Published in final edited form as:

J Nerv Ment Dis. 2011 May ; 199(5): 313–318. doi:10.1097/NMD.0b013e3182174e84.

The role of caregiver major depression in the relationship between anxiety disorders and asthma attacks in island Puerto Rican youth and young adults

Jonathan M. Feldman, Ph.D.^{1,2}, Edna Acosta Pérez, Ph.D.³, Glorisa Canino, Ph.D.³, Elizabeth L. McQuaid, Ph.D.⁴, Renee D. Goodwin, Ph.D.⁵, and Alexander N. Ortega, Ph.D.⁶

¹Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY

²Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx NY

³Department of Pediatrics, School of Medicine, University of Puerto Rico, Behavioral Sciences Research Institute, San Juan, Puerto Rico

⁴Division of Child and Family Psychiatry, Brown Medical School, Bradley Hasbro Children's Research Center, Providence, RI

⁵Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY

⁶Department of Health Services, University of California Los Angeles School of Public Health, Los Angeles, CA

Abstract

The goal of this study was to assess whether the association between asthma attacks and anxiety disorders in youth/young adults is reduced after adjusting for caregivers' psychiatric disorders. An island-wide probability sample of 641 households in Puerto Rico with youth/young adults between 10 and 25 years old participated along with their caregivers. The Diagnostic Interview Schedule for Children and the Composite International Diagnostic Interview were conducted to assess anxiety and depressive disorders. Youth/young adults with an anxiety disorder were more likely to have a lifetime history of asthma attacks versus youth/young adults without an anxiety disorder. Caregivers of participants with asthma attacks were more likely to have major depression than caregivers of participants without asthma attacks. The association between asthma attacks and anxiety disorders in youth was no longer significant after adjustment for caregiver major depression. It is important to consider the role of caregiver depression in asthma-anxiety comorbidity in youth/young adults.

Keywords

anxiety; asthma; depression; mental health; Puerto Rican

Reprint request should be sent to: Jonathan M. Feldman, Ph.D., Ferkauf Graduate School of Psychology/Yeshiva University, Rousso Building, 1300 Morris Park Avenue, Bronx, NY 10461, USA, Telephone: +1-718/430-3968, Fax: +1-718/430-3960, Jonathan.Feldman@einstein.yu.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Puerto Ricans are disproportionately affected by asthma. Children and adults of Puerto Rican descent, both in the U.S. Commonwealth of Puerto Rico and the U.S. mainland, have higher asthma prevalence rates compared with other ethnic and racial groups (Bravo et al, 2001; Findley et al, 2003; Lara et al, 2006; Ledogar et al, 2000; Rose et al, 2006). A recent population-based study showed that the lifetime asthma prevalence rate was 41% in San Juan, Puerto Rico and 35% for Puerto Rican youth living in the Bronx, NY (Busse et al, 2001). Puerto Rican youth and adults also have greater emergency department (ED) visits and hospitalizations (Esteban et al, 2009; Ray et al, 1998), and school absences (Findley et al, 2003) due to asthma than other ethnic and racial groups. These studies demonstrate that asthma presents a major public health problem for Puerto Rican youth.

Youth with asthma and their parents may be at greater risk for anxiety and depression. Both community and clinical studies across ethnicities have shown that youth and young adults with asthma have elevated rates of anxiety disorders (Bruzze et al, 2009; Feldman et al, 2010; Goodwin et al, 2004; Goodwin et al, 2005; Katon et al, 2007; Ortega et al, 2004b) and depressive disorders (Goodwin et al, 2004; Katon et al, 2007; Ortega et al, 2004b), which are associated with greater health care utilization (Goodwin et al, 2005; Richardson et al, 2008). Parents of youth with asthma across ethnicities are also more likely to have mental health problems than parents of youth without a history of asthma (Feldman et al, 2010; Ortega et al, 2004a; Shalowitz et al, 2006). The association between parental mental health problems and pediatric asthma persists even after controlling for anxiety and depressive disorders in Puerto Rican youth (Ortega et al, 2004a). Furthermore, maternal stress predicts wheezing in infants (Wright et al, 2002), and continuous maternal distress from birth to age seven predicts the development of childhood asthma (Kozyrskyj et al, 2008). There is recent evidence that prenatal maternal anxiety predicts the subsequent onset of asthma later in childhood (Cookson et al, 2009). Parental psychopathology is also a predictor of childhood anxiety and depression (Ashford et al, 2008). Therefore, an important question to address is whether caregiver mental health plays a role in the association between asthma and psychiatric disorders in youth and young adults.

The goal of the current study was to examine whether associations between asthma attacks and anxiety and depressive disorders in Puerto Rican youth and young adults are explained by caregiver depressive and anxiety disorders. This goal examined whether significant associations between asthma attacks and psychiatric disorders in youth and young adults no longer exist when adjusting for caregiver psychiatric disorders. Given the literature showing the effects of caregiver mental health problems on pediatric asthma (Cookson et al, 2009; Kozyrskyj et al, 2008; Wright et al, 2002), anxiety and depression (Ashford et al, 2008), we hypothesized that adjusting for caregiver psychiatric disorder would reduce the relationship between asthma attacks and psychiatric disorders in Puerto Rican youth and young adults. The use of structured, psychiatric interviews in the present study is also an advantage over previous research, which relied upon self-report measures of parental psychopathology (Ortega et al, 2004a). Psychiatric interviews also allow for exploration of differential effects between anxiety and depression in these relationships. We also collected measures of asthma morbidity in order to provide descriptive data on the level of current asthma control in this sample.

METHODS

Study design and participants

Data for this study are from the “Asthma, Depression, and Anxiety in Puerto Rican Youth” study, which collected data on a third wave cohort (2005 – 2008) of Puerto Rican youth and young adults with asthma between 10 to 25 years old. The goal of the original study (“Services Use and Need in Puerto Rican Children Study”) was to determine the rates and

correlates of psychiatric disorders and mental health utilization patterns among Puerto Rican children from 4 to 17 years of age (Canino et al, 2004). Wave one was conducted from 1999–2000, and wave two was a one-year follow-up from 2000–2001. The methods used in this study have been reported in greater detail in separate publications for wave one (Canino et al, 2004) and wave two (Feldman et al, 2006). Therefore, the description of the sample and measures will be described in brief and will focus on the description of wave three of the study, which has not been previously reported.

Youth between the ages of four and seventeen years living on the island of Puerto Rico comprised an island-wide household probability sample drawn from four strata: urban versus rural areas, Puerto Rico's health reform areas, child's age, and gender. A total of 2,102 children from the community were deemed eligible. At wave one, 1,886 children and caregivers were interviewed for a response rate of 90.1%. At wave two, 1,789 caregiver-youth dyads of children from 5 to 18 years were interviewed for a 94.9% retention rate at one-year follow-up.

We recruited for this study via mailings that were sent to participants from wave two. The goal of data collection for the current study (wave three) was to obtain a representative community sample including youth and young adults from four groups (asthma and anxiety/depression; asthma no anxiety/depression; anxiety/depression no asthma; neither asthma nor anxiety/depression). We identified all youth and young adults who had previously reported a lifetime physician diagnosis of asthma at wave two, and also met DSM-IV-TR (Diagnostic and Statistical Manual of Mental Disorders, Fourth edition, Text Revision) criteria for any threshold or sub-threshold anxiety or depressive disorder ($n = 176$). We randomly selected participants from wave two with a lifetime physician diagnosis of asthma, but no anxiety or depressive disorder ($n = 241$). We also identified a sample of participants from wave two without a physician diagnosis of asthma but who had any threshold or sub-threshold DSM-IV anxiety or depressive disorder ($n=175$). Finally, a sample of participants with neither a diagnosis of asthma nor a threshold or sub-threshold anxiety or depressive disorder was also randomly selected ($n=233$). The study sample resulted in a total of 825 households. We were able to track and interview 641 households with youth and young adults between 10 and 25 years old for a response rate of 77.7% across five-year follow-up from the second wave of the study.

Procedure

The same survey interviewing procedure that had been used in previous waves was used for the third wave. Interviews were conducted in the families' homes and different interviewers were used for the youth/young adult and caregiver interviews. Interviewers were blinded to the results of each other's interviews. The adult informant was the participant's biological mother for 91% of the interviews, and grandmother for 6% of the interviews. All interviews were audio taped, and 15% were reviewed for quality control purposes. The study was approved by the institutional review boards of the University of Puerto, Medical Sciences Campus and the University of California, Los Angeles. Caregiver consent and child assent were obtained for youth under the age of seventeen years (consent for participants eighteen years and older). In order for a youth/young adult to participate, caregivers also were required to participate in the study.

Measures for Psychiatric Interviews

The Diagnostic Interview Schedule for Children (DISC)-IV (Shaffer et al, 2000) is a structured diagnostic interview used to assess children's anxiety and depressive disorders during the past year. The DISC consists of separate caregiver and child interviews. The DISC impairment algorithm was used to ensure that psychiatric diagnoses met full DSM-IV-

TR criteria. Depressive disorders included major depressive disorder and dysthymia. Anxiety disorders included social phobia, panic, generalized anxiety, separation anxiety, and posttraumatic stress disorder. Disorders were coded as positive if either caregiver or youth report met criteria for any DSM-IV-TR depressive or anxiety disorder, which is consistent with previous studies (Feldman et al, 2006; Ortega et al, 2004a). However, both caregiver and youth/young adult reports are also presented separately in descriptive data below. The Spanish version of the DISC-IV has good test-retest reliability, which is comparable to the English version (Bravo et al, 2001; Shaffer et al, 2000). We also used a young adult version of the DISC-IV for participants over 17 years old. The young adult version was developed by the originators of the DISC, who adapted the child version to be more appropriate for young adults (e.g., slight wording changes, differences in diagnostic criteria for children versus adults).

The Composite International Diagnostic Interview (CIDI), World Mental Health Survey Initiative version, was administered to caregivers in order to assess caregiver anxiety and depressive disorders during the past year. The CIDI is a structured, diagnostic interview based on DSM-IV and ICD-10 criteria. We administered the following sections of the CIDI: major depressive disorder, panic disorder, agoraphobia, social phobia, posttraumatic stress disorder, and generalized anxiety disorder. We examined major depressive disorder and any anxiety disorder as our two categories of psychiatric disorders. Participants who met criteria for at least one anxiety disorder were coded as being positive for any anxiety disorder. Clinical reappraisal studies of the English version of the CIDI have shown good concordance with diagnoses of anxiety and mood disorders using the Structured Clinical Interview for DSM-IV (SCID) (Haro et al, 2006). Recent data on the CIDI with a nationally representative sample of English-speaking and Spanish-speaking Latinos showed good concordance with DSM-IV diagnoses for major depressive disorder and panic disorder (Alegria et al, 2009). However, problems in concordance were identified for post-traumatic stress disorder and generalized anxiety disorder. Therefore, our analyses for adult anxiety disorders are considered secondary analyses.

Measures of asthma

The asthma indicator in this study was caregiver report of the youth or young adult ever having had an asthma attack. Use of this measure is consistent with prior studies that have examined associations between psychiatric disorders in youth and lifetime asthma attacks (Bravo et al, 2001; Feldman et al, 2006; Ortega et al, 2004b). Additionally, lifetime report of asthma attacks was associated with caregiver mental health problems, after controlling for childhood anxiety and depressive disorders (Ortega et al, 2004a).

Measures of asthma control included a question for both caregivers and youth on perception of asthma severity ("How severe do you think your/your child's asthma is?"). We also collected caregiver report data on ED visits for asthma, use of quick-relief asthma medication, and use of any asthma medication during the past year.

Spirometry was conducted on a subsample (n=126) of participants with lifetime asthma attacks in order to assess pulmonary function on the day of testing. Our primary measure of pulmonary function was percent predicted FEV₁, which is the volume of air expired during the first second of a forced vital capacity maneuver, which involves maximal inspiration followed by a forceful and rapid expiration into a spirometer (Koko pneumotachometer; nSpire Health, Inc, Longmont, Colorado). The percent predicted FEV₁ is based on reference values for age, height, weight, and gender. Participants were asked to avoid taking medications for allergies or flu symptoms for two days prior to their appointment; long-acting bronchodilators for one day before testing; and short-acting bronchodilators for six

hours prior to spirometry. If participants needed to take these medications due to symptoms, then their appointments were rescheduled.

Socio-demographic factors

Caregiver report of socio-demographic variables included maternal education, perception of poverty, zone of residence, age and gender. Caregivers reported their perception of poverty as either living well, living from check to check, or living poorly. This item was adapted from a measure developed by Gore (Gore et al, 1992). Perception of poverty was used instead of other indicators of poverty, such as household income, because analyses from wave one showed no relationship between psychiatric disorders and income or parental education (Canino et al, 2004).

Exposure to environmental tobacco smoke

Caregivers reported whether their child was ever exposed for one month or longer to cigarette, pipe, or cigar smoke for at least 2 hours per week. Caregivers were also asked if they had ever smoked cigarettes an average of at least one cigarette per day for one month or longer. Exposure to environmental tobacco smoke has been linked to asthma in youth (Hedman et al, 2011). Furthermore, cigarette smoking increases the risk of depression (Boden et al, 2010), and even secondhand smoke exposure is associated with depression in non-smokers (Bandiera et al, 2010). Given that environmental tobacco smoke is a major risk factor for asthma and maternal depression, this variable was incorporated into the statistical model.

Data Analyses

Analyses were weighted to account for the stratified sampling design (e.g., selecting participants in wave three on their disease status in wave two) and conducted with SUDAAN software. The sample was weighted to represent the general population of youth in Puerto Rico in the year 2008 based on the US Census Bureau. We conducted chi-square analyses for categorical measures and t-tests for continuous measures to examine differences between youth/young adults with versus without a lifetime history of asthma attacks. Logistic regression models were used to assess youth/young adult anxiety disorders as a predictor of caregiver-reported lifetime asthma attacks. Separate regressions models were conducted to examine unadjusted (model #1) and adjusted odds ratios, after controlling for demographics and exposure to environmental tobacco smoke (model #2), and caregiver major depression, demographics, and exposure to smoke (model #3). Demographic variables entered into the models included youth/young adult age, caregiver perception of poverty, and maternal educational level.

RESULTS

A different pattern of psychiatric disorders emerged for youth/young adults compared to caregivers when examining between-group differences on lifetime history of asthma attacks (see Table 1). Youth and young adults with a lifetime history of asthma attacks were more likely to be diagnosed with an anxiety disorder during the past year than youth and young adults who never had an asthma attack. This between-group difference was statistically significant when examining the combined report (adult/youth report) and adult report of anxiety disorders. However, youth/young adult report of anxiety disorders did not reach statistical significance, which might be attributed to the small sample size of youth who endorsed anxiety disorders ($n = 33$). Youth and young adults with a lifetime history of asthma attacks were younger and more likely to be exposed to environmental tobacco smoke than participants with no history of asthma attacks.

Caregivers of youth/young adults with asthma attacks were more likely to have major depressive disorder than caregivers of youth/young adults without asthma attacks (see Table 1). Caregivers with major depression were more likely to report that their child had been exposed to environmental tobacco smoke (45.9%) than caregivers without major depression (31.8%; $p < .05$). Caregivers with major depression were more likely to self-report lifetime cigarette smoking (17.7%) versus caregivers without depression (10.9%), but this difference did not reach statistical significance ($p = .06$). Given the significant findings for anxiety disorders in youth/young adults and major depression for caregivers, the models focused on these psychiatric disorders.

Youth and young adults with an anxiety disorder were almost 2 ½ times more likely to have a lifetime history of asthma attacks versus youth without an anxiety disorder ($p < .01$; see Table 2). Anxiety disorder in youth/young adults was still significantly associated ($p < .01$) with lifetime asthma attacks after controlling for youth age, caregiver perception of poverty, maternal educational level, and exposure to environmental tobacco smoke. However, youth/young adult anxiety disorder was no longer a significant predictor of lifetime asthma attacks after adjusting for caregiver major depression in the model. The odds ratio was reduced to 1.6 in this analysis, and this finding was outside the range of significance ($p = 0.12$). Caregiver major depression was the strongest predictor of lifetime asthma attacks (OR = 2.52; 95% CI 1.35 – 4.71, $p < .01$), followed by exposure to environmental tobacco smoke (OR = 1.87; 95% CI 1.21 – 2.89, $p < .01$).

The severity of asthma in this sample was very mild (see Table 3). Approximately 45% of the youth/young adults and caregivers viewed the asthma as “very mild”. Furthermore, 67% of the sample did not use quick-relief medication for asthma during the past year, and 64% did not use any medications for asthma. The %FEV₁ predicted value ($\bar{M} = 96.6$) in the subsample provided an objective indicator that asthma was under good control on the day of testing.

DISCUSSION

The findings from the present study reveal the importance of caregiver major depression in the context of comorbidity between anxiety disorders and asthma attacks in youth and young adults. Several prior studies have shown that youth and young adults with asthma are more likely to have an anxiety disorder than participants without asthma (Bruzzese et al, 2009; Feldman et al, 2010; Goodwin et al, 2004; Goodwin et al, 2005; Katon et al, 2007; Ortega et al, 2004b). However, this relationship may be partially explained by major depression in the caregivers. Maternal depression may be a risk factor for the development of pediatric asthma given the link between maternal distress and subsequent onset of wheezing (Wright et al, 2002) and asthma (Kozyrskyj et al, 2008) in youth. Furthermore, caregiver depression can interfere with self-management of asthma. Maternal depressive symptoms are associated with lower asthma medication adherence in children, lower maternal self-efficacy to handle children’s asthma attacks, and more concerns about inhaled corticosteroids (Bartlett et al, 2001; Bartlett et al, 2004). Caregiver depressive symptoms are also consistently associated with worse pediatric asthma morbidity (Bartlett et al, 2001; Brown et al, 2006; Shalowitz et al, 2001; Weil et al, 1999). Therefore, the combination of caregiver major depression and a history of asthma exacerbations may both contribute to a higher rate of anxiety disorders in youth. This link between caregiver mental health problems and pediatric asthma is particularly strong given the prior finding that this association was still significant after controlling for anxiety and depressive disorders in Puerto Rican youth (Ortega et al, 2004a).

The possibility of the “depression-distortion” hypothesis (Hood, 2009) should also be considered in the context of these findings. This hypothesis states that caregiver report of

depression in youth may be attributed to distorted reports by caregivers who have depression themselves. Support for this hypothesis has been found for depressive symptoms in pediatric type 1 diabetes (Hood, 2009). The present study found some support for this hypothesis when considering comorbidity rates of depression in youth based on youth/young adult informant (weighted % = 2.29) versus caregiver informant (weighted % = 6.12). However, the primary finding of this study focused on youth/young adult anxiety disorders. Furthermore, the present study focused on DSM-IV disorders and thus, informant bias may be less pronounced than when examining psychiatric symptoms.

The present study also highlights a differential manifestation of associations between asthma and psychiatric disorders in youth/young adults (i.e., anxiety) versus caregivers (i.e., depression). The literature supports more consistent associations between asthma and pediatric anxiety versus asthma and pediatric depression (Feldman et al, 2010; Ortega et al, 2002; Vila et al, 2000). Furthermore, anxiety disorders are more common than depressive disorders across race and ethnicity in community samples of youth (Angold et al, 2002; Canino et al, 2004). Therefore, the association between anxiety disorders and asthma attacks in youth and young adults is consistent with the prior literature. Many of the prior studies have focused on associations between pediatric asthma and caregiver depressive symptoms and psychological distress (Feldman et al, 2010; Kozyrskyj et al, 2008; Ortega et al, 2004a; Shalowitz et al, 2006; Wright et al, 2002). The present study extends the literature by showing caregiver major depressive disorder is associated with asthma attacks in youth, but caregiver anxiety disorder is not associated with asthma attacks. Future studies should continue to differentiate between caregiver psychiatric disorders to identify potential mechanisms explaining this association.

One possible link between caregiver depression and youth asthma attacks may be prenatal cigarette smoking (Goodwin et al, 2009). In the present study, adjustment for exposure to environmental tobacco smoke did not significantly alter the association between anxiety disorders and asthma attacks in youth. Based on these findings, it does not appear that the role of caregiver depression in asthma-anxiety comorbidity is simply due to environmental tobacco smoke exposure. Additional studies with more extensive measures of environmental tobacco smoke will be important to replicate these results. Furthermore, prenatal cigarette smoking is an important factor that should be examined in future studies.

There are limitations that should be considered when interpreting these results. The severity of asthma was very mild, and 64% of participants were not currently using any asthma medications. The mild severity of asthma likely reflects the use of a community sample and the measure of lifetime report of asthma attacks. Some participants may not have experienced recent asthma symptoms. Furthermore, caregiver report of lifetime asthma attacks may also be influenced by distorted parental perceptions, which may result from mental illness. However, caregiver report of children's asthma symptoms is a better predictor of health care use and functional health status than pulmonary function tests (Sharek et al, 2002). The measure of lifetime asthma attacks is consistent with the notion of asthma as a lifetime chronic inflammatory disorder with recurrent exacerbations, despite extended periods of symptom remission (NHLBI, 2007). These data are also consistent with a recent study showing island Puerto Rican children have higher percentages of mild asthma severity compared to Latinos and non-Latino whites living in Rhode Island (Esteban et al, 2009). These findings suggest that links between psychiatric disorders and asthma attacks may be common in Puerto Rico even at the mildest levels of asthma severity. Although the association between anxiety disorders and asthma attacks in youth/young adults may be partially explained by caregiver depression, it is important to consider other factors (e.g., genetic, cultural, environmental) that may explain comorbidity between asthma attacks and anxiety disorders in youth and young adults. Furthermore, the directionality of these

associations cannot be determined by the present study. Finally, problems with the validity of the Spanish version of the CIDI for some anxiety disorders (e.g., post-traumatic stress disorder, generalized anxiety disorder) has recently been identified (Alegria et al, 2009). However, our primary finding focused on caregiver major depression, which has good concordance with the SCID (Alegria et al, 2009). The use of psychiatric interviews for both caregiver and child is a novel approach given that most prior studies have focused on self-report instruments.

In conclusion, this study has important public health implications for Puerto Rican youth and young adults with asthma attacks and their families. Given the high rate of asthma in Puerto Rican youth (Cohen et al, 2007), efforts at prevention and treatment of psychiatric disorders in both youth/young adults and caregivers may have a large impact. Educational interventions for anxiety and depression in community settings, and brief psychiatric screening instruments in clinics may be useful for identifying youth, young adults, and caregivers in need of psychiatric treatment. Untreated caregiver depression may have large effects on their children's psychiatric and asthma symptoms. This study highlights the critical role that caregivers' mental health may play in the context of asthma attacks and anxiety in youth and young adults.

Acknowledgments

The authors thank Pedro Garcia for conducting the statistical analyses. This study was supported by R01 MH069849 (Alexander Ortega, Ph.D., PI) and 5P60 MD002261-02 (Glorisa Canino, Ph.D., PI).

References

- Alegria M, Shrout PE, Torres M, Lewis-Fernandez R, Abelson JM, Powell M, Interian A, Lin J, Laderman M, Canino G. Lessons learned from the clinical reappraisal study of the Composite International Diagnostic Interview with Latinos. *Int J Methods Psychiatr Res.* 2009; 18:84–95. [PubMed: 19507168]
- Angold A, Erkanli A, Farmer EM, Fairbank JA, Burns BJ, Keeler G, Costello EJ. Psychiatric disorder, impairment, and service use in rural African American and white youth. *Archives of General Psychiatry.* 2002; 59:893–901. [PubMed: 12365876]
- Ashford J, Smit F, van Lier PA, Cuijpers P, Koot HM. Early risk indicators of internalizing problems in late childhood: a 9-year longitudinal study. *Journal of Child Psychology and Psychiatry and Allied Disciplines.* 2008; 49:774–780.
- Bandiera FC, Arheart KL, Caban-Martinez AJ, Fleming LE, McCollister K, Dietz NA, Leblanc WG, Davila EP, Lewis JE, Serdar B, Lee DJ. Secondhand smoke exposure and depressive symptoms. *Psychosomatic Medicine.* 2010; 72:68–72. [PubMed: 19949159]
- Bartlett SJ, Kolodner K, Butz AM, Eggleston P, Malveaux FJ, Rand CS. Maternal depressive symptoms and emergency department use among inner-city children with asthma. *Arch Pediatr Adolesc Med.* 2001; 155:347–353. [PubMed: 11231800]
- Bartlett SJ, Krishnan JA, Riekert KA, Butz AM, Malveaux FJ, Rand CS. Maternal depressive symptoms and adherence to therapy in inner-city children with asthma. *Pediatrics.* 2004; 113:229–237. [PubMed: 14754931]
- Boden JM, Fergusson DM, Horwood LJ. Cigarette smoking and depression: tests of causal linkages using a longitudinal birth cohort. *British Journal of Psychiatry.* 2010; 196:440–446. [PubMed: 20513853]
- Bravo M, Ribera J, Rubio-Stipec M, Canino G, Shrout P, Ramirez R, Fabregas L, Chavez L, Alegria M, Bauermeister JJ, Martinez Taboas A. Test-retest reliability of the Spanish version of the Diagnostic Interview Schedule for Children (DISC-IV). *Journal of Abnormal Child Psychology.* 2001; 29:433–444. [PubMed: 11695544]

- Brown ES, Gan V, Jeffress J, Mullen-Gingrich K, Khan DA, Wood BL, Miller BD, Gruchalla R, Rush AJ. Psychiatric symptomatology and disorders in caregivers of children with asthma. *Pediatrics*. 2006; 118:e1715–e1720. [PubMed: 17142496]
- Bruzzese JM, Fisher PH, Lemp N, Warner CM. Asthma and social anxiety in adolescents. *Journal of Pediatrics*. 2009; 155:398–403. [PubMed: 19555965]
- Busse W, Raphael GD, Galant S, Kalberg C, Goode-Sellers S, Srebro S, Edwards L, Rickard K. Low-dose fluticasone propionate compared with montelukast for first-line treatment of persistent asthma: a randomized clinical trial. *Journal of Allergy and Clinical Immunology*. 2001; 107:461–468. [PubMed: 11240946]
- Canino G, Shrout PE, Rubio-Stipec M, Bird HR, Bravo M, Ramirez R, Chavez L, Alegria M, Bauermeister JJ, Hohmann A, Ribera J, Garcia P, Martinez-Taboas A. The DSM-IV rates of child and adolescent disorders in Puerto Rico: prevalence, correlates, service use, and the effects of impairment. *Arch Gen Psychiatry*. 2004; 61:85–93. [PubMed: 14706947]
- Cohen RT, Canino GJ, Bird HR, Shen S, Rosner BA, Celedon JC. Area of residence, birthplace, and asthma in Puerto Rican children. *Chest*. 2007; 131:1331–1338. [PubMed: 17494783]
- Cookson H, Granell R, Joinson C, Ben-Shlomo Y, Henderson AJ. Mothers' anxiety during pregnancy is associated with asthma in their children. *J Allergy Clin Immunol*. 2009; 123:847–853. e11. [PubMed: 19348924]
- Esteban CA, Klein RB, McQuaid EL, Fritz GK, Seifer R, Kopel SJ, Santana JR, Colon A, Alvarez M, Koinis-Mitchell D, Ortega AN, Martinez-Nieves B, Canino G. Conundrums in childhood asthma severity, control, and health care use: Puerto Rico versus Rhode Island. *Journal of Allergy and Clinical Immunology*. 2009; 124:238–244. 244 e1–244 e5. [PubMed: 19615729]
- Feldman JM, Ortega AN, Koinis-Mitchell D, Kuo AA, Canino G. Child and family psychiatric and psychological factors associated with child physical health problems: results from the Boricua youth study. *Journal of Nervous and Mental Disease*. 2010; 198:272–279. [PubMed: 20386256]
- Feldman JM, Ortega AN, McQuaid EL, Canino G. Comorbidity between asthma attacks and internalizing disorders among Puerto Rican children at one-year follow-up. *Psychosomatics*. 2006; 47:333–339. [PubMed: 16844893]
- Findley S, Lawler K, Bindra M, Maggio L, Penachio MM, Maylahn C. Elevated asthma and indoor environmental exposures among Puerto Rican children of East Harlem. *J Asthma*. 2003; 40:557–569. [PubMed: 14529106]
- Goodwin RD, Canino G, Ortega AN, Bird HR. Maternal mental health and childhood asthma among Puerto Rican youth: the role of prenatal smoking. *Journal of Asthma*. 2009; 46:726–730. [PubMed: 19728214]
- Goodwin RD, Fergusson DM, Horwood LJ. Asthma and depressive and anxiety disorders among young persons in the community. *Psychological Medicine*. 2004; 34:1465–1474. [PubMed: 15724877]
- Goodwin RD, Messineo K, Bregante A, Hoven CW, Kairam R. Prevalence of probable mental disorders among pediatric asthma patients in an inner-city clinic. *Journal of Asthma*. 2005; 42:643–647. [PubMed: 16266954]
- Gore S, Aseltine RH Jr, Colton ME. Social structure, life stress and depressive symptoms in a high school-aged population. *Journal of Health and Social Behavior*. 1992; 33:97–113. [PubMed: 1619266]
- Haro JM, Arbabzadeh-Bouchez S, Brugha TS, de Girolamo G, Guyer ME, Jin R, Lepine JP, Mazzi F, Reneses B, Vilagut G, Sampson NA, Kessler RC. Concordance of the Composite International Diagnostic Interview Version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World Mental Health surveys. *Int J Methods Psychiatr Res*. 2006; 15:167–180. [PubMed: 17266013]
- Hedman L, Bjerg A, Sundberg S, Forsberg B, Ronmark E. Both environmental tobacco smoke and personal smoking is related to asthma and wheeze in teenagers. *Thorax*. 2011; 66:20–25. [PubMed: 21047869]
- Hood KK. The influence of caregiver depressive symptoms on proxy report of youth depressive symptoms: a test of the depression-distortion hypothesis in pediatric type 1 diabetes. *Journal of Pediatric Psychology*. 2009; 34:294–303. [PubMed: 18776211]

- Katon W, Lozano P, Russo J, McCauley E, Richardson L, Bush T. The prevalence of DSM-IV anxiety and depressive disorders in youth with asthma compared with controls. *Journal of Adolescent Health*. 2007; 41:455–463. [PubMed: 17950165]
- Kozyrskyj AL, Mai XM, McGrath P, Hayglass KT, Becker AB, Macneil B. Continued exposure to maternal distress in early life is associated with an increased risk of childhood asthma. *Am J Respir Crit Care Med*. 2008; 177:142–147. [PubMed: 17932381]
- Lara M, Akinbami L, Flores G, Morgenstern H. Heterogeneity of childhood asthma among Hispanic children: Puerto Rican children bear a disproportionate burden. *Pediatrics*. 2006; 117:43–53. [PubMed: 16396859]
- Ledogar R, Penchascadeh A, Iglesias Garden C, Acosta L. Asthma and Latino cultures: different prevalence reported among groups sharing the same environment. *American Journal of Public Health*. 2000; 90:929–935. [PubMed: 10846511]
- NHLBI. Bethesda, MA: 2007. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma.
- Ortega AN, Goodwin RD, McQuaid EL, Canino G. Parental mental health, childhood psychiatric disorders, and asthma attacks in island Puerto Rican youth. *Ambulatory Pediatrics*. 2004a; 4:308–315. [PubMed: 15264963]
- Ortega AN, Huertas SE, Canino G, Ramirez R, Rubio-Stipec M. Childhood asthma, chronic illness, and psychiatric disorders. *J Nerv Ment Dis*. 2002; 190:275–281. [PubMed: 12011605]
- Ortega AN, McQuaid EL, Canino G, Goodwin RD, Fritz GK. Comorbidity of asthma and anxiety and depression in Puerto Rican children. *Psychosomatics*. 2004b; 45:93–99. [PubMed: 15016921]
- Ray NF, Thamer M, Fadilioglu B, Gergen PJ. Race, income, urbanicity, and asthma hospitalization in California: a small area analysis. *Chest*. 1998; 113:1277–1284. [PubMed: 9596306]
- Richardson LP, Russo JE, Lozano P, McCauley E, Katon W. The effect of comorbid anxiety and depressive disorders on health care utilization and costs among adolescents with asthma. *General Hospital Psychiatry*. 2008; 30:398–406. [PubMed: 18774422]
- Rose D, Mannino DM, Leaderer BP. Asthma prevalence among US adults, 1998–2000: role of Puerto Rican ethnicity and behavioral and geographic factors. *American Journal of Public Health*. 2006; 96:880–888. [PubMed: 16571713]
- Shaffer D, Fisher P, Lucas CP, Dulcan MK, Schwab-Stone ME. NIMH Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV): description, differences from previous versions, and reliability of some common diagnoses. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2000; 39:28–38. [PubMed: 10638065]
- Shalowitz MU, Berry CA, Quinn KA, Wolf RL. The relationship of life stressors and maternal depression to pediatric asthma morbidity in a subspecialty practice. *Ambul Pediatr*. 2001; 1:185–193. [PubMed: 11888399]
- Shalowitz MU, Mijanovich T, Berry CA, Clark-Kauffman E, Quinn KA, Perez EL. Context matters: a community-based study of maternal mental health, life stressors, social support, and children's asthma. *Pediatrics*. 2006; 117:e940–e948. [PubMed: 16651297]
- Sharek PJ, Mayer ML, Loewy L, Robinson TN, Shames RS, Umetsu DT, Bergman DA. Agreement among measures of asthma status: a prospective study of low-income children with moderate to severe asthma. *Pediatrics*. 2002; 110:797–804. [PubMed: 12359798]
- Vila G, Nolle-Clemencon 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]
- Weil CM, Wade SL, Bauman LJ, Lynn H, Mitchell H, Lavigne J. The relationship between psychosocial factors and asthma morbidity in inner-city children with asthma. *Pediatrics*. 1999; 104:1274–1280. [PubMed: 10585977]
- Wright R, Cohen S, Carey V, Weiss S, Gold N. Parental stress as a predictor of wheezing in infancy. *American Journal of Respiratory and Critical Care Medicine*. 2002; 165:358–365. [PubMed: 11818321]

Table 1

Sample characteristics (weighted %) of youth/young adult participants at wave 3

	Ever Had an Asthma Attack (<i>n</i> = 353) <i>n</i> (%)	Never Had an Asthma Attack (<i>n</i> = 288) <i>n</i> (%)	<i>p</i>
Youth/young adult gender			
Male	199 (56.29)	144 (47.73)	0.051
Female	154 (43.71)	144 (52.27)	
Youth/young adult age (<i>M</i> ± <i>SE</i>)	16.31 ± 0.23	17.68 ± 0.25	< 0.001
Zone of residence			
Urban	266 (72.81)	213 (74.29)	0.747
Rural	87 (27.19)	75 (25.71)	
Caregiver perception of poverty			
live well	184 (53.51)	166 (57.93)	0.056
check to check	127 (35.35)	101 (36.87)	
live poorly	40 (11.14)	20 (5.21)	
Maternal education			
Less than high school	70 (21.51)	57 (16.16)	0.268
High school	112 (32.33)	92 (32.99)	
At least some college	163 (46.16)	135 (50.86)	
Youth/young adult exposed to smoke	150 (42.08)	89 (28.25)	< 0.01
Depression in youth (combined report)	30 (7.11)	19 (6.68)	0.850
Depression in youth (adult report)	25 (6.12)	10 (3.28)	0.128
Depression in youth (youth report)	12 (2.29)	10 (3.73)	0.373
Anxiety in youth (combined report)	61 (15.97)	24 (7.25)	< 0.01
Anxiety in youth (adult report)	43 (11.22)	17 (5.17)	< 0.05
Anxiety in youth (youth report)	23 (6.00)	10 (3.12)	0.094
Caregiver anxiety disorder	45 (11.89)	23 (7.71)	0.122
Caregiver major depressive disorder	71 (19.38)	24 (7.42)	< 0.001

Table 2

Unadjusted and adjusted effects of anxiety disorders on lifetime asthma attacks in youth/young adults

	Youth/young adult anxiety disorder (Model 1 ^a)	Youth/young adult anxiety disorder (Model 2 ^b)	Youth/young adult anxiety disorder (Model 3 ^c)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Lifetime asthma attacks	2.43 (1.38, 4.29)**	2.13 (1.21, 3.74)**	1.64 (0.88, 3.06)

**
 $p < 0.01$

^a Unadjusted model

^b Model adjusted for exposure to environmental tobacco smoke and demographics (youth/young adult age, caregiver perception of poverty, and maternal educational level)

^c Model adjusted for exposure to environmental tobacco smoke, demographics, and caregiver major depressive disorder

Table 3

Descriptive characteristics of asthma control

	<i>n</i> (weighted %)
Perceived Asthma Severity (Caregiver report), %	
Very Mild	137 (44.64)
Mild	62 (22.55)
Moderate	85 (27.12)
Severe	20 (5.69)
Perceived Asthma Severity (Youth/young adult report), %	
Very Mild	106 (45.09)
Mild	60 (31.33)
Moderate	39 (17.11)
Severe	15 (6.48)
ER visits for asthma past year (Caregiver Report), M $\pm$ SE	0.39 $\pm$ 0.07
Use of quick-relief medication past year (Caregiver Report), %	
Never	205 (66.88)
1–2 days/week	57 (18.00)
3–6 days/week	41 (12.04)
Daily	9 (3.08)
Use of any asthma medication past year (Caregiver Report), %	
Yes	115 (36.44)
No	196 (63.56)
% FEV ₁ , M $\pm$ SE	96.58 $\pm$ 1.89