followups with the Physical Component Score (PCS) and Mental Component Score (MCS) of the SF-36, a widely used measure of general health status.[25] Scores on both the PCS and MCS range from 0 to 100, with means of 50 and standard deviations of 10. Higher scores reflect better functioning. Depressive symptoms were evaluated at followups 1 and 2 with the Center for Epidemiologic Studies-

Depression Scale (CES-D), a 20-item scale with scores ranging from 0 to 60.[26] Higher scores indicate more severe depressive symptoms.

Demographic Characteristics

We examined the relationship of PCAQ scores with the following demographic characteristics: sex, race/ethnicity, education (high school or less, some college, college graduate), baseline age (categorized as 18 to 29, 30 to 39, and 40 to 50 years), baseline marital status (married or living with a partner vs others), and baseline family income ($\leq$\$20,000, \$20,00-\$40,000, \$40,000-\$75,000, $>$\$75,000). Baseline smoking status was defined as never smoked, former smoker, or current smoker.

Statistical Analysis

We evaluated the internal consistency of all scales with Cronbach's α and conducted a principal components analysis of the PCAQ.[27] We evaluated the PCAQ's concurrent validity by studying the association of PCAQ scores with demographic characteristics and smoking status, and with psychosocial and clinical measures described previously. We tested these associations separately for each measure using Pearson product-moment or Spearman rank-order correlations. To take into account potential confounding by demographic characteristics, we also retested each measure's relationship to PCAQ scores using multiple linear regression analyses, with PCAQ scores as dependent variables, and age, sex, race/ethnicity, marital status, education, income, and smoking status as independent variables.

As another test of concurrent validity, we evaluated the cross-sectional relationship between perceived control of asthma and outcomes. We first calculated bivariate correlations between baseline PCAQ scores and baseline MAQOL total and subscale scores, PCS, and MCS. We then calculated multiple linear regression analyses, with baseline MAQOL total and subscale scores, PCS, and MCS as dependent variables in separate analyses. In these regression analyses, the primary independent variable was baseline PCAQ score. These analyses controlled for age, sex, race/ethnicity, marital status, education, income, smoking status, and severity of asthma score.

To evaluate the predictive validity of the PCAQ, we evaluated the relationship between perceived control of asthma and subsequent outcomes. We used multiple linear regression analysis, with followup MAQOL scores, PCS, MCS, and CES-D as dependent variables. In these analyses, the primary independent variables were baseline PCAQ score and, for analyses using followup 2 outcomes, change in PCAQ score between baseline and followup. These analyses controlled for baseline age, sex, race/ethnicity, marital status, education, income, smoking status, severity of asthma score, and change in severity of asthma between baseline and followup.

RESULTS

Psychometric Properties of the PCAQ

The PCAQ items and their response frequencies are shown in Table 1. Responses to the items were fairly well distributed across response options. In the principal components analysis of the PCAQ, the eigenvalue for the first component was 3.72 and sharply declined to 1.63 for the second component, suggesting that PCAQ items represented a single construct primarily. The PCAQ items showed high internal consistency (Cronbach's $\alpha = 0.76$), and therefore, a single score was calculated. Responses were scored from 1 to 5 for each of the 11 items, yielding a possible score range of 11 to 55 (Table 2). A lower score indicates the perception of less control over one's asthma. The actual observed PCAQ scores ranged from 20 to 55 at baseline, with a median score of 39, a mean of 38.8, and a standard deviation of 6.7. At the 36-month followup similar results were noted: the observed range of scores was 19 to 55, median 40.5, mean 40.7, and standard deviation 6.8.

Table 1. PCAQ: Scale Items and Response Frequencies at Baseline (n = 374)

	Item-total correlation	Response frequencies (%)*				
		SD	D	N	A	SA
I can reduce my asthma by staying calm and relaxed.	0.38	3.1	12.5	1.6	60.2	22.7
† Too often, my asthma just seems to hit me out of the blue.	0.28	10.2	32.0	1.6	41.4	14.8
If I do all the right things, I can successfully manage my asthma.	0.66	2.3	9.4	0.8	54.7	32.8
I can do a lot of things myself to cope with my asthma.	0.43	0.8	0.8	0	54.7	43.8
When I manage my personal life well, my asthma does not affect me as much.	0.46	6.3	21.1	3.1	53.1	16.4
I have considerable ability to control my asthma.	0.59	3.9	9.4	1.6	59.4	25.8
† I would feel helpless if I couldn't rely on other people for help when I'm not feeling well from asthma.	0.25	23.4	47.7	1.6	20.3	7.0
† No matter what I do, or how hard I try, I just can't seem to get relief from my asthma.	0.52	21.9	59.4	0	14.1	4.7
I am coping effectively with my asthma.	0.52	3.1	3.1	0	61.7	32.0
† It seems as though fate and other factors beyond my control affect my asthma.	0.40	17.2	31.3	2.3	42.2	7.0
† Asthma is controlling my life.	0.45	28.9	32.8	0.8	25.0	12.5

* Response options: SD = strongly disagree, D = disagree, N = neutral, A = agree, SA = strongly agree.
† Item is reverse-scored.

Table 2. Summary Statistics for PCAQ Scores (Baseline and 36-Month Followup)

# of items	11
Potential range of scores	11–55
Observed range of scores	
Baseline (n = 374)	20–55
Followup 2 (n = 128)	19–55
Mean score ± standard deviation	
Baseline (n = 374)	38.8 ± 6.7
Followup 2 (n = 128)	40.7 ± 6.8
Median (25th–75th percentile)	
Baseline (n = 374)	39 (34.5–43)
Followup 2 (n = 128)	40.5 (37–45)
Cronbach's α	
Baseline (n = 374)	0.76
Followup 2 (n = 128)	0.79

Concurrent Validity

Table 3 shows the results of multiple regression analysis examining the cross-sectional relationship of demographic characteristics and smoking status with PCAQ scores. Sex, race/ethnicity, age, marital status, and smoking status were not statistical predictors of PCAQ scores. College-level education was marginally associated with higher PCAQ scores, as was expected ($P = 0.08$). Higher income was significantly associated with higher PCAQ scores (better perceived control). However, all demographic and smoking factors considered together produced only marginal explanatory power (model $R^2 = 0.08$).

PCAQ scores were significantly associated with clinical status variables in the expected ways (Table 4). Better perceived control of asthma was associated with less severe asthma ($r = 0.36$, $P < 0.0001$). FEV_1 as a percentage of predicted was also significantly associated with perceived control, with greater control being associated with higher FEV_1 ($r = 0.16$, $P < 0.001$).

PCAQ scores were also significantly correlated in the expected directions with the psychosocial variables. Greater perceived control was associated with greater self-efficacy ($r = 0.38$, $P < 0.0001$). As perceived control increased, perceived severity of asthma and perceived danger from asthma decreased (severity: $r = -0.40$, $P =< 0.0001$; danger: $r = -0.38$, $P < 0.0001$), and perceived helpfulness of asthma medicines increased ($r = 0.31$, $P < 0.0001$).

Predictive Validity

Cross-sectional analyses. PCAQ scores were significantly correlated with concurrent asthma outcomes (Table 5).

Table 3. Association of Baseline Demographic Characteristics and Smoking Status with PCAQ Score* (n = 374)

Demographic Variable	Frequency % (n)	Multiple linear regression	
		β ± SE	*P*
Female gender	70.1 (262)	0.96 ± 0.76	0.21
Race or ethnicity			
White, non-Hispanic	67.9 (254)	—†	—
Hispanic	12.8 (48)	−0.66 ± 1.05	0.53
Black	7.8 (29)	−2.15 ± 1.33	0.11
Asian or Pacific Islander	7.8 (29)	−1.84 ± 1.32	0.17
Other	3.7 (14)	−1.33 ± 1.83	0.47
Age			
30–39 years	33.4 (125)	—†	—
18–29 years	15.2 (57)	0.17 ± 1.08	0.87
40–50 years	51.3 (192)	−0.90 ± 0.77	0.25
Married or living with partner	58.3 (218)	0.48 ± 0.86	0.58
Education			
≤ High school	26.5 (99)	—†	—
Some college	36.9 (138)	0.17 ± 0.89	0.85
College graduate	36.6 (137)	1.76 ± 1.00	0.08
Annual family income			
≤ $20,000	24.2 (72)	—†	—
$20,001–$40,000	32.0 (95)	2.71 ± 1.05	0.01
$40,001–$75,000	18.2 (54)	3.22 ± 1.10	0.004
> $75,000	25.6 (76)	2.26 ± 1.31	0.08
Cigarette smoking status			
Never smoked	58.3 (218)	—†	—
Former smoker	33.7 (126)	−1.14 ± 0.77	0.14
Current smoker	8.0 (30)	−0.23 ± 1.36	0.87
R^2 for entire model, including all predictors = 0.08.			

* Results from multiple regression analysis, regression PCAQ scores on gender, race/ethnicity, age, marital status, education, income, and smoking status variables.

† Reference category in regression analysis.

Table 4. Association of Psychosocial and Clinical Variables with PCAQ Score at Baseline* (n = 374)

	Mean ± SD	% (n)	Bivariate correlation with PCAQ Score	
			r	*P*
Clinical variables				
Severity of asthma score †	12.3 ± 5.6		−0.36	<0.0001
FEV_1 % predicted (n = 231)	80.1 ± 21.9		0.16	<0.01
Psychosocial variables				
Asthma self-efficacy§	9.2 ± 4.1		0.38	<0.0001
Perceived severity of asthma			−0.40‖	<0.0001
Mild		25.7 (96)		
Moderate		43.1 (161)		
Severe		31.3 (117)		
Perceived danger of asthma			−0.38‖	<0.0001
Low		34.8 (130)		
Moderate		40.1 (150)		
High		25.1 (94)		
Medicines help asthma			0.31‖	<0.0001
Not at all		7.5 (28)		
A little		20.9 (78)		
A lot		70.3 (263)		
Don't take medicines		1.3 (5)		

* Higher PCAQ scores reflect greater perceived control.
† Higher Severity of Asthma scores reflect more severe disease.
‡ Higher SF-36 scale scores (Physical Functioning, Role Functioning, Mental Health, Perceived Health) reflect better function.
§ Higher Asthma Self-Efficacy scores reflect greater self-efficacy.
‖ Spearman correlation coefficients; all others are Pearson product-moment correlation coefficients.

Greater perceived control was associated with less negative impact of asthma on quality of life (MAQOL total, $r = -0.59$; Physical subscale, $r = -0.47$; Emotional subscale, $r = -0.40$; Social subscale, $r = -0.57$; Health Concerns subscale, $r = -0.46$; all $P < 0.0001$). Greater perceived control was also significantly associated with better physical ($r = 0.40$, $P < 0.0001$) and mental ($r = 0.29$, $P < 0.0001$) functioning. The association of PCAQ scores with concurrent outcomes remained after controlling for demographic characteristics, smoking status, and severity of asthma. In each case, the addition of PCAQ scores to the regression model significantly increased the model R^2.

Longitudinal analysis. Baseline PCAQ scores were significantly correlated with asthma outcomes at both followup interviews in expected directions, although the strength of the associations was somewhat weaker as time from baseline increased (Table 6). At both followups, greater perceived control of asthma at baseline was correlated with less negative impact of asthma on quality of life, better physical and mental functioning, and fewer depressive symptoms.

In multivariate analyses, baseline PCAQ scores contributed significantly to asthma-specific quality of life outcomes at both followup 1 and followup 2, controlling for baseline demographic characteristics, smoking status, and asthma se-

Table 5. Association of Perceived Control of Asthma with Health Status Outcomes: Cross-Sectional (Baseline) (n = 374)

Baseline outcomes	Mean ± SD	Correlation with baseline PCAQ (*r*)	Regression results R^2 explained by:		
			Covariates*	PCAQ	Total model
MAQOL† Total	26.8 ± 12.4	−0.59	0.36‡	0.15	0.51
MAQOL–Physical	6.4 ± 4.4	−0.47	0.28	0.10	0.38
MAQOL–Emotional	6.2 ± 3.8	−40	0.18	0.09	0.27
MAQOL–Social	9.7 ± 4.3	−0.57	0.35	0.13	0.49
MAQOL–Health concerns	4.6 ± 2.7	−0.46	0.30	0.07	0.38
SF-36 PCS	43.4 ± 12.4	0.40	0.33	0.04	0.37
SF-36 MCS	45.2 ± 9.0	0.29	0.07§	0.09	0.16

* Covariates were: sex, race, age, education, smoking status, income, and severity of asthma score.
† MAQOL = Marks Asthma Quality of Life Questionnaire.
‡ All statistical tests significant at $P < 0.0001$ unless otherwise noted.
§ $P = 0.06$

Table 6. Association of Perceived Control of Asthma with Health Status Outcomes: Longitudinal

Outcomes at followup	Mean ± SD	Correlation with baseline PCAQ	Regression results R^2 explained by:			
			Covariates*	PCAQ (baseline)	Change in PCAQ, baseline to followup 2	Total model
Followup 1 (18 months; n = 242)						
MAQOL Total	23.6 ± 15.0	−0.48§	0.35§	0.07§	—	0.42§
MAQOL–Physical	5.6 ± 4.2	−0.40§	0.36§	0.04§	—	0.40§
MAQOL–Emotional	6.7 ± 4.1	−0.21‡	0.16†	0.01*	—	0.17‡
MAQOL–Social	7.0 ± 6.6	−0.53§	0.32§	0.11§	—	0.43§
MAQOL–Health concerns	4.3 ± 2.8	−0.41§	0.29§	0.04‡	—	0.34§
SF-36 PCS	44.8 ± 12.7	0.40§	0.29§	0.064	—	0.34§
SF-36 MCS	44.4 ± 8.6	0.20‡	0.13*	0.02*	—	0.15†
CES-D	11.3 ± 10.8	−0.34§	0.17‡	0.05‡	—	0.22§
Followup 2 (36 months, n = 128)						
MAQOL Total	26.8 ± 12.4	−0.35§	0.33§	0.06†	0.15§	0.54§
MAQOL–Physical	6.4 ± 4.4	−0.20*	0.35§	0.10§	0.09‡	0.54§
MAQOL–Emotional	6.2 ± 3.8	−0.21*	0.14	0.05†	0.06†	0.24*
MAQOL–Social	9.7 ± 4.3	−0.36§	0.33‡	0.05†	0.11§	0.49§
MAQOL–Health concerns	4.6 ± 2.7	−0.37§	0.33‡	0.07‡	0.06‡	0.46§
SF-36 PCS	44.2 ± 12.3	0.21*	0.31‡	0.02	0.02	0.35‡
SF-36 MCS	44.3 ± 9.8	0.26†	0.10	0.07†	0.01	0.18
CES-D	9.2 ± 12.4	−0.38§	0.16	0.09‡	0.09‡	0.34‡

* Covariates for analyses were: sex, race, age, education, smoking status, income, severity of asthma score, and change in severity of asthma score between baseline and followup.
* $P < 0.05$, † $P < 0.01$, ‡ $P < 0.001$, § $P < .0001$

verity, and change in severity of asthma score from baseline to followup (Table 6). In analyses of the followup 2 outcomes, change in PCAQ between baseline and followup 2 also contributed significantly to the predictive value of the models.

Baseline PCAQ scores were significantly associated with MCS and PCS at followup 1 (Table 6). The addition of baseline PCAQ to the regression model predicting followup 2 MCS significantly improved the model ($P < 0.05$), but the addition of change in PCAQ did not. Neither baseline PCAQ nor change in PCAQ was significantly associated with PCS at followup 2. Baseline PCAQ scores were significantly associated with CES-D scores at both followups, and the change in PCAQ from baseline to followup 2 was also significantly associated with followup 2 CES-D scores.

DISCUSSION

These findings document the utility of the 11-item PCAQ as a reliable and valid measure of perceived control of asthma. Scores were spread throughout the potential score range, indicating sufficient variability to detect differences among groups. The pattern of relationships between PCAQ scores and psychosocial and clinical status variables provides strong evidence for the construct validity of the PCAQ. Greater perceived control was associated with less severe asthma, greater asthma self-efficacy, lower perceived severity of asthma, lower perceived danger from asthma, and greater perceived usefulness of asthma medications. To the extent that pulmonary function test data were available, these also supported the validity of the PCAQ. We regret that this analysis was limited because we did not have such data available for all subjects.

These results support our hypothesis that perceived control of asthma is strongly associated with asthma-specific outcomes. Greater perceived control was significantly associated with better asthma-specific quality of life concurrently and predicted asthma-specific quality of life 18 and 36 months later. This association was seen even after controlling for demographic characteristics, smoking status, asthma severity, and, for the longitudinal analyses, change in asthma severity between baseline and followup.

Perceived control was also associated with generic mental health outcomes. Greater perceived control of asthma was associated with better mental functioning (as measured by the MCS) and lower levels of depressive symptoms (as measured by the CES-D) concurrently, and predicted both MCS and CES-D 18 and 36 months later. Finally, perceived control of asthma was associated with generic physical health status outcomes (as measured by the PCS) concurrently and significantly predicted PCS scores 18 months later, but not 36 months later. All of these associations were noted after controlling for demographics, smoking, and severity of asthma.

The impact of PCAQ on outcomes at followup was substantially less than its impact at baseline, suggesting that future work might focus on the usefulness of the PCAQ in longitudinal studies. However, our findings of associations

with outcomes as much as 36 months in the future suggest that in the case of shorter followups (eg, 3 to 6 months), associations would likely be stronger.

The study sample is not from the general population, but from a population with access to care by specialists. However, this sampling strategy yields greater diagnostic homogeneity for asthma. There was a wide range in responses, suggesting that even though our sample was drawn from a clinical population, a broad range of the perceived control construct was represented. Further, demographic variables, although skewed in our population (which was largely female, >30 years old, and well educated), seemed to have little impact on PCAQ scores. Nonetheless, we can not exclude the possibility that the sample design could have introduced selection bias into the study, and generalizations to all adults with asthma should be viewed with this potential limitation in mind. It is also possible that the restricted data set that we used in this analysis (removing potentially compromised interview data) could have introduced additional selection effects. In a previous analysis, however, we did not find that this restriction substantively affected analyses of the MAQOL or the SF-36, two of the key measures analyzed here.[24]

Other authors have developed self-efficacy scales pertinent to asthma.[20,28,29] Because perceived control and self-efficacy are related concepts, we used selected items from the Asthma Self-Efficacy Scale[20] to evaluate the construct validity of the PCAQ. However, because the concept of self-efficacy is bound to specific behaviors and/or specific circumstances, the self-efficacy scales focus on control of symptoms/exacerbations for each of a series of triggers. Perceived control, in contrast, is a more general construct reflecting individuals' perceived abilities to deal with, in this case, their asthma. The Multidimensional Health Locus of Control instrument[8] has been widely used among adults, but the Multidimensional Health Locus of Control is not specific to any one condition. Thus, the PCAQ is unique in the topic that it addresses.

It is important to recognize that the concepts of *perceived* control of asthma and *actual* control of asthma are distinct concepts, although their relationship is important. Any intervention based on increasing perceived control should make sure that such perceptions are linked to accurate assessments of asthma severity. Our results show that perceived control is negatively associated with both perceived severity and perceived danger (ie, higher perceived control is associated with lower perceived severity and danger; lower perceived control is associated with higher perceived severity and danger). Thus, it appears that patients' perceptions of perceived control are based, at least in part, on their perceptions of the severity and danger of their asthma. In addition, previous studies of self-efficacy, a concept related to perceived control, have shown that increasing patients' knowledge of how to treat their symptoms, regardless of the severity of those symptoms, may increase their self-efficacy and reduce the anxiety or distress caused by either the symptoms themselves or the fear of the symptoms.[30] Thus, asthma self-management education may improve perceived control, and thus be linked to decreases in distress and improvements in quality of life, without giving individuals a false sense of security concerning the actual severity or control of their asthma.

CONCLUSION

We have documented the utility of a brief, 11-item questionnaire to measure perceived control of asthma. The PCAQ was demonstrated to be reliable and valid. Perceived control of asthma was shown to be associated with both asthma-specific and generic health status outcomes concurrently and predictively. The relationship between PCAQ and both concurrent and later outcomes was robust, persisting after controlling for demographics and asthma severity. Our findings suggest that if perceived control could be modified, better outcomes, particularly better psychologic outcomes, might be achieved for individuals with asthma.

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