

Childhood Asthma, Chronic Illness, and Psychiatric Disorders

ALEXANDER N. ORTEGA, Ph.D.,¹ SARAH E. HUERTAS, M.D.,² GLORISA CANINO, Ph.D.,³
RAFAEL RAMIREZ, Ph.D.,³ and MARITZA RUBIO-STIPEC, Sc.D.³

Asthma is a serious and vexing problem for many children and their families. Asthma, like most syndromes, has many symptoms and potential causes and effects. Studies have shown that pediatric asthma is associated with psychiatric disorders, but the specificity and temporality of these relations is not well known. This study examined the associations between any and specific psychiatric disorders and both childhood asthma and other childhood chronic illnesses. The study used the Methods for the Epidemiology of Child and Adolescent Mental Disorders data, a four-site, community-based study of 1,285 pairs of youths and caretakers. Psychiatric disorders were assessed using the Diagnostic Interview Schedule for Children (DISC 2.3). Methods for the Epidemiology of Child and Adolescent Mental Disorders was also used to assess individual characteristics, parental reports of asthma, and other chronic illnesses. Asthma and 'other' chronic illnesses were associated with different psychiatric disorders. In particular, having a history of asthma was associated with having an anxiety disorder, after adjustment for potential confounding, but was not associated with having an affective disorder. Having a chronic illness other than asthma or cancer was associated with having any affective disorder and dysthymia but not anxiety disorder. These results call for more mechanistic research that explores the specific relations between childhood anxiety disorder and asthma and between affective disorder and other pediatric chronic illnesses.

—*J Nerv Ment Dis* 190:275–281, 2002

Asthma is the most common chronic condition afflicting children in the United States and is respon-

sible for approximately 2.9 million visits to pediatricians each year (Adams et al., 1999; Eggleston, 1999; Schappert et al., 1999). The study of the etiology of asthma dates back to, at least, Hippocrates, who is credited as being the first to describe asthma. He believed that asthma was caused by a disturbance of humors that had not been cleansed from the brain

¹ Department of Epidemiology and Public Health, Division of Health Policy and Administration, Yale University School of Medicine, 60 College Street, P.O. Box 208034, New Haven, Connecticut 06520-8034. Send reprint requests to Dr. Ortega.

² Department of Psychiatry, Medical Sciences Campus, University of Puerto Rico, San Juan, Puerto Rico.

³ Behavioral Sciences Research Institute, Medical Sciences Campus, University of Puerto Rico, San Juan, Puerto Rico.

This study was supported in part by National Institute of Environmental Health Sciences Grant ES-05410 and from National Institute of Mental Health Grant P01-MH-59876, US Public Health Service.

The Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) program is an epidemiological methodology study performed by four independent research teams in collaboration with staff of the Division of Clinical Research, which was reorganized in 1992 with current components in the Division of Epidemiology and Services Research and the Division of Clinical and Treatment Research of the National Institute of Mental Health (NIMH), Rockville, MD. The NIMH Principal Collaborators are Darrel A. Regier, M.D., M.P.H., Ben Z. Locke, M.S.P.H., Peter S. Jensen, M.D., William E. Narrow, M.D., M.P.H., Donald S. Rae, M.A., John E. Richters, Ph.D., Karen H. Bourdon, M.A., and Margaret T. Roper, M.S.; the NIMH Project Officer was

William J. Huber. The Principal Investigators and Coinvestigators from the four sites are as follows: Emory University, Atlanta, GA, UO1 MH46725: Mina K. Dulcan, M.D., Benjamin B. Lahey, Ph.D., Donna J. Brogan, Ph.D., Sherryl H. Goodman, Ph.D., and Elaine W. Flagg, Ph.D.; Research Foundation for Mental Hygiene at New York State Psychiatric Institute (Columbia University), New York, NY, UO1 MH46718: Hector R. Bird, M.D., David Shaffer, M.D., Myrna Weissman, Ph.D., Patricia Cohen, Ph.D., Denise Kandel, Ph.D., Christina Hoven, Dr.P.H., Mark Davies, M.P.H., Madelyn S. Gould, Ph.D., and Agnes Whitaker, M.D.; Yale University, New Haven, CT, UO1 MH46717: Mary Schwab-Stone, M.D., Phillip J. Leaf, Ph.D. (now at Johns Hopkins), Sarah M. Horwitz, Ph.D., and Judith H. Lichtman, M.P.H.; University of Puerto Rico, San Juan, PR, UO1 MH46732: Glorisa Canino, Ph.D., Maritza Rubio-Stipec, Sc.D., Milagros Bravo, Ph.D., Margarita Alegria, Ph.D., Julio Ribera, Ph.D., Sara Huertas, M.D., Michael Woodbury, M.D., and Jose Bauermeister, Ph.D.

before birth. Further, in his *Treatise on Asthma*, the renowned 12th-century physician Moses Maimonides initially hypothesized that emotions are associated with asthma (Jonas et al., 1999; Munster 1968). The notion that psychiatric disorders are associated with asthma exacerbations and severity persists today; however, there is little agreement among researchers about the strength of the association or the temporal sequencing of asthma and psychiatric disorders.

Clinical and epidemiological studies in both the asthma and psychiatric literature have documented general associations between asthma and both maternal anxiety disorder and maternal depression (Bosley et al., 1996; Carr et al., 1996; Weil et al., 1999). Earlier studies of maternal mental health and pediatric asthma focused on overprotective and coping behaviors (Mrazek et al., 1991; Parker and Lipscombe, 1979), but more recent studies have reported associations between maternal psychiatric disorders and pediatric asthma (Shalowitz et al., 2001; Weil et al., 1999). Further, a wide range of pediatric psychiatric problems present more commonly in children with asthma (Bender et al., 2000; Creer et al., 1992; Forero et al., 1996; Perrin et al., 1992; Wamboldt et al., 1998). However, most studies highlight the consistent relationship between asthma and anxiety disorder and depression (Bennett, 1994; Hamlett et al., 1992; Miller, 1987; Wamboldt et al., 1998).

Three propositions about the relation between psychiatric disorders and asthma have been offered in the literature: a) psychiatric illness is thought to modify the management of asthma (*i.e.*, psychiatric impairment reduces one's ability to properly manage his or her asthma; Bender et al., 2000; Cluley and Cochrane, 2001; Fehrenbach and Peterson, 1989; Weil et al., 1999); b) psychiatric illness is part of the development of asthma and leads to exacerbations typically through hyperventilation (Carr, 1998; Carr et al., 1996; Carr et al., 1994); and c) internalizing asthma burden leads to psychiatric illness (Bender et al., 2000; Mrazek, 1992).

Although many studies have documented the relation between asthma and psychiatric problems, little information is known about the extent and specificity of the comorbid relation. Further, the current literature on pediatric asthma and psychiatric illness has been limited by the use of clinical-based as opposed to community-based samples, and many studies have failed to account for important confounders, such as familial or social characteristics, or have not used standardized diagnostic measures of psychopathology. A number of unanswered questions remain in the literature. For example, the extent to which the association between psychiatric

disorders and asthma is more robust than the associations between psychiatric disorders and other chronic health conditions is unknown. It is also unclear whether the comorbidity of asthma and psychiatric disorders varies among groups with an especially high risk of adverse outcomes caused by asthma, such as poor, inner-city, or minority children (Carter-Pokras and Gergen, 1993; Crain et al., 1994; Weiss et al., 1992).

In this study, we sought to determine the strengths of the associations between psychiatric disorders and asthma and other serious chronic conditions using data from the Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) study, a community-based study of childhood psychiatric disorders (Lahey et al., 1996). The study is unique because it: a) is based on probability samples from four communities (Atlanta, New Haven, New York, and Puerto Rico), b) used standard structured diagnostic interviews to assess psychiatric disorders, and c) allowed for the assessment of the comorbidity of childhood asthma and psychiatric disorders in different ethnocultural groups at high risk for asthma (*e.g.*, island Puerto Ricans, mainland Hispanics, and African Americans; Beckett et al., 1996; Carter-Pokras and Gergen, 1993; Homa et al., 2000; Mendoza et al., 1991; Ortega and Calderon, 2000). The present study examined the characteristics of children by whether they have asthma or some other serious chronic illness. Moreover, to understand the specificity of the relations between psychiatric disorders and asthma and to differentiate the relation from that of other chronic illness and psychiatric disorders, we examined the associations between any and specific psychiatric disorders and asthma or "other" chronic illness, after adjustment for potential confounding.

Methods

The methods used in the MECA study have been described previously (Lahey et al., 1996). Probability samples of children were obtained in 1992 in four geographically and ethnically diverse communities in New Haven, Atlanta, New York, and Puerto Rico. The target population included all youths residing within these selected communities. Of 1523 eligible youths, 1285 pairs of youths and caretakers were interviewed (84%); 92% of the caretakers interviewed were mothers.

Assessments

Children and their adult caretakers were interviewed in their homes by using the National Institute of Mental Health (NIMH) Diagnostic Interview

Schedule for Children, version 2.3 (DISC 2.3; Shaffer et al., 1996) and the Service Utilization and Risk Factors Interview (SURF; Goodman et al., 1998). The DISC 2.3 is a comprehensive, highly structured research diagnostic instrument that assesses the most common DSM-III-R (American Psychiatric Association, 1987) diagnoses among children and adolescents through parent and child interviews. The DISC 2.3 was administered by trained lay interviewers. The English version of the DISC 2.3 generates reliable and valid diagnoses for most diagnostic categories (Jensen et al., 1995; Schwab-Stone et al., 1996), and similar findings have been reported for the Spanish version of the instrument (Ribera et al., 1996; Bravo et al., 1993).

Psychiatric Diagnoses

Two parallel versions of the DISC 2.3, the youth and parent versions, were administered to obtain current (within 6 months) diagnoses according to DSM-III-R. Psychiatric diagnoses were obtained by combining information from adult and child respondents. Information was combined by considering the diagnostic criteria met if a condition was reported by either respondent (Shaffer et al., 1996). The diagnoses were a) anxiety disorder (separation anxiety, avoidant disorder, obsessive-compulsive disorder, overanxious disorder, simple phobia, social phobia, agoraphobia, panic disorder, and generalized anxiety disorder); b) mood disorder (dysthymia, hypomania, major depression, and mania); c) disruptive disorder (attention deficit hyperactivity disorder, conduct disorder, and oppositional defiant disorder); and d) miscellaneous disorder (eating disorders, elimination disorders, and tic disorders). Although measures of substance use disorders and psychosis were obtained, these were not used in the current study because only one child with asthma met criteria for a substance use disorder.

Psychiatric diagnoses were examined first as supraordinate diagnostic categories of mood, anxiety, disruptive, and miscellaneous disorders. We also used a summary variable, "any psychiatric disorder," for any child who was positive on any of the four groups of disorders previously listed. Because of the low prevalence of several of the individual disorders, only the following were separately examined: simple phobia, separation anxiety, overanxious disorder, generalized anxiety disorder, social phobia, agoraphobia, major depression, dysthymia, and conduct, oppositional, and attention deficit disorders.

The SURF (Goodman et al., 1998) was used to assess risk factors for psychopathology. The reliability of SURF has been reported elsewhere (Goodman

et al., 1998). In general, the reliability of the measures used to assess risk factors ranged from good to fair. The following are the risk factors covered by SURF that were relevant to the current study: demographic factors, teen motherhood (maternal age of 18 years or younger), and history of asthma and other chronic illnesses. The history of asthma was determined by asking parents whether their children had ever had asthma. Parents were asked if their children had ever had one of the following chronic illnesses: cardiac problems that limited physical activity, sickle cell anemia, diabetes, leukemia, or tumors. We excluded cancer from the list because of its potential life-threatening outcomes, which make its association with mental illness unique. Children with any of the chronic conditions other than asthma or cancer constituted the "other" chronic illness group for all analyses. Children were considered low income if the reported household income was below \$25,000.

Statistical Analysis

First, differences in selected characteristics (age, sex, family income, born to a teenage mother, ethnicity or race, and study site) of children and adolescents with a history of asthma or other chronic illness were determined using chi-square tests. Second, children with a history of asthma versus those with no history of asthma were compared by psychiatric disorders. Third, to measure the strength of the associations of asthma and other chronic illness with psychiatric disorders, a series of logistic regression models were fitted. Separate models included psychiatric diagnoses as dependent variables (any psychiatric disorder, three supraordinate categories of disorder, and specific disorders) and history of asthma, other chronic illness, child's age, sex, family income (less than or more than \$25,000), and study site (1 = Puerto Rico, 0 = other sites) as independent variables; the covariates were chosen and categorized based on the significant associations found in the bivariate analyses. For each logistic regression model, the odds ratios and 95% confidence intervals are tabulated. For each model that had an anxiety disorder as a dependent variable, affective disorder was incorporated as a covariate to account for potential confounding caused by comorbidity. Similarly, for each model that had an affective disorder as a dependent variable, anxiety disorder was used as a covariate. The model for any psychiatric disorder also included affective and miscellaneous disorders as covariates to adjust for potential comorbidity.

TABLE 1
Characteristics of Children with and without Asthma

	Total Sample (N = 1295)	Asthma (n = 199)	Chronic Illness ^a (n = 37)
	n (%)	n (%)	n (%)
Age (yr)			
9–11	448 (34.9)	73 (37.1)	9 (25.7)
12–17	835 (65.1)	124 (62.9)*	26 (74.3)*
Male	686 (53.0)	118 (59.3)*	23 (62.2)
Family income			
< \$25,000	423 (32.7)	95 (47.7)	28 (75.7)*
Born to teenage mother	101 (7.8)	19 (9.5)	7 (16.3)*
Chronic illness	37 (2.9)	9 (4.5)*	— (—)
Ethnic/racial group			
Island Hispanic	311 (24.1)	92 (29.6)	18 (5.8)
Mainland Hispanic	52 (4.0)	6 (11.5)	3 (5.8)
African American	189 (14.6)	25 (13.2)	7 (3.7)
Non-Hispanic white	668 (51.7)	67 (10.0)	7 (1.1)
Mainland other	72 (5.6)	6 (8.3)*	1 (1.4)*
Study site			
Atlanta	303 (23.4)	43 (14.2)	3 (1.0)
New Haven	321 (24.8)	23 (7.2)	7 (2.2)
New York	357 (27.6)	38 (10.6)	8 (2.2)
Puerto Rico	314 (24.3)	95 (30.3)*	19 (6.1)*

^a Serious chronic illness other than asthma or cancer.

**p* < 0.05; chi-square test for differences across the categories.

Results

Table 1 lists the characteristics of children with a history of asthma and children with a history of chronic illness other than asthma or cancer. A total of 199 (15%) children were reported to have had a history of asthma. Children with asthma were more likely to be between the ages of 12 and 17 years, male, from Puerto Rico, and to have comorbid chronic illness compared with children without asthma (Table 1). Thirty-seven (<1%) children were classified as having chronic illness other than asthma or cancer. Children with other chronic illness were more likely to be between the ages of 12 and 17 years, from families that earned less than \$25,000 a year, born to a teenaged mother, and from Puerto Rico compared with children without chronic illness (Table 1).

Comparisons of mental illness were made between children with and without a history of asthma. Children with a history of asthma were more likely to have any anxiety disorder, simple phobia, separation anxiety, and overanxious disorder than children without a history of asthma (Table 2). No differences by history of asthma were found for affective disorder or disruptive disorders.

In multivariate models that adjusted for age, sex, family income, study site, and psychiatric comorbidity, a history of asthma was associated with having any psychiatric disorder, any anxiety disorder, simple phobia, separation anxiety, and overanxious dis-

TABLE 2
Comparison of Psychiatric Disorders Between Children with and without Asthma

	Asthma n (%)	No History of Asthma n (%)
Any psychiatric disorder	112 (56.3)	537 (49.0)
Any anxiety disorder	97 (49.2)*	410 (37.7)
Simple phobia	60 (31.1)*	219 (20.4)
Separation anxiety	22 (11.3)*	63 (5.8)
Overanxious disorder	32 (16.5)*	114 (10.6)
Generalized anxiety	9 (4.6)	52 (4.8)
Social phobia	36 (18.5)	162 (15.0)
Agoraphobia	21 (10.8)	64 (5.9)
Any affective disorder	26 (13.4)	127 (11.7)
Major depression	12 (6.4)	79 (7.3)
Dysthymia	10 (5.2)	47 (4.4)
Any disruptive disorder	29 (15.0)	155 (14.3)
Conduct	12 (6.4)	62 (5.8)
Oppositional defiant	14 (7.3)	77 (7.1)
Attention deficit		
hyperactivity disorder	11 (5.8)	72 (6.7)

**p* < 0.05; chi-square test for differences between asthmatics and nonasthmatics.

TABLE 3
Adjusted Odds Ratios for Psychiatric Diagnoses Given a Lifetime Report of Asthma or Other Chronic Illness

	N	Asthma OR (CI) ^a	Chronic Illness ^b OR (CI) ^a
Any psychiatric disorder	643	1.41 (1.03–1.94)	1.20 (0.60–2.40)
Any anxiety disorder	497	1.59 (1.14–2.21)	0.60 (0.28–1.28)
Simple phobia	275	1.70 (1.18–2.44)	0.99 (0.44–2.22)
Separation anxiety	85	1.82 (1.05–3.16)	1.86 (0.69–5.0)
Overanxious disorder	144	1.89 (1.18–3.03)	1.28 (0.48–3.47)
Generalized anxiety	60	1.18 (0.55–2.54)	2.21 (0.59–8.24)
Social phobia	191	1.14 (0.74–1.75)	1.43 (0.61–3.31)
Agrophobia	84	1.58 (0.90–2.77)	0.57 (0.13–2.58)
Any affective disorder	149	1.23 (0.75–2.01)	2.68 (1.11–6.49)
Major depression	90	0.88 (0.45–1.72)	0.83 (0.19–3.72)
Dysthymia	55	1.09 (0.51–2.31)	3.80 (1.30–11.12)
Any disruptive disorder	182	1.29 (0.82–2.03)	0.77 (0.26–2.33)
Conduct	73	1.22 (0.62–2.38)	1.70 (0.54–5.36)
Oppositional defiant	90	1.28 (0.69–2.35)	0.83 (0.19–3.69)
Attention deficit			
hyperactivity disorder	82	1.08 (0.55–2.12)	— ^c

^a Odds ratios and 95% confidence intervals; models predict the presence of the condition versus its absence.

^b Serious chronic illness other than asthma or cancer.

^c Insufficient data to calculate.

order, and was not associated with any other disorders (Table 3). Having a chronic illness other than asthma and cancer was associated with having any affective disorder and dysthymia, and was not associated with any other disorder (Table 3).

Puerto Rican Ethnicity and Site

Because we found that Puerto Rican children were more likely to have a history of asthma than were children from other sites, we examined, in

separate analyses, the relation between psychiatric disorder and asthma adjusted for site. Using logistic regression models that included site, age, gender, low household income, and having other chronic illness as covariates, we found that study site did not mediate the relation between asthma and psychiatric disorder. Likewise, Puerto Rican children were more likely to have other chronic illnesses, but logistic regression models showed that study site did not mediate the observed association between chronic illness and psychiatric disorder.

Discussion

In this community-based study, we found that having a history of asthma was associated with having any psychiatric disorder and with having anxiety disorders. The relations persisted even in the face of adjustment for potential confounders. Furthermore, the findings suggest that the relation between anxiety disorder and chronic illness is specific to asthma and not other chronic conditions. We found that children with chronic illness other than asthma or cancer were likely to have any affective disorder or dysthymia, but not anxiety disorder. The current study also found that caregivers of Puerto Rican children were more likely to report both a history of pediatric asthma and other chronic illness, which is consistent with findings of other studies (Carter-Pokras and Gergen, 1993; Homa et al., 2000; Ledogar et al., 2000; Mendoza et al., 1991; Ortega et al., 2001), but, interestingly, living on the island did not mediate the observed relations.

The finding that anxiety disorder was associated with having a history of asthma but was not associated with other chronic conditions both supports and extends the current literature on asthma and psychiatric disorders (Brown et al., 2000; Bussing et al., 1995; Bussing et al., 1996; Vila et al., 1998, 2000). Our findings are somewhat similar to those of Bussing et al. (1995), who found that behavioral and emotional problem scores for children with asthma were comparable with those of children with other chronic conditions, with the exception of one subscale, anxiety-depression, in which scores were significantly higher for children with asthma. Studies of children with attention deficit hyperactivity disorder with and without asthma have also suggested a unique relationship between asthma and anxiety disorders (Biederman et al., 1994). Future research might focus on gaining a better understanding of the temporal relationship between anxiety disorder and asthma and determining the mechanisms that explain the relation. For example, studies have found that stress is related to both asthma (McQuaid et al.,

2000; Perrin et al., 1992) and psychiatric disorders (Bryant and Panasetis, 2001; Jackson et al., 2001); therefore, future studies might also focus on explaining the asthma-stress-mental health triad to explain comorbid psychiatric disorder and asthma.

However, our finding that a history of asthma is only associated with anxiety disorder disagrees with some studies of childhood that found an increased odds for a variety of psychiatric symptoms and disorders (Forero et al., 1996; Mrazek, 1992) or studies that have found a particular relationship between depressive disorders and children with asthma (Bennett, 1994; Galil, 2000; Miller, 1987). Possible explanations for these different findings is that some of the previous studies have relied on behavioral scales that do not differentiate adequately between anxiety and depression (Bussing et al., 1995), have examined behaviors or behavioral and emotional symptoms (Bussing et al., 1995; Forero et al., 1996), or have been carried out in populations of children with very severe asthma (Miller, 1987; Wamboldt et al., 1996). Further, MECA was a community-based study, and many of the other studies relied on clinical samples, which are likely to have high rates of comorbidity.

In our preliminary analyses of the MECA data, we found that the positive relation between asthma and anxiety disorder was particularly robust for children who had been hospitalized for asthma, suggesting that children with severe asthma are more likely to have anxiety disorder. This finding is consistent with early reports that found an increased risk for psychiatric disorder only among children with severe asthma (Graham et al., 1967; Mrazek, 1992). One possible explanation for this finding is that the psychopathology is related to hospitalization and not to asthma per se. Because we are limited to the use of secondary data, we were unable to determine the effects of hospitalization on a psychiatric disorder for those children with other chronic illnesses. However, because of the nature and seriousness of the chronic illnesses examined, there is a high likelihood that children with such illnesses were hospitalized at some time; thus, it is unlikely that hospitalization by itself could explain the difference in the patterns of association found for children who had been hospitalized for their asthma and children with other serious chronic illnesses.

Study Limitations

There are some obvious limitations to our analyses. First, the history of asthma was based on parental report. However, the percent of children with asthma in the MECA sample is similar to those ob-

tained through more detailed asthma surveys in Puerto Rico and elsewhere (Gergen et al., 1988; Orengo et al., 1996; Persky et al., 1998; Strachan et al., 1994). Furthermore, Pless and Pless (1995) found that parental reports of asthma had good agreement with patients' records. Second, reports of asthma were lifetime reports, whereas reports for psychiatric disorder were for the last 6 months or 1 year. However, it is likely that children who were reported to have asthma at some point in their lives would still have asthma at the time of assessment for psychiatric disorders (Lebowitz et al., 1990). Third, because of small numbers of children with other chronic illnesses, we used an aggregate measure of other chronic illnesses; thus, we did not assess the effects of separate major chronic illnesses on psychiatric disorders.

Conclusion

This community-based study observed higher proportions of asthma among the Puerto Rican subsample compared with children from the New York, New Haven, and Atlanta sites, but being from Puerto Rico did not mediate the relation between asthma and anxiety disorder. Further, this study suggests that the relation between pediatric asthma and psychiatric disorders is specific to anxiety disorder and not other psychiatric disorders, such as affective disorder. The strong association between asthma and anxiety disorder in this community sample has potentially important implications, and calls attention to the possibility of comorbid anxiety disorder and severe asthma and the need to investigate this relation further. Clinicians should be mindful that both conditions might need management or intervention (Fritz et al., 1981; Klein, 2001), particularly with children who are vulnerable, such as those from low-income families. In this study, approximately half of the children with asthma and other serious chronic illnesses lived in low-income households. Finally, the finding that children with severe asthma have significant odds of having anxiety disorder and that this association does not extend to children with other chronic illnesses raises several unanswered questions for further study about the mechanisms for the development of psychiatric disorders in children with chronic illness.

References

Adams PF, Hendershot GE, Marano MA (1999) Current estimates from the National Health Interview Survey, 1996. National Center for Health Statistics. *Vital Health Stat* 10:1-140.
 American Psychiatric Association (1987) *Diagnostic and statistical manual of mental disorders* (3rd ed). Washington, DC: American Psychiatric Association.

Beckett WS, Belanger K, Gent JF, Holford TR, Leaderer BP (1996) Asthma among Puerto Rican Hispanics: A multi-ethnic comparison study of risk factors. *Am J Respir Crit Care Med* 154:894-899.
 Bender BG, Annett RD, Ikle D, DuHamel TR, Rand C, Strunk RC (2000) Relationship between disease and psychological adaptation in children in the Childhood Asthma Management Program and their families. *Arch Pediatr Adolesc Med* 154:706-713.
 Bennett DS (1994) Depression among children with chronic medical problems: A meta-analysis. *J Pediatr Psychol* 19:149-169.
 Biederman J, Milberger S, Faraone SV, Guite J, Warburton R (1994) Associations between childhood asthma and ADHD: issues of psychiatric comorbidity and familiarity. *J Am Acad Child Adolesc Psychiatry* 33:842-848.
 Bosley CM, Corden ZM, Cochrane GM (1996) Psychosocial factors and asthma. *Respir Med* 90:453-457.
 Bravo M, Woodbury-Farina M, Canino G, Rubio-Stipec M (1993) The Spanish translation and cultural adaptation of the Diagnostic Interview Schedule for Children (DISC) in Puerto Rico. *Cult Med Psychiatry* 17:329-344.
 Brown ES, Khan DA, Mahadi S (2000) Psychiatric diagnoses in inner city outpatients with moderate to severe asthma. *Int J Psychiatry Med* 30:319-327.
 Bryant RA, Panasetis P (2001) Panic symptoms during trauma and acute stress disorder. *Behav Res Ther* 39:961-966.
 Bussing R, Burket RC, Kelleher ET (1996) Prevalence of anxiety disorders in a clinic-based sample of pediatric asthma patients. *Psychosomatics* 37:108-115.
 Bussing R, Halfon N, Benjamin B, Wells KB (1995) Prevalence of behavior problems in US children with asthma. *Arch Pediatr Adolesc Med* 149:565-572.
 Carr RE (1998) Panic disorder and asthma: causes, effects and research implications. *J Psychosom Res* 44:43-52.
 Carr RE, Lehrer PM, Hochron SM, Jackson A (1996) Effect of psychological stress on airway impedance in individuals with asthma and panic disorder. *J Abnorm Psychol* 105:137-141.
 Carr RE, Lehrer PM, Rausch LL, Hochron SM (1994) Anxiety sensitivity and panic attacks in an asthmatic population. *Behav Res Ther* 32:411-418.
 Carter-Pokras OD, Gergen PJ (1993) Reported asthma among Puerto Rican, Mexican-American, and Cuban children, 1982-1984. *Am J Public Health* 83:580-582.
 Cluley S, Cochrane GM (2001) Psychological disorder in asthma is associated with poor control and poor adherence to inhaled steroids. *Respir Med* 95:37-39.
 Crain EF, Weiss KB, Bijur PE, Hersh M, Westbrook L, Stein RE (1994) An estimate of the prevalence of asthma and wheezing among inner-city children. *Pediatrics* 94:356-362.
 Creer TL, Stein REK, Rappaport L, Lewis C (1992) Behavioral consequences of illness: Childhood asthma as a model. *Pediatrics* 90:808-815.
 Eggleston PA (1999) Asthma. In JA McMillan, CD DeAngelis, RD Feigin JB Warshaw (Eds), *Oski's pediatrics: Principles and practice* (3rd ed). Philadelphia: Lippincott Williams & Wilkins.
 Fehrenbach AM, Peterson L (1989) Parental problem-solving skills, stress, and dietary compliance in phenylketonuria. *J Consult Clin Psychol* 57:237-241.
 Forero R, Bauman A, Young L, Booth M, Nutbeam D (1996) Asthma, health behaviors, social adjustment, and psychosomatic symptoms in adolescence. *J Asthma* 33:157-164.
 Fritz GK, Steiner H, Hillyard J, Lewiston N (1981) Pediatric and psychiatric collaboration in the management of childhood asthma. *Clin Pediatr* 20:772-776.
 Galil N (2000) Depression and asthma in children. *Curr Opin Pediatr* 12:331-335.
 Gergen PJ, Mullally DI, Evan R III (1988) National survey of prevalence of asthma among children in the United States, 1976-1980. *Pediatrics* 81:1-7.
 Goodman SH, Hoven CW, Narrow WE, Cohen P, Fielding B, Alegria M, Leaf PJ, Kandel D, Horwitz SM, Bravo M, Moore R, Dulcan MK (1998) Measurement of risk for mental disorders

- and competence in a psychiatric epidemiologic community survey: The National Institute of Mental Health Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) Study. *Soc Psychiatry Psychiatr Epidemiol* 33:162-173.
- Graham P, Rutter M, Yule W, Pless I (1967) Childhood asthma: a psychosomatic disorder? Clinical and epidemiological considerations. *Br J Preventive Soc Med* 21:78-85.
- Hamlett KW, Pellegrini DS, Katz KS (1992) Childhood chronic illness as a family stressor. *J Pediatr Psychol* 17:33-47.
- Homa DM, Mannino DM, Lara M (2000) Asthma mortality in U.S. Hispanics of Mexican, Puerto Rican, and Cuban heritage, 1990-1995. *Am J Respir Crit Care Med* 161:504-509.
- Jackson JL, Houston JS, Hanling SR, Terhaar KA, Yun JS (2001) Clinical predictors of mental disorders among medical outpatients. *Arch Intern Med* 161:875-879.
- Jensen P, Roper M, Fisher P, Piacentini J, Canino G, Richters J, Rubio-Stipec M, Dulcan M, Goodman S, Davies M, Rae D, Shaffer D, Bird H, Lahey B, Schwabstone M (1995) Test-retest reliability of the Diagnostic Interview Schedule for Children (DISC 2.1)—Parent, child, and combined algorithms. *Arch Gen Psychiatry* 52:61-71.
- Jonas BS, Wagener DK, Lando JF, Feldman JJ (1999) Symptoms of anxiety and depression as risk factors for development of asthma. *J Appl Biobehav Res* 4:91-110.
- Klein DF (2001) Asthma and psychiatric illness. *JAMA* 285:881-882.
- Lahey BB, Flagg EW, Bird HR, Schwab-Stone ME, Canino G, Dulcan MK, Leaf PJ, Davies M, Brogan D, Bourdon K, Horwitz SM, Rubio-Stipec M, Freeman DH, Lichtman JH, Shaffer D, Goodman SH, Narrow WE, Weissman MM, Kandel DB, Jensen PS, Richters JE, Regier DA (1996) The NIMH Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) study: Background and methodology. *J Am Acad Child Adolesc Psychiatry* 35:855-864.
- Lebowitz MD, Holberg CJ, Martinez FD (1990) A longitudinal study of risk factors in asthma and chronic bronchitis in childhood. *Eur J Epidemiol* 6:341-347.
- Ledogar RJ, Penchaszadeh A, Iglesias Garden CC, Acosta LG (2000) Asthma and Latino cultures: different prevalence reported among groups sharing the same environment. *Am J Public Health* 90:929-935.
- McQuaid EL, Fritz GK, Nassau JH (2000) Stress and airway resistance in children with asthma. *J Psychosom Res* 49:239-245.
- Mendoza FS, Ventura SJ, Valdez RB, Castillo RO, Saldivar LE, Baisden K, Martorell R (1991) Selected measures of health status for Mexican-American, mainland Puerto Rican, and Cuban-American children. *JAMA* 265:227-232.
- Miller B (1987) Depression and asthma: a potentially lethal mixture. *J Allergy Clin Immunol* 80:481-486.
- Mrazek DA (1992) Psychiatric complications of pediatric asthma. *Ann Allergy* 69:285-290.
- Mrazek DA, Klinnert MD, Mrazek P, Macey T (1991) Early asthma onset: Consideration of parenting issues. *J Am Acad Child Adolesc Psychiatry* 30:277-282.
- Munster S (1968) Maimonides' treatise on asthma. *Dis Chest* 54:128-132.
- Orengo JC, Loyo WI, Serrano RA, Mercado HE, Horta H (1996) Prevalence of respiratory and allergic problems among school-aged children in the Air Basin. Presented at the Catano Workshop, San Juan, Puerto Rico. Department of Health, Environmental Health Secretariat and US Environmental Protection Agency.
- Ortega AN, Belanger KD, Bracken MB, Leaderer BP (2001) A childhood asthma severity scale: symptoms, medications, and health care visits. *Ann Allergy Asthma Immunol* 86:405-413.
- Ortega AN, Calderon JG (2000) Pediatric asthma among minority populations. *Curr Opin Pediatr* 12:579-583.
- Parker G, Lipscombe P (1979) Parental overprotection and asthma. *J Psychosom Res* 23:295-299.
- Perrin JM, MacLean WE, Gortmaker SL, Asher KN (1992) Improving the psychological status of children with asthma: a randomized controlled trial. *J Dev Behav Pediatr* 13:241-247.
- Persky VW, Slezak J, Contreras A, Becker L, Hernandez E, Ramakrishnan V, Piorkowski J (1998) Relationships of race and socioeconomic status with prevalence, severity, and symptoms of asthma in Chicago school children. *Ann Allergy Asthma Immunol* 81:266-271.
- Pless CE, Pless IB (1995) How well do they remember. The accuracy of parent reports. *Arch Pediatr Adolesc Med* 149:553-558.
- Ribera JC, Canino G, Rubio-Stipec M, Bravo M, Bauermeister JJ, Alegria M, Woodbury M, Huertas S, Guevara LM, Bird HR, Freeman D, Shrout PE (1996) The Diagnostic Interview Schedule for Children (DISC 2.1) in Spanish: Reliability in a Hispanic population. *J Child Psychol Psychiatry* 37:195-204.
- Schappert SM, Nelson C (1999) National Ambulatory Medical Care Survey, 1995-96 summary. National Center for Health Statistics. *Vital Health Stat* 13:1-131.
- Schwab-Stone ME, Shaffer D, Dulcan MK, Jensen PS, Fisher P, Bird HR, Goodman SH, Lahey BB, Lichtman JH, Canino G, Rubio-Stipec M, Rae DS (1996) Criterion validity of the NIMH Diagnostic Interview Schedule for Children Version 2.3 (DISC-2.3). *J Am Acad Child Adolesc Psychiatry* 35:878-888.
- Shaffer D, Fisher P, Dulcan MK, Davies M, Piacentini J, Schwab-Stone ME, Lahey BB, Bourdon K, Jensen PS, Bird HR, Canino G, Regier DA (1996) The NIMH Diagnostic Interview Schedule for Children Version 2.3 (DISC 2.3): description, acceptability, prevalence rates, and performance in the MECA study. *J Am Acad Child Adolesc Psychiatry* 35:865-877.
- Shalowitz MU, Berry CA, Quinn KA, Wolf RL (2001) The relationship of life stressors and maternal depression to pediatric asthma morbidity in a subspecialty practice. *Ambul Pediatr* 1:185-193.
- Strachan DP, Anderson HR, Limb ES, O'Neill A, Wells N (1994) A national survey of asthma prevalence, severity, and treatment in Great Britain. *Arch Dis Child* 70:174-178.
- Vila G, Nolle-Clemencon C, de Blic J, Mouren-Simeoni MC, Scheinmann P (1998) Asthma severity and psychopathology in a tertiary care department for children and adolescent. *Eur Child Adolesc Psychiatry* 7:137-144.
- Vila G, Nolle-Clemencon C, de Blic J, Mouren-Simeoni MC, Scheinmann P (2000) Prevalence of DSM-IV anxiety and affective disorders in a pediatric population of asthmatic children and adolescents. *J Affect Disord* 58:223-231.
- Wamboldt MZ, Weintraub P, Krafchick D, Wamboldt F (1996) Psychiatric family history in adolescents with severe asthma. *J Am Acad Child Adolesc Psychiatry* 35:1042-1049.
- Wamboldt MZ, Fritz G, Mansell A, McQuaid EL, Klein RB (1998) Relationship of asthma severity and psychological problems in children. *J Am Acad Child Adolesc Psychiatry* 37:943-950.
- Weil CM, Wade SL, Bauman LJ, Lynn H, Mitchell H, Lavigne J (1999) The relationship between psychosocial factors and asthma morbidity in inner-city children with asthma. *Pediatrics* 104:1274-1280.
- Weiss KB, Gergen PJ, Crain EF (1992) Inner-city asthma. The epidemiology of an emerging US public health concern. *Chest* 101(6 Suppl):362S-367S.