Published in final edited form as:

J Clin Psychol Med Settings. 2010 December ; 17(4): 349–356. doi:10.1007/s10880-010-9214-3.

Anxiety and Asthma Symptoms in Urban Adolescents with Asthma: The Mediating Role of Illness Perceptions

Meghan E. McGrady

Department of Psychology, University of Cincinnati, Cincinnati, OH, USA

Department of Family and Community Medicine, University of Cincinnati College of Medicine, P.O. Box 670840, Cincinnati, OH 45267-0840, USA

Sian Cotton

Department of Family and Community Medicine, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Susan L. Rosenthal

Department of Pediatrics, Columbia University College of Physicians and Surgeons, New York, NY, USA

Yvonne Humenay Roberts

Department of Psychology, University of Cincinnati, Cincinnati, OH, USA

Maria Britto

Division of Adolescent Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA

Michael S. Yi

Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Department of Internal Medicine, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Abstract

Twenty to 40% of adolescents with asthma experience significant symptoms of anxiety. This study examined the mediational role of illness perceptions in the relationship between anxiety and asthma symptoms in adolescents. One hundred fifty-one urban adolescents (ages 11–18) with asthma completed measures of illness perceptions, and anxiety and asthma symptoms. Using the Baron and Kenny approach and Sobel tests, we examined whether illness perceptions mediated the anxiety-asthma symptom relationship. Three illness perceptions significantly mediated the relationship between anxiety and asthma symptoms, $z = 1.97$ – 2.13 , $p < .05$; adjusted $R^2 = 0.42$ – 0.51 , $p < .05$. Greater anxiety symptoms were associated with perceptions that asthma negatively impacted one's life and emotions and was difficult to control. These negative illness perceptions were, in turn, related to greater asthma symptoms. Illness perceptions helped explain the anxiety-asthma symptoms link in adolescents. Results suggest that targeting illness perceptions in adolescents with asthma and anxiety may help reduce asthma symptoms.

Keywords

Asthma; Anxiety; Adolescents; Illness perceptions

Asthma is the most common childhood chronic illness in the United States and affects an estimated 15% of adolescents (Bloom, Cohen, & Freeman, 2009; Centers for Disease Control and Prevention, 2006). Low-income, urban, and minority adolescents are disproportionately affected, accounting for over half of all cases (Akinbami & Schoendorf, 2002; Akinbami, Moorman, Garbe, & Sondik, 2009). Characterized by airway obstruction, airway inflammation, and airway hyper-responsiveness, asthma often results in complications including activity limitations, difficulty sleeping, persistent cough, and in some extreme cases, hospital visits or death (Akinbami & Schoendorf, 2002; Guill, 2004). Risk of these adverse outcomes is heightened in urban populations. Specifically, rates of emergency department visits and mortality are higher in African-American and low-income children than non-Hispanic white or higher-income children (Akinbami et al., 2009; LeNoir, 1999).

Urban adolescents with asthma live in environments with multiple factors that may lead to increased levels of depression or anxiety (McDonald & Richmond, 2008). In general, adolescents with asthma are twice as likely as their healthy peers to exhibit clinically significant symptoms of anxiety, with an estimated 20–40% meeting *DSM-IV-TR* criteria for at least one anxiety disorder (Ross, Davis, & Hogg, 2007; Vila, Nollet-Clemenc, de Blic, Mouren-Simeoni, & Scheinmann, 2000). Researchers have proposed that this relationship may be the result of shared environmental factors, shared risk factors, or the effect of asthma medication (Goodwin, 2003).

While the mechanism underlying the relationship between asthma and anxiety remains unknown, the presence of an anxiety disorder has been repeatedly linked to more negative health outcomes in adolescents with asthma (Vila et al., 2003; McCauley, Katon, Russo, Richardson, & Lozano, 2007). For adolescents with asthma, symptoms of anxiety are related to more self-reported symptoms of asthma (Vila et al., 2003), activity limitations (McCauley et al., 2007), and asthma-related worries (Vila et al., 2003). These differences remain after controlling for asthma severity, a potential confounding variable. For example, when asthma severity is controlled for, adolescents with asthma and a co-morbid anxiety or depressive disorder reported significantly more days with asthma symptoms than their peers with asthma alone (Richardson et al., 2006).

While the dynamic relationship between anxiety and asthma symptoms is well established (Katon, Richardson, Lozano, & McCauley, 2004), what is less clear are factors that may mediate (or help explain) this relationship. Given the high rates of asthma in urban samples (Akinbami & Schoendorf, 2002; Akinbami et al., 2009), the high rates of asthma and anxiety co-morbidity (Ross et al., 2007; Vila et al., 2000), and the increased risk of urban adolescents for adverse asthma-related outcomes (Akinbami et al., 2009; LeNoir, 1999), it is important to understand how asthma and anxiety are related in samples of urban adolescents. Understanding mediating factors in urban adolescents could help specify target areas related to anxiety, thus possibly improving asthma symptoms and ultimately health-related quality of life for these at-risk adolescents.

As part of a larger model explaining the potential adverse impact of co-morbid anxiety/depressive disorders in adolescents and adults with asthma, Katon et al. (2004) proposed that anxiety disorders may be linked to poorer asthma-related outcomes (i.e., increased asthma symptom burden, increased functional impairment, and increased health utilization and

medical costs). In this model, they proposed that fearful cognitions, self-efficacy, and locus of control may partially mediate the relationship between anxiety and asthma symptoms (Katon et al., 2004; McCauley et al., 2007). In this model, fearful cognitions include catastrophizing and “a sense of being out of control and needing help and support” (Katon et al., 2004, p. 353). While examination of all potential mediators is necessary to fully understand this relationship, this paper focuses on the role of cognitions. Cognitions are both modifiable and potentially amenable to treatment via standard psychological (particularly cognitive behavioral) therapies (Barrett, 1998); thus, making them a good candidate for investigation.

While the full model proposed by Katon et al. (2004) has not been tested, negative cognitions (e.g., catastrophic thinking, a sense of being out of control) have been linked to both anxiety and asthma symptoms (De Peuter, Lemaigre, Van Diest, & Van den Bergh, 2008). In a study of adults with asthma, higher rates of catastrophic cognitions about asthma during an exacerbation were correlated with retrospective report of more frequent symptoms during a typical asthma exacerbation (De Peuter et al., 2008). Further, higher rates of catastrophic cognitions were associated with more symptoms of anxiety (De Peuter et al., 2008).

Based on the model of anxiety-asthma proposed by Katon and colleagues, cognitions are one possible pathway through which anxiety symptoms may be related to asthma symptoms. Illness perceptions, an individual's beliefs about his or her illness, are one component of an individual's cognitions (Leventhal, Diefenbach, & Leventhal, 1992). Thus, further examination of anxiety symptoms, illness perceptions, and perceived asthma symptoms could inform psychological treatment methods for anxiety in adolescents with asthma. Specifically, examination of this part of the model could identify specific illness perceptions to be targeted in psychological treatment. Therefore, the purpose of this study was to examine the possible mediating role of illness perceptions in the anxiety-asthma symptoms relationship in a sample of urban adolescents. We hypothesized that adolescents with increased symptoms of anxiety would perceive their illness to be more negative (regardless of their actual asthma severity), and, as a result, experience greater asthma symptoms (see Fig. 1).

Method

Participants for this study were drawn from a larger 2-year longitudinal study of 151 urban adolescents (ages 11–18 years) (Cotton et al., 2010). The purpose of the larger study was to examine religious/spiritual variables related to coping with asthma (Cotton et al., 2010). The current secondary data analysis was undertaken to better understand the relationship between anxiety symptoms, asthma symptoms, and illness perceptions. Eligible adolescents had a current diagnosis of asthma and were currently receiving care from an adolescent primary care clinic at a Midwestern children's hospital. After fully explaining the nature of the research study, research assistants obtained appropriate consent and assent. Participants completed questionnaires during clinic visits or at a pre-arranged time. Participants were compensated \$25 for their time and effort. All study procedures were approved by the relevant Institutional Review Board. Only cross-sectional data collected at baseline were used for this paper.

Measures

Demographic variables including age, gender, ethnicity, parental education were obtained via self-report.

Covariate: Asthma Severity—After the participant completed questionnaires, a research assistant obtained a rating of asthma severity directly from a provider in the adolescent primary care clinic. Providers classified patient's asthma severity as intermittent, mild persistent, moderate persistent, or severe persistent in accordance with the guidelines of the National Heart, Lung, and Blood Institute (National Heart, Lung, and Blood Institute, 2007).

Predictor: Anxiety—Anxiety, the primary predictor variable, was assessed using the 10-item Multidimensional Anxiety Scale for Children (MASC-10; March, Parker, Sullivan, Stallings, & Conners, 1997). The MASC-10 has good internal consistency, $\alpha = .68$ and test-retest reliability, $r = .86$, $p < .05$ in community samples (March et al., 1997). Possible responses on the MASC-10 range from 0 (no symptom) to 3 (distinct symptom). In our study protocol, possible responses ranged from 1 to 4 and were recoded for data analysis purposes. Responses were summed and converted to gender and age-specific *T*-scores in accordance with the published guidelines (March et al., 1997). A *T*-score of 65 is the suggested clinical cut-point in this sample, indicative of “clinically significant” symptoms of anxiety. However, because *T*-scores on the MASC-10 represent symptoms of anxiety rather than a diagnosis of an anxiety disorder, *T*-scores were analyzed as a continuous variable. The MASC-10 demonstrated an internal consistency of .74 in this sample.

Mediator: Illness Perceptions—The Brief Illness Perceptions Questionnaire (Brief-IPQ) was used to assess participant's cognitive and emotional perceptions of asthma (Broadbent, Petrie, Main, & Weinman, 2006). The Brief-IPQ is an eight-item measure that assesses perceived consequences, timeline, personal control, treatment control, identity, concern, emotional representation, and coherence of one's illness. Items were rated on a Likert-scale from 1 (absence of perception) to 10 (full agreement with perception). An anchor of 1 was used instead of 0 (as included in the original measure) (Broadbent et al., 2006) to ensure the scaling of this measure was consistent with others in our study protocol. For example, participants rated, “How much does asthma affect your life?” on a scale of 1 (no effect at all) to 10 (severely affects my life). Items are scored such that higher responses on items one, two, five, six, and eight represent more negative illness perceptions. Items three, four, and seven are scored such that higher responses indicate more positive illness perceptions. Consistent with the published guidelines for this measure, each of the eight items were treated as individual variables (Broadbent et al., 2006). To our knowledge, the psychometric properties of the Brief IPQ have not been reported in adolescents with asthma. However, the items on the Brief IPQ have demonstrated adequate test-retest reliability and predictive validity in samples of adults with various illnesses (Broadbent et al., 2006).

Outcome: Asthma Symptoms—Adolescent self-report asthma symptoms were examined using the Symptoms subscale of the PedsQL™ 3.0 Asthma Module, a measure of asthma-specific health-related quality of life (Varni, Burwinkle, Rapoff, Kamps, & Olson, 2004). Adolescents rated how often symptoms had been a problem for them in the last month from 1 (never a problem) to 5 (almost always a problem). Sample items include “I cough,” and “My chest hurts or feels tight.” Items were scored in accordance with publisher guidelines, such that possible scores ranged from 0 to 100, and higher scores represented fewer symptoms (Varni et al., 2004). The Symptoms subscale of the PedsQL™ 3.0 Asthma Module is considered a valid measure of self-reported asthma symptoms in children and adolescents (Varni et al., 2004). This subscale has demonstrated adequate internal consistency, $\alpha > .70$ in samples of inner-city youth (Greenley, Josie, & Drotar, 2008), and demonstrated a similar degree of internal consistency in this sample, $\alpha = .78$.

Statistical Analyses

Descriptive statistics and frequencies were calculated for the final sample. Preliminary analyses indicated that the primary outcome variable, perceived asthma symptoms, was normally distributed, $p > .05$. As a result, no transformations were undertaken.

As testing of mediational models is warranted if there are significant associations among the primary variables of interest, bivariate correlations were calculated first. Only illness perceptions that were correlated with both anxiety symptoms and asthma symptoms were included in subsequent regression analyses. In accordance with Baron and Kenny (1986), a series of regression analyses were used to examine the hypothesis that illness perceptions mediate the relationship between anxiety and asthma symptoms. The first set of regressions examined the relationship between anxiety symptoms and illness perceptions. The second set of regressions examined the relationship between anxiety symptoms and asthma symptoms. Finally, the third set of regressions examined the relationship between anxiety symptoms and asthma symptoms with illness perceptions included in the model.

Relevant demographic covariates (age and gender) were included in all models. Asthma severity was also included as a covariate as empirically ($r_s = -.24$, $p < .01$ with self-report asthma symptoms) and conceptually, this variable differs from self-report asthma symptoms. All variables remained in the final models regardless of whether or not they significantly predicted the outcome variable. Thus, final models included predictors and all covariates. In accordance with guidelines for testing mediational models, post-hoc probing (Sobel test) was used to assess the significance of each mediational model (Holmbeck, 2002).

Results

Demographics of the sample are presented in Table 1. Of the 151 participants ($M = 15.8$ years, $SD = 1.8$ years), 22 (15%) endorsed clinically significant levels of anxiety (T -score [65; $M = 52.51$, $SD = 12.38$; range = 29–88). An additional 18 (12%) adolescents endorsed “above average” levels of anxiety (T -scores > 60). The mean score on the measure of perceived asthma symptoms (PedsQL™ Asthma Module, Symptoms subscale) was 60.5 ($SD = 20.0$; range = 14–100). Mean scores in our sample were similar to those obtained in a sample of inner-city youth with intermittent and mild persistent asthma (Greenley et al., 2008).

In bivariate analyses, higher levels of anxiety symptoms were associated with more perceived asthma symptoms as measured by the Symptoms subscale of the PedsQL™ Asthma Module ($r = -.40$, $p < .001$). Five of the eight individual illness perception questions were significantly associated with both increased anxiety and greater asthma-related impairment ($p < .05$): (1) “How much does your asthma affect your life?” (consequences); (2) “How long do you think your asthma will continue?” (timeline); (3) “How much control do you have over your asthma?” (personal control); (4) “How much do you experience symptoms from your asthma?” (identity); and (5) “How much does your asthma affect you emotionally?” (emotional representations) (Table 2). Because correlations were significant for these five illness perceptions (potential mediators), a set of three regression analyses was conducted for each illness perception.

The first set of regression analyses included anxiety and covariates as independent variables and each of the five illness perceptions as the dependent variable. The regression models were significant for four of the five illness perceptions, with greater anxiety predicting more negative illness perceptions. Specifically, greater anxiety symptoms were linked with perceptions that asthma has a greater impact on an adolescent's life and emotions. In addition, increased anxiety symptoms were related to a longer perceived duration of asthma

and less perceived control over asthma symptoms. Significant covariates varied for each model.

The second set of analyses was one regression analysis with anxiety at baseline and covariates predicting perceived asthma symptoms. The regression model was significant $F(4,144) = 21.97, p = .00$, with increased anxiety ($\beta = -.28, p = .00$), and covariates (female gender, $\beta = -.42, p = .00$ and increased severity, $\beta = -.21, p = .01$) associated with more asthma symptoms.

The third set of regression models included both anxiety and the four aforementioned illness perceptions, along with the covariates, as predictors of perceived asthma symptoms. All four proposed mediators were significantly related to perceived asthma symptoms (Table 3). In the first model, greater asthma symptoms were predicted by adolescent's perceptions that asthma greatly affected their life ($p = .00$), female gender ($p = .00$), and increased anxiety symptoms ($p = .01$), $F(5, 143) = 31.60, p = .00$, adjusted $R^2 = 0.51$. In the second model, greater asthma symptoms were predicted by longer perceived duration of asthma ($p = .00$), female gender ($p = .00$), increased severity ($p = .01$), and increased anxiety symptoms ($p = .00$), $F(5, 142) = 24.96, p = .00$, adjusted $R^2 = 0.45$. In the third model, increased anxiety symptoms ($p = .00$), older age ($p = .04$), increased severity ($p < .01$), female gender ($p = .00$), and lower perceived control over asthma ($p = .00$), predicted greater symptoms, $F(5, 143) = 22.44, p = .00, R^2 = 0.42$. In the fourth model, increased emotional impact of asthma ($p = .00$), increased anxiety symptoms ($p = .00$), increased severity ($p = .01$), and female gender ($p = .00$) predicted greater asthma symptoms, $F(5, 143) = 27.39, p = .00, R^2 = 0.47$.

When both anxiety and illness perceptions were included in the model, the effect of anxiety symptoms on asthma symptoms (as indicated by β) was reduced in all four models. Post-hoc examination of these models using the Sobel test indicated three significant mediators: (1) "How much does asthma affect your life?" $z = 2.09, p < .05$; (2) "How much control do you have over your asthma?" $z = 1.97, p < .05$; and (3) "How much does your asthma affect you emotionally?" $z = 2.13, p < .05$. The fourth illness perception, "How long do you think your asthma will continue?" approached significance as a mediator, $z = 1.84, p = .07$.

Conclusions

In this sample of urban adolescents with asthma, over one quarter of participants exhibited symptoms of anxiety above the mean. Of these, 15% endorsed clinically significant symptoms of anxiety. These rates of clinically significant symptoms of anxiety are similar to rates obtained in previous studies of adolescents with asthma (Katon et al., 2004; Vila et al., 2000), and are about twice that of urban adolescent populations (Roberts, Roberts, & Xing, 2007). Increased rates of anxiety in urban adolescents may be attributable to various environmental factors including increased exposure to community violence (McDonald & Richmond, 2008).

Consistent with previous findings, higher levels of anxiety symptoms were related to more self-reported asthma symptoms; thus raising the question as to whether screening for anxiety symptoms in individuals with asthma may help improve treatment. Specifically, anxiety screening for individuals reporting numerous asthma symptoms despite reported adherence to the prescribed medical regimen could help determine whether or not anxiety symptoms may be contributing to asthma symptoms. Previous research suggests that the Trait subscale of the State-Trait Anxiety Inventory for Children (STAI-C) demonstrates high sensitivity and specificity in screening adolescents with asthma for anxiety disorders (Ross et al., 2007).

As hypothesized, the relationship between anxiety symptoms and asthma symptoms was partially mediated by illness perceptions. Specifically, higher levels of anxiety were associated with feeling that one's asthma negatively impacted one's life and emotions, and was difficult to control. These negative illness perceptions, in turn, were related to greater asthma symptoms.

Given the high rates of asthma and co-morbid anxiety (Ross et al., 2007; Vila et al., 2000), and adverse asthma-related outcomes in urban adolescents (Akinbami et al., 2009; LeNoir, 1999), it is important to explore interventions aimed to improve outcomes. Our results suggest that illness perceptions could be tested in a pilot psychological intervention as a means to potentially improve asthma symptoms in adolescents. Cognitive behavioral therapy (CBT) has been shown to effectively reduce symptoms of anxiety in healthy adolescents (Barrett, 1998; Flannery-Schroeder, 2004), and children (ages 8–12 years) with asthma (Papneja & Manassis, 2006). To our knowledge, however, no studies have examined the ability of CBT to decrease asthma symptoms in children or adolescents (Yorke, Fleming, & Shuldham, 2007a), and results of studies with adults remain mixed (Yorke, Fleming, & Shuldham, 2007b). In samples of adults, participation in CBT has been linked to improvements in symptoms as measured by the Asthma Quality of Life Questionnaire (Yorke et al., 2007b), but not those measured by components of the Asthma Symptoms Checklist (Yorke et al., 2007b). Specifically, participation in CBT resulted in improvement in obstruction, fatigue, and irritation, but not dyspnea, hyperventilation, and anxiety (Yorke et al., 2007b). Given the anxiety-specific components of these symptoms, interventions may be more effective if they include additional anxiety-related components.

To our knowledge, CBT interventions for adolescents with asthma have not yet tailored treatment to include components specifically related to perceptions of asthma. Our data suggest that addressing illness perceptions in treatment may result in asthma-related changes. For example, if illness perceptions are incorporated as part of the CBT “framework” or “language,” treatment may address co-morbid anxiety more precisely, thus affecting asthma-related outcomes such as symptoms. In particular, our findings suggest that addressing adolescent's perceived control of asthma and perceived impact of asthma on their life and emotions may have the potential to lead to decreases in asthma symptoms. These hypotheses are supported by research in other chronic illness populations. For example, in a sample of adults with chronic pain, changes in illness perceptions accounted for 26% of the variance in improved physical functioning (Moss-Morris, Humphrey, Johnson, & Petrie, 2002).

The findings of this study should be interpreted within the context of several limitations. First, given the cross-sectional nature of our analyses, it is not possible to infer causality (directionality). For example, it is possible that illness perceptions may lead to increased symptoms of anxiety. Future studies should examine this relationship and competing models (i.e. Leventhal's Self-Regulation Model, Leventhal et al., 1992) using longitudinal data. Second, because illness perceptions were not the primary focus of the larger project, only a brief measure was used. As a result, illness perception constructs were measured by single items. Future studies should use an extended version of the IPQ (Moss-Morris et al., 2002), in which constructs are defined by multiple items, to examine the relationships supported in this paper. Third, because we were interested in examining specific mediators that clinicians could target in practice, we did not simultaneously examine all variables as mediators. As a result, it is not possible to draw conclusions regarding the combined effect of all three mediators. Finally, because data were collected in a primary care setting, the majority of our participants had intermittent asthma. Thus, the results of our study may not be generalizable to adolescents with more severe disease.

Despite these limitations, this study provides additional information regarding the relationship between anxiety and asthma symptoms in adolescents. Targeting illness perceptions should be considered when working clinically to improve outcomes in adolescents with asthma and co-morbid anxiety. Future studies should empirically test whether CBT interventions that target negative illness perceptions such as perceived control of asthma are effective for adolescents in sustaining both short and long-term reduction in asthma symptoms.

Acknowledgments

This work was supported by a National Institute for Child Health and Human Development Grant # K23 HD052639 (Cotton, PI).

References

- Akinbami LJ, Moorman JE, Garbe PL, Sondik EJ. Status of childhood asthma in the United States, 1980–2007. *Pediatrics* 2009;123:S131–S145. [PubMed: 19221156]
- Akinbami LJ, Schoendorf KC. Trends in childhood asthma: Prevalence, health care utilization, and mortality. *Pediatrics* 2002;110:315–322. [PubMed: 12165584]
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 1986;51:1173–1182. [PubMed: 3806354]
- Barrett PM. Evaluation of cognitive-behavioral group treatments for childhood anxiety disorders. *Journal of Clinical Child and Adolescent Psychology* 1998;27:459–468.
- Bloom B, Cohen RA, Freeman G. Summary health statistics for U.S. children: National health interview survey, 2008. *Vital Health Statistics Series* 2009;10:1–48.
- Broadbent E, Petrie KJ, Main J, Weinman J. The Brief Illness Perception Questionnaire. *Journal of Psychosomatic Research* 2006;60:631–637. [PubMed: 16731240]
- Centers for Disease Control and Prevention. Lifetime asthma population estimates. 2006. Retrieved December 1, 2009, from <http://www.cdc.gov/asthma/nhis/06/table1-1.htm>
- Cotton S, Weekes J, McGrady ME, Rosenthal SL, Yi MS, Pargament K, et al. Spirituality and religiosity in adolescents with asthma. *Journal of Religion and Health*. 2010 Epub Oct 6.
- De Peuter S, Lemaigre V, Van Diest I, Van den Bergh O. Illness-specific catastrophic thinking and overperception in asthma. *Health Psychology* 2008;27:93–99. [PubMed: 18230019]
- Flannery-Schroeder, EC. Generalized anxiety disorder. In: Morris, TL.; March, JS., editors. *Anxiety disorders in children and adolescents*. Guilford Press; New York: 2004. p. 125-140.
- Goodwin RD. Asthma and anxiety disorders. *Advances in Psychosomatic Medicine* 2003;24:51–71. [PubMed: 14584347]
- Greenley JN, Josie KL, Drotar D. Self-reported quality of life among inner-city youth with asthma: An empirical examination of the PedsQL 3.0 Asthma Module. *Annals of Allergy, Asthma, and Immunology* 2008;100:106–111.
- Guill MF. Asthma update: Epidemiology and pathophysiology. *Pediatric Reviews* 2004;15:299–305.
- Holmbeck GN. Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology* 2002;21:87–96. [PubMed: 11726683]
- Katon WJ, Richardson L, Lozano P, McCauley E. The relationship of asthma and anxiety disorders. *Psychosomatic Medicine* 2004;66:349–355. [PubMed: 15184694]
- Lenoir MA. Asthma in the inner cities. *Journal of the National Medical Association* 1999;91:1S–8S. [PubMed: 12653387]
- Leventhal H, Diefenbach M, Leventhal EA. Illness cognition: Using common sense to understand treatment adherence and affect cognitive interactions. *Cognitive Therapy and Research* 1992;16:143–163.
- March JS, Parker JD, Sullivan K, Stallings P, Conners CK. The Multidimensional Anxiety Scale for Children (MASC): Factor structure, reliability, and validity. *Journal of the American Academy of Child and Adolescent Psychiatry* 1997b;36:554–565. [PubMed: 9100431]

- McCauley E, Katon W, Russo J, Richardson L, Lozano P. Impact of anxiety and depression on functional impairment in adolescents with asthma. *General Hospital Psychiatry* 2007;29:214–222. [PubMed: 17484938]
- McDonald CC, Richmond TR. The relationship between community violence exposure and mental health symptoms in urban adolescents. *Journal of Psychiatric and Mental Health Nursing* 2008;15:833–849. [PubMed: 19012675]
- Moss-Morris R, Weinman J, Petrie KJ, Horne R, Cameron LD, Buick D. The Revised Illness Perception Questionnaire (IPQ-R). *Psychology and Health* 2002;17(1):1–16.
- National Heart, Lung, and Blood Institute. Expert panel report 3: Guidelines for the diagnosis and management of asthma. 2007 Report.
- Papneja T, Manassis K. Characterization and treatment response of anxious children with asthma. *Canadian Journal of Psychiatry* 2006;51:393–397.
- Richardson LP, Lozano P, Russo J, McCauley E, Bush T, Katon W. Asthma symptom burden: Relationship to asthma severity and anxiety and depression symptoms. *Pediatrics* 2006;118:1042–1051. [PubMed: 16950996]
- Roberts RE, Roberts CR, Xing Y. Rates of DSM-IV psychiatric disorders among adolescents in a large metropolitan area. *Journal of Psychiatric Research* 2007;41:959–967. [PubMed: 17107689]
- Ross CJ, Davis T, Hogg DY. Screening and assessing adolescent asthmatics for anxiety disorders. *Clinical Nursing Research* 2007;16:5–24. [PubMed: 17204805]
- Varni JW, Burwinkle TM, Rapoff MA, Kamps JL, Olson N. The PedsQL™ in pediatric asthma: Reliability and validity of the Pediatric Quality of Life Inventory™ Generic Core Scales and Asthma Module. *Journal of Behavioral Medicine* 2004;27:297–318. [PubMed: 15259457]
- Vila G, Hayder R, Bertrand C, Falissard B, de Blic J, Mouren-Simeoni MC, et al. Psychopathology and quality of life for adolescents with asthma and their parents. *Psychosomatics* 2003;44:319–328. [PubMed: 12832598]
- Vila G, Nolle-Clemenc C, de Blic J, Mouren-Simeoni MC, Scheinmann P. Prevalence of DSM-IV anxiety and affective disorders in a pediatric population of asthmatic children and adolescents. *Journal of Affective Disorders* 2000;58:223–231. [PubMed: 10802131]
- Yorke J, Fleming SL, Shulldham C. A systematic review of psychological interventions for children with asthma. *Pediatric Pulmonology* 2007a;42:114–124. [PubMed: 17186533]
- Yorke J, Fleming SL, Shulldham C. Psychological interventions for adults with asthma: A systematic review. *Respiratory Medicine* 2007b;101:1–14. [PubMed: 16757162]

Fig. 1.
Proposed mediational model

Table 1

Demographic and disease characteristics

Age, <i>M</i> (<i>SD</i> years)	15.8 (1.8)
Gender, <i>N</i> (% female)	91 (60%)
Ethnicity, <i>N</i> (%)	
African-American	129 (85%)
White	13 (9%)
Other ethnicity	9 (6%)
Highest parental education, <i>N</i> (%)	
High school or less	63 (42%)
Some college	42 (28%)
College degree or higher	34 (23%)
Unsure	10 (7%)
Asthma Severity, <i>N</i> (%)	
Intermittent	72 (48%)
Mild persistent	38 (25%)
Moderate persistent	36 (24%)
Severe persistent	5 (3%)

Table 2

Correlation matrix

	Anxiety symptoms (MASC- 10)	Perceived asthma symptoms (PedsQL™ Asthma Module, Symptoms subscale)
How much does asthma affect your life?	.38***	-.60***
How long do you think your asthma will continue?	.25**	-.49***
How much control do you have over your asthma? ^a	-.23**	.38**
How much do you think your treatment can help your asthma? ^a	-.07	-.08
How much do you experience symptoms from your asthma?	.21*	-.59***
How concerned are you about your asthma?	.12	-.43***
How well do you feel you understand your asthma? ^a	-.12	-.04
How much does your asthma affect you emotionally?	.29***	-.51***

Note:

*
 $p < .05$

**
 $p < .01$

 $p < .001$

^aItem reverse scored

Table 3

Final regression models predicting perceived asthma symptoms

Model	Variable	Standardized β	t	Adjusted R^2
Model 1 ^a				.51
	How much does asthma affect your life?	-.44	-6.63 ***	
	Anxiety Symptoms	-.16	-2.51 *	
	Gender	-.37	-6.23 ***	
	Age	-.03	-.52	
	Severity	-.10	-1.56	
Model 2				.45
	How long do you think your asthma will continue?	-.32	-4.87 ***	
	Anxiety Symptoms	-.23	-3.53 **	
	Gender	-.37	-5.70 ***	
	Age	-.08	-1.32	
	Severity	-.16	-2.48	
Model 3 ^a				.42
	How much control do you have over your asthma?	.26	3.93 ***	
	Anxiety Symptoms	-.23	-3.49 **	
	Gender	-.39	-6.03 ***	
	Age	-.13	-2.04 *	
	Severity	-.18	-2.78 **	
Model 4 ^a				.47
	How much does asthma affect you emotionally?	-.35	-5.55 ***	
	Anxiety Symptoms	-.20	-3.11 **	
	Gender	-.37	-5.82 ***	
	Age	-.11	-1.85	
	Severity	-.16	-2.66 **	

*
 $p < .05$ **
 $p < .01$ ***
 $p < .001$ ^aIllness perceptions are significant mediators