Published in final edited form as:

Ann Allergy Asthma Immunol. 2010 July ; 105(1): 12–19. doi:10.1016/j.anai.2010.04.009.

Randomized trial of self-management education in asthmatic patients and effects of depressive symptoms

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Abstract

Background—Self-management education is a cornerstone of routine asthma care.

Objectives—To improve asthma knowledge and self-efficacy and to assess effects in patients with depressive symptoms.

Methods—In a randomized trial, controls received asthma brochures and social support through frequent follow-up visits. Intervention patients made a contract to adopt a behavior to improve asthma and received a workbook, weekly reinforcements for 12 weeks, and frequent follow-up visits. Outcomes were Asthma Quality of Life Questionnaire (AQLQ) and 36-Item Short Form Health Survey (SF-36) scores and emergency department (ED) visits and hospitalizations for asthma.

Results—Ninety patients were randomized to each group. Mean age was 43 years, 84% were women, and mean study time was 27 months. Intervention patients had more improvement in AQLQ scores at 5 months, but this difference was not sustained. For the entire period, AQLQ scores improved by a clinically important difference from 4.1 to a mean of 5.1 in both groups ($P < .001$) with no difference between groups ($P = .91$). In multivariate analysis, younger age, more education, better enrollment AQLQ score, more asthma self-efficacy and knowledge, and fewer depressive symptoms were associated with more improvement ($P < .05$ for all). Similar results were found for the SF-36. Thirty-one percent of patients had an ED visit, and 9% were hospitalized, with no differences between groups. In multivariate analysis, female sex, expecting to be cured of asthma, less asthma knowledge, and more depressive symptoms were associated with ED visits. Being in the intervention group attenuated the effects of depressive symptoms for all outcomes.

Conclusions—Quality of life improved in both groups, with particular benefit in intervention patients with depressive symptoms.

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Disclosures: Authors have nothing to disclose.

Previous Presentation: Data from this article was presented in poster form at the 2009 International Meeting of the American Thoracic Society; May 17, 2009; San Diego, California. It has not been otherwise disseminated or published.

Introduction

Self-management education is a cornerstone of asthma therapy and is recommended by the National Asthma Education and Prevention Program Expert Panel.¹ Various classroom-style programs have been developed to increase knowledge through instruction about triggers, medications, and self-assessment and to increase self-efficacy through peer interactions.^{2–4} These programs are effective in improving outcomes; however, only 8% of patients enroll in them, and many do not attend all the sessions.^{5,6} The current national goal is to increase the proportion of patients who receive asthma education to 30% and for education to occur during routine clinical practice.^{1,5}

Integrating patient education into busy clinical settings, however, poses challenges.⁷ Practical issues, such as time, qualified personnel, and what should be taught and how often, are pertinent considerations. Several programs have been developed to address these issues using telephone and Internet-based instruction and have resulted in favorable outcomes.^{8,9} In addition, patient characteristics that may impede learning need to be considered, including different learning styles, low literacy level, and little motivation to manage one's condition, such as might exist in patients with depressive symptoms.

The objective of this trial was to test an educational intervention in the primary care setting to improve asthma knowledge and self-efficacy. The intervention was based on social learning theory, which emphasizes learning through experience and the example of others.¹⁰ The intervention was administered during 1 in-person interaction, followed by telephone reinforcements. Outcomes were change in asthma-related quality of life and need for emergency department (ED) visits and hospitalizations during approximately 2 years. An additional goal was to assess the particular effects of the intervention in patients with depressive symptoms.

Methods

This trial was approved by the institutional review board at the Weill Cornell Medical College/New York Presbyterian Hospital, and patients provided written informed consent. Patients were enrolled from the Cornell Internal Medicine Associates primary care practice in New York City. Patients were screened by reviewing daily appointment schedules. Patients were eligible if they could speak English and had moderate persistent asthma defined according to the National Heart, Lung, and Blood Institute criteria, which consider daily symptoms, medications, and exacerbations.¹¹ Patients were excluded if they had pulmonary or other severe comorbidity. Patients were approached when they came for routine office visits with their physicians, and if they agreed to participate, they were enrolled at that time. Patients did not receive monetary incentives for their participation.

At enrollment, patients were interviewed in-person by study personnel who were not medical providers but were college-educated individuals interested in health education. During the interview, patients completed validated questionnaires that measured asthma characteristics, including the Asthma Quality of Life Questionnaire (AQLQ), the Asthma Self-efficacy Scale, and the knowledge domain of the Knowledge, Attitude, and Self-efficacy Asthma Questionnaire.^{12–14} Patients were asked what medications they actually were taking for asthma, and in some cases, these did not coincide with all the medications that were prescribed. Adherence to medications was assessed using the Morisky Medication Adherence Scale.¹⁵ General physical and mental health were measured using the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) and the Charlson Comorbidity Index.^{16,17} In addition, depressive symptoms were assessed using the Geriatric Depression Scale, which measures psychological symptoms of depression and not somatic symptoms, which could overlap with

asthma symptoms.^{18,19} The Geriatric Depression Scale has been tested against the Research Diagnostic Criteria for major depression and is valid and reliable in older and younger adults.^{18,20} Perceived social support was assessed using the Duke Social Support Scale, which considers the size of the network available to provide support and the amount of support provided.²¹ A portable spirometer was used to measure pulmonary function, and no medications were administered during spirometry.

Patients were randomized to the control or intervention group. At enrollment, controls received 3 brochures from the American Lung Association providing facts about asthma, how to modify the home to minimize triggers, and how to use a peak flow meter. During the study period, attempts were made to contact controls every 3 months by telephone to inquire about any interval ED visits and hospitalizations for asthma. Periodically throughout the trial, when controls returned for office visits, they again were interviewed in-person to complete the AQLQ and the SF-36. The goal was to administer the final AQLQ and SF-36 at approximately 24 months. Thus, we did not have a traditional control group but rather provided controls with educational materials and frequent contacts that exceeded usual care.

At enrollment, intervention patients were given a workbook entitled *TAKE CONTROL OF YOUR ASTHMA: An Individualized Workbook for Self-Management*. This workbook was developed for this trial and contains 20 chapters that address asthma knowledge and self-efficacy.²² Knowledge chapters were based on educational programs from the National Heart, Lung, and Blood Institute. Self-efficacy chapters were developed specifically for the workbook and contain vignettes that describe actual patients and effective techniques to manage asthma. One of the self-efficacy chapters asks patients to make a contract to adopt a behavior that they think will improve their asthma. At enrollment, study personnel reviewed the contents of the workbook with patients and helped them make a contract. During the first 12 weeks of the study, intervention patients were contacted weekly by telephone or mail to encourage them to read the workbook and to persevere with their contract. Subsequently, similar to controls, intervention patients were contacted every 3 months to record any interval ED visits and hospitalizations for asthma and were interviewed again in-person when they returned for office visits, with the final assessment at approximately 24 months.

The primary outcome was a comparison of repeated measurements of the AQLQ between the control and intervention groups during the 24-month study period. Secondary outcomes were comparisons of repeated measurements of the SF-36 physical and mental components and having an ED visit or hospitalization for asthma during the study period.

The sample size calculation was based on the primary outcome. According to the authors of the AQLQ, the standard deviation of the total score determined during the development and testing of the AQLQ was 0.9, and a difference of 0.5 in the total score was a minimum clinically importance difference.^{12,23} In a previous longitudinal study²⁴ in the same medical practice as the present trial, we found the standard deviation of the total score to be 1.2. Using a standard deviation of 1.1 and setting α at .05, 80 patients in each group (160 total) gave a power of 0.82 to detect a 0.5 difference in AQLQ scores between groups. To allow for a 10% lost-to-follow-up rate, 180 patients were enrolled.

Randomization was performed in permuted blocks and was verified at the conclusion of the trial. Patients were blinded to randomization group. Study personnel who administered the telephone and in-person follow-up visits were not blinded because these contacts also were used to reinforce components of the intervention. However, different study personnel blinded to randomization group conducted the final follow-up. Spot checks and co-administrations of interviews were conducted periodically throughout the trial to maximize the fidelity of the enrollment and follow-up protocols.

The main outcome was analyzed using a mixed-effects model. This analysis was required because there were multiple follow-up visits per patient, but the interval and the total number of follow-up visits per patient varied. The dependent variable was repeated measurements of AQLQ scores from each follow-up. Independent demographic and asthma variables were assessed in bivariate analyses, with changes through time modeled with a fixed time variable. Variables moderately associated with repeated measurements of AQLQ scores in bivariate analyses were retained in a multivariate model with the fixed time variable and controlled for variables that differed between randomization groups at enrollment. Similar analyses were performed for repeated measurements of the SF-36. An intention-to-treat analysis was performed by carrying forward enrollment scores for patients who had no follow-up visits and assigning the group mean follow-up time for the first repeated measurement. Having had an ED visit and hospitalization for asthma during the study period were secondary outcomes and were assessed using generalized estimating equations accounting for follow-up time. Analyses were performed using a software program (SAS; SAS Institute Inc, Cary, North Carolina).²⁵

Results

Of 1,016 patients screened, 667 were excluded primarily owing to medical and psychiatric comorbidity, particularly emphysema, coronary artery disease, active major depression, and somatization disorder (Fig 1). Of the remaining 349 eligible patients, 169 were not enrolled mostly because they were missed by study personnel or they did not attend their scheduled office visit. Fifteen patients refused participation; the main reason was because they had no time to participate in research. The remaining 180 patients were enrolled, and 90 were randomized to each group. Only 1 patient from each group was lost to any repeated assessment of the AQLQ and the SF-36. All the patients had at least 1 contact by telephone to record ED visits and hospitalizations.

At enrollment, the groups were comparable with respect to most demographic and asthma characteristics (Table 1). Approximately one-third of the patients had a history of smoking, and this rate was higher in the intervention group. Body mass index also was higher in the intervention group, and, overall, 44% of patients were obese. Approximately 21% of participants had any major physical comorbidity, mostly diabetes mellitus, and 30% had a positive screen for depression. Approximately 26% of patients cited depression as a comorbidity, and half of these had a positive screen for depression. Of the remaining 74% of patients who did not cite depression as a comorbidity, approximately one-quarter had a positive screen for depression ($\kappa = 0.29$). Not all the patients reported taking asthma maintenance medications, and most reported that they were somewhat adherent to their asthma medications. Approximately 24% of patients expected that it was somewhat to very likely that they could be cured of asthma. Asthma self-efficacy was moderate, but asthma knowledge was low. The AQLQ score reflected a moderate impact of asthma, and the SF-36 physical component score reflected limitations in function that, given the low overall comorbidity, were most likely due to asthma.

Mean time in the study was 27 months. The number of contacts to measure the AQLQ and the SF-36 during the study period was comparable between groups, with approximately 50% from each group receiving 3 or more interviews to assess these outcomes (Table 2). In addition, approximately 50% of participants were contacted 4 or more times by telephone to record any ED visits or hospitalizations. For intervention patients, 87% had at least 1 contact with study personnel during the first 12 weeks to reinforce the workbook and the contract; most had 3 or more contacts. Intervention patients who were not contacted by telephone during any particular week were sent information by postal mail or email for that week. The most common contracts were to “take medications” and “use a peak flow meter.” At the conclusion of the trial, 72% reported that they fulfilled their contract mostly or completely.

At 1 follow-up visit, patients in both groups again completed the Asthma Self-efficacy Scale and the knowledge domain of the Knowledge, Attitude, and Self-efficacy Asthma Questionnaire. Compared with enrollment scores, repeated self-efficacy scores improved for both groups, but more so for intervention patients (0.38, $P < .001$) than for controls (0.20, $P = .06$). Knowledge scores improved minimally for intervention patients but not for controls (2.12, $P = .15$ and -1.49 , $P = .33$, respectively).

For the first repeated measurement at approximately 5 months, intervention patients had greater improvements in AQLQ scores than did controls (1.2 vs 0.3, $P = .003$). For the entire follow-up period, mean AQLQ scores were 5.1 for controls and 5.1 for intervention patients, which corresponded to within-patient improvements from enrollment scores of approximately 1.0 ($P < .001$) for each group. In a mixed-effects model accounting for the fixed time variable, there was no difference between randomization groups for the main outcome, ie, repeated measurements of AQLQ scores ($P = .98$). Several demographic and asthma variables were associated with improvements in AQLQ scores in bivariate analyses (Table 3). In a multivariate model accounting for the fixed time variable and controlling for variables found at enrollment to differ between groups (ie, body mass index, smoking history, and medication adherence), the variables that remained associated with improvement in AQLQ scores were younger age, more education, better enrollment AQLQ score, more asthma self-efficacy, more asthma knowledge, and fewer depressive symptoms.

Similar analyses were conducted for SF-36 scores, and no differences were found between randomization groups. For the physical component, younger age, male sex, white race, more education, more social support, less comorbidity, fewer depressive symptoms, and a better enrollment physical component score were associated with improvement. In multivariate analysis, fewer depressive symptoms and a better enrollment score remained associated ($P < .001$ for both). For the mental component, more education, more social support, less comorbidity, fewer depressive symptoms, and a better enrollment mental component score were associated with improvement. In multivariate analysis, fewer depressive symptoms ($P = .002$), less comorbidity ($P = .01$), and a better enrollment mental component score ($P = .003$) remained associated.

In total, 56 patients (31%) had an ED visit for asthma during the study period, with no difference between groups (30% of controls and 32% of intervention patients, $P = .84$ [accounting for time in the study]). In multivariate analysis, female sex, expecting to be cured of asthma, less asthma knowledge, and a positive screen for depression were associated with having an ED visit (Table 4). In total, 16 patients (9%) were hospitalized for asthma during the study period, with no difference between groups (7% of controls and 11% of intervention patients, $P = .30$ [accounting for time in the study]). In multivariate analysis, previous hospitalization for asthma ($P = .04$) and a positive screen for depression ($P = .02$) were associated with having a hospitalization for asthma during the study period.

Given that depressive symptoms were associated with all outcomes, relationships between this variable and other variables known to be associated with poor clinical asthma were assessed. For enrollment characteristics, patients with a positive screen for depression were more likely to be nonwhite, to have less education, to be current smokers, to have less asthma self-efficacy, and to have less asthma knowledge ($P \leq .001$ for all). In addition, patients with a positive screen had worse enrollment AQLQ and physical and mental component scores ($P < .001$ for each comparison). These baseline relationships were similar for the control and intervention groups. There were differences, however, between randomization groups in outcomes according to depressive symptoms. For controls, patients with a positive screen had less improvement in quality of life and were more likely to have had an ED visit and to have been hospitalized for asthma compared with those with a negative screen (Table 5). For intervention patients,

however, those with a positive screen did not have less improvement in quality of life and were not more likely to have had an ED visit or to have been hospitalized. This suggests that the intervention may have been beneficial for patients with more depressive symptoms. Similar results were found for the SF-36 physical component scores where depressive symptoms were less of a determinant of outcome for patients in the intervention group.

At each telephone and in-person follow-up visit, patients were asked about adverse events. No adverse events were associated with this trial. At the conclusion of the trial, patients were asked how participation affected their asthma; 46% of controls and 68% of intervention patients ($P = .005$) reported that it made their asthma better, and the remaining patients reported that it had no effect; none reported that it made their asthma worse.

Discussion

In this trial to foster asthma self-management, patients in the intervention and control groups had clinically important improvements in quality of life across 27 months. Although patients in the intervention group had more improvement during the first several months, these differences were not sustained. Thirty-one percent of patients had at least 1 ED visit, and 9% were hospitalized for asthma during the trial, with no differences between randomization groups. Younger age, more education, more asthma self-efficacy, more asthma knowledge, and fewer depressive symptoms were associated with more improvement in quality of life, less ED use, and fewer hospitalizations.

The favorable results seen in both randomization groups may have been due, in part, to the study protocol itself, which provided the control group with more than usual care. Specifically, patients in both groups received multiple telephone and in-person follow-up visits, which was a form of asthma-specific social support and offered many opportunities for patients to discuss asthma with study personnel. Because these contacts reminded patients about self-management and occurred throughout the trial, they may have provided continuous support to engage in effective behaviors in both groups, such as following up with physicians, improving medication adherence, and avoiding triggers.⁶ The intervention seemed to provide some additional benefit in the early phase of the trial, when patients received weekly telephone reinforcements; however, this benefit waned with time as the weekly contacts ceased. The present findings are consistent with those of other studies in which controls derived benefit from increased asthma-related attention^{4,6-8} and effects of interventions diminished with time in the absence of specific reinforcements or boosters.²⁶

Of the independent variables we measured, depressive symptoms was the one most consistently associated with worse outcomes. Although the coexistence of asthma and depression is well known, this longitudinal study supports other studies^{24,27} that showed that depressive symptoms lead to worse asthma outcomes. In addition, we found that having more depressive symptoms was associated with other independent variables known to be related to poor outcomes, such as being a smoker and having less education and asthma self-efficacy and knowledge. Thus, the impact of depressive symptoms was direct and indirect, making it complex to ascertain its entire contribution. However, these data suggest that the intervention may have had some sustained benefit in patients with depressive symptoms. Specifically, differences in outcomes based on whether patients had a positive or negative screen for depression were attenuated for patients in the intervention group. Possible mechanisms for this might be that the more intense asthma-related social support that was part of the intervention buffered patients from some effects of depression. Although this trial was not designed to compare subgroups of patients, this finding provides preliminary support for developing specific interventions to improve self-management in patients with depressive symptoms. This approach parallels treatment for other chronic conditions that have a high prevalence of

comorbid depression, such as coronary artery disease, diabetes mellitus, and musculoskeletal diseases, where acknowledging depressive symptoms in the management of the physical illness leads to better outcomes.^{28–30}

Similar to a previous study,²⁴ we again found that less self-efficacy, less knowledge, and expecting to be cured of asthma were associated with worse outcomes. In general, patients who expected a cure thought that asthma was similar to other respiratory conditions, such as bronchitis or pneumonia, where treatment could “cure” the condition although they could get the condition again.³¹ This expectation reflects a lack of asthma knowledge. In the present trial, asthma self-efficacy improved in both groups, but asthma knowledge did not. This divergent finding may be related to the educational level of the patients. Unlike self-efficacy, which is experience based, increasing knowledge requires some type of instruction, and the method used herein to increase knowledge through the workbook may not have been effective in patients with less education. A possible reason for this is that patients with low education may not be accustomed to relying on written material for information and, thus, were less inclined to read the workbook, although it was illustrated and had a fifth grade reading level.

There are several limitations to this trial. First, patients in this study had moderate asthma, and results may not be generalizable to patients with more or less severe disease and to patients who were eligible but were not enrolled. Second, follow-up of the main outcome was conducted during in-person interviews to parallel the enrollment process. This resulted in marked variation in intervals between follow-up visits and the number of follow-up visits. Although a mixed-effects analysis was appropriately used to account for this, follow-up visits conducted at uniform intervals for all patients would have permitted better delineation of effects of the intervention across time. Third, minimal reinforcement was given to the intervention group after the initial 12 weeks. Interval boosters administered according to a set protocol would have been useful to ascertain whether effects of the intervention could have been sustained. Fourth, information about ED visits and hospitalizations was obtained from self-report and was not verified by review of hospital records. However, we queried patients about these outcomes frequently, and, given that they were major events, it is likely that they were recalled.

In this trial, protocols to foster asthma self-management were effective in improving longitudinal outcomes across approximately 2 years. These protocols were relatively easy to administer during primary care office visits and, thus, meet current national goals to integrate asthma education into routine clinical practice. In addition, this trial highlighted potential unique features regarding depressive symptoms and asthma self-management. In particular, the self-efficacy and knowledge components of the intervention tended to have prolonged benefit in patients with depressive symptoms. This finding is relevant because although depressive symptoms occur commonly in asthmatic patients, there is little information about how to improve asthma education and outcomes in the context of coexisting depressive symptoms.

Acknowledgments

We thank B. Robert Meyer, MD, and the physicians and patients at Cornell Internal Medicine Associates for their participation.

Funding Sources: This study was supported by grant K23 04067 from the National Heart, Lung, and Blood Institute.

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Figure 1.
Flow diagram of the study participants.

Table 1
Characteristics of the Study Groups at Enrollment

Variable	Control group (n = 90)	Intervention group (n = 90)	P value
Age, mean (SD), y	43 (13)	42 (14)	.61
Female sex, %	84	83	.84
Race, % ^a			
White	36	27	.59
African American	37	31	
Hispanic	22	38	
Other	5	4	
College graduate, %	53	41	.10
Never married, %	47	52	.46
Employed, %	51	54	.41
Current smoker, %	7	12	.20
Ever smoked, %	27	42	.03
Body mass index, mean (SD) ^b	29 (8)	32 (9)	.02
Any major comorbidity, % ^c	22	19	.58
Perceived social support score, mean (SD) ^d	46 (19)	47 (19)	.97
Depressive symptoms score, mean (SD) ^e	8 (7)	9 (7)	.37
Screened positive for depression, % ^f	26	33	.25
Asthma duration, mean (SD), y	23 (15)	23 (15)	.91
Forced expiratory volume in 1 second, mean (SD), % of predicted	83 (20)	81 (19)	.60
Current asthma medications, %			
None	3	0	.08
Inhaled β -agonist only	29	24	.50
Inhaled corticosteroid	58	67	.22
Leukotriene modifier	13	24	.06
Other ^g	16	13	.67
Any maintenance medication, %	68	76	.25
Self-reported adherence to medications			
Score, mean (SD) ^h	1.9 (1.3)	1.6 (1.2)	.07
Completely, %	21	19	.07
Somewhat, %	69	74	
Not at all, %	10	7	
Expect to be cured of asthma, % ⁱ	20	28	.22
Asthma self-efficacy score, mean (SD) ^j	3.5 (1.0)	3.5 (0.9)	.80
Asthma knowledge score, mean (SD) ^k	54 (18)	50 (16)	.14
Asthma quality of life score, mean (SD) ^l	4.1 (1.4)	4.1 (1.4)	.95
SF-36 physical component score, mean (SD) ^m	39 (13)	39 (13)	.76

Variable	Control group (n = 90)	Intervention group (n = 90)	P value
SF-36 mental component score, mean (SD) ^m	46 (10)	46 (13)	.85

Abbreviation: SF-36, 36-Item Short Form Health Survey.

^aSelf-described.

^bCalculated as weight in kilograms divided by height in meters squared.

^cUsing the Charlson Comorbidity Index, which measures major physical conditions.

^dUsing the Duke Social Support Scale (possible score range, 0–100); higher scores indicate more support.

^eUsing the Geriatric Depression Scale (possible score range, 0–30); higher scores indicate more depressive symptoms.

^fDefined as a Geriatric Depression Scale score of at least 11.

^gTheophylline, cromolyn sodium, ipratropium bromide, and oral β -agonist.

^hUsing the Morisky Medication Adherence Scale (possible score range, 0–4); higher scores indicate less adherence.

ⁱThe response options were very likely, somewhat likely, and do not expect this.

^jUsing the Asthma Self-efficacy Scale (possible score range, 1–5); higher scores indicate more self-efficacy.

^kUsing the Knowledge, Attitude, and Self-efficacy Asthma Questionnaire knowledge domain (possible score range, 0–100); higher scores indicate more knowledge.

^lUsing the Asthma Quality of Life Questionnaire (possible score range, 1–7); higher scores indicate better status.

^mFor each, the possible score range was 0 to 100; higher scores indicate better status (50 is the normative value for the general population).

Table 2
Longitudinal Components of the Trial

Component	Control group	Intervention group	P value
Time in study, mean (SD), mo	27 (5)	28 (5)	.83
No. of repeated measures of outcomes, %			
0	1	1	.94
1	6	9	
2	46	37	
3	31	33	
≥4	16	20	
No. of contacts to record interval care, %			
1–2	18	21	.76
3–4	56	52	
5–6	24	21	
7–8	2	6	
No. of reinforcements for intervention patients during first 12 wk,%			
0	NA	13	NA
1–2	NA	32	
3–4	NA	20	
5–6	NA	19	
≥7	NA	16	
How well intervention patients fulfilled contract ^a			
Not at all	NA	6	NA
A little/somewhat	NA	22	
Mostly	NA	45	
Completely	NA	27	

Abbreviation: NA, not applicable.

^aSelf-reported at the final assessment.

Table 3
Variables Associated With Improvement in Asthma Quality of Life Questionnaire Scores During Follow-Up

Variable	Bivariate analyses ^{a,b}		Multivariate analysis ^{a,c}	
	Estimate	P value	Estimate	P value
Intervention group	−0.005	.98	−0.06	.70
Younger age	+0.02	.01	+0.02	<.001
More education	+0.31	<.001	+0.11	.06
Male sex	+0.65	.01	NA	NS
White race	+0.70	<.001	NA	NS
More social support	+0.01	.01	NA	NS
Expects to be cured of asthma	−0.55	.08	NA	NS
Has maintenance medications	−0.38	.08	NA	NS
Less comorbidity	+0.42	.006	NA	NS
Better enrollment AQLQ score	+0.64	<.001	+0.49	<.001
More asthma self-efficacy	+0.54	<.001	+0.18	.03
More asthma knowledge	+0.02	.003	+0.01	.01
More depressive symptoms	−0.09	<.001	−0.03	.008

Abbreviations: NA, not applicable; NS, not significant at $P \geq .10$.

^a Each comparison was assessed using a mixed-effects model.

^b Accounting for fixed time variable.

^c Accounting for fixed time variable and controlling for body mass index, smoking history, and self-reported medication adherence.

Table 4
Variables Associated With Having an Emergency Department Visit During the Study Period

Variable	Bivariate analyses ^a		Multivariate analysis ^b	
	Estimate	P value	Estimate	P value
Intervention group	+0.07	.84	−0.19	.61
Female sex	+1.6	.01	+1.3	.04
Expects to be cured of asthma	+1.7	.001	+1.6	.01
Less asthma self-efficacy	+0.37	.04	NA	NS
Less asthma knowledge	+0.04	<.001	+0.03	.02
Positive screen for depression	+1.2	.001	+0.74	.07

Abbreviation: NA, not applicable; NS, not significant at $P \geq .10$.

^a Accounting for follow-up time.

^b Accounting for follow-up time and controlling for age.

Table 5

Effects of Depression Screen on Outcomes^a

Outcomes	Control group		P value	Intervention group		P value
	Negative screen for depression (n = 67)	Positive screen for depression (n = 23)		Negative screen for depression (n = 60)	Positive screen for depression (n = 30)	
Asthma quality of life, mean (SD) ^b	5.5 (1.3)	4.0 (1.4)	.02 ^c	5.4 (1.2)	4.5 (1.5)	.24 ^c
Had an emergency department visit for asthma, %	21	57	.001 ^d	27	43	.16 ^d
Was hospitalized for asthma, %	1	22	.01 ^d	8	17	.22 ^d

^aBased on Geriatric Depression Scale score (a score ≥ 11 indicates a positive screen for depression).

^bAsthma Quality of Life Questionnaire (AQLQ) repeated measurements (possible score range, 1–7); higher scores indicate better status.

^cAccounting for follow-up time and controlling for enrollment AQLQ score.

^dAccounting for follow-up time.