Parental psychosocial stress and asthma morbidity in Puerto Rican twins

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Background: Little is known about paternal psychosocial factors and childhood asthma.
Objective: We sought to examine the link between maternal and paternal psychosocial stress and asthma outcomes in young children.
Methods: Parents of 339 pairs of Puerto Rican twins were interviewed individually about their own psychosocial stress and about asthma in their children at age 1 year and again about their child's asthma at age 3 years. Fathers were asked about symptoms of posttraumatic stress disorder (PTSD), depression, and antisocial behavior. Mothers were asked about depressive symptoms. Outcomes assessed in children included recent asthma symptoms, oral steroid use and hospitalizations for asthma in the prior year, and asthma diagnosis. Generalized estimated equation models were used for the multivariate analysis of parental psychosocial stress and asthma morbidity in childhood.
Results: After multivariable adjustment, paternal PTSD symptoms, depression, and antisocial behavior were each associated with increased asthma symptoms at age 1 year (eg, odds ratio, 1.08 for each 1-point increase in PTSD score; 95% CI, 1.03-1.14). Maternal depressive symptoms were associated with an increased risk of asthma hospitalizations at age 1 year. At age 3 years, maternal depressive symptoms were associated with asthma diagnosis and hospitalizations for asthma (odds ratio for each 1-point increase in symptoms, 1.16; 95% CI, 1.00-1.36). In an analysis combining 1- and 3-year outcomes, paternal depression was associated with oral steroid use, maternal depressive symptoms were associated with asthma hospitalizations and asthma diagnosis, and parental depression was associated with hospitalizations for asthma.
Conclusions: Both paternal and maternal psychosocial factors can influence asthma morbidity in young Puerto Rican children. (J Allergy Clin Immunol 2011;127:734-40.)

Key words: *Psychosocial stress, childhood wheeze, Puerto Rico, parental stress, asthma, paternal stress*

Asthma is a global public health problem that affects more than 6.8 million children and adolescents in the United States.[1,2] In this country the urban poor[3,4] are disproportionately affected, and Puerto Ricans have the highest lifetime prevalence of asthma.[5] Although death from asthma is rare, asthma mortality rates are highest among Puerto Ricans in the United States.[6]

There is increasing evidence of a link between stress and both asthma development and control. Psychological stress can be understood as a "social pollutant" that can affect biology when "breathed in,"[7] and it has been associated with difficulties in asthma management,[8,9] impaired functional status,[10] and increased asthma mortality.[11-13] Stress might not only cause asthma morbidity in adults but it can also affect their children.

In healthy children parental stress has been associated with an increased frequency of childhood illnesses and altered immune function.[14] In children with asthma, increased parental stress has been shown to be associated with altered functional status, hospitalizations for asthma,[15] and poor asthma control.[16] Parental stress is associated with an increased risk of asthma or wheeze in childhood.[17,18] Negative life stressors and maternal depression have been shown to be strong predictors of asthma morbidity.[19] The majority of previous studies have focused on maternal or "caregiver" stress more generally, without specifying whether this is the mother, father, or another person.

In addition to high rates of asthma, island Puerto Ricans have a high prevalence of psychosocial stress in both adults and children, mostly related to high levels of exposure to violence[20] and high levels of poverty, with 45% of the population living below the poverty level.[21] The prevalence rates of psychiatric disorders in island Puerto Ricans are high but comparable with those reported for the overall population of the mainland United States (approximately 25% in adults[22,23] and approximately 17% in children and adolescents[24]).

To examine the issue of parental stress and childhood asthma more closely, we analyzed the relation between indicators of parental psychosocial stress individually in mothers and fathers and asthma morbidity in a cohort of young Puerto Rican twins. We hypothesized that maternal and paternal psychosocial stress would be independently associated with increased asthma morbidity in children.

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Abbreviations used
CIDI 3.0: Composite International Diagnostic Interview version 3.0
DSM-IV: *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*
ETS: Environmental tobacco smoke
PTSD: Posttraumatic stress disorder

METHODS

Population

All families with a multiple-gestation pregnancy in Puerto Rico in 2006 were considered for inclusion. Contact information was obtained from the Puerto Rico Neo-natal Twin Registry established with the assistance of the Puerto Rican Department of Health. Of the 481 families with multiple births in 2006, 82 were ineligible because the neonates were triplets or at least 1 twin was deceased. Of the 399 eligible families, 60 chose not to participate, leaving 339 (85%) families each with a set of twins (see Fig E1 in this article's Online Repository at www.jacionline.org). Although the original goal of this study (the Puerto Rican Infant Twin Study) was to examine the origins of child temperament, families were not selected for any illness. Mothers and fathers were interviewed separately and asked questions about demographic information (eg, household income and education level), child behavior and medical history, and their own psychological stress and medical history (including smoking and substance abuse) within the first year of life of the children. They were again interviewed about their children's medical history when the children were 3 years of age. Written informed consent was obtained from all study participants. The study was approved by the Institutional Review Board of the University of Puerto Rico.

Measures

Psychosocial stress. Mothers and fathers were each questioned about psychosocial stress within the first year of life of their children. Maternal questionnaires included questions on depressive symptoms. Paternal questionnaires included questions on posttraumatic stress disorder (PTSD), antisocial behavior, and depression.

We used the Mood and Feelings Questionnaire[25,26] to ask mothers about depressive symptoms. The Mood and Feelings Questionnaire, an instrument designed for the evaluation of core depressive symptomatology and use in epidemiologic studies, has high internal reliability (Cronbach $\alpha = 0.9$). Although developed primarily for use in children and adolescents, it has been used previously in studies of adults.[27] The questions asked of mothers are listed in Table E1 in this article's Online Repository at www.jacionline.org.

Fathers were asked questions from the World Health Organization Composite International Diagnostic Interview version 3.0 (CIDI 3.0).[28] The CIDI 3.0 is a standardized diagnostic interview designed to assess current and lifetime mental disorders according to the definitions and criteria of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV). The instrument was translated and adapted for use among Spanish-speaking populations by using a comprehensive process guided by a conceptual model that focused on cross-cultural equivalence in 5 dimensions following a cultural adaptation model described in detail elsewhere.[29] For most DSM-IV diagnoses in both English and Spanish, the instrument has demonstrated adequate concordance based on the World Mental Health–CIDI assessments and the Structured Clinical Interview for Axis 1 Disorders.[30,31] A full list of questions can be found at http://www.hcp.med.harvard.edu/wmhcidi. DSM-IV disorders assessed in fathers included major depressive episode, social phobia, and drug and alcohol use and abuse. For the purposes of this analysis, we used major depressive episode from this questionnaire because of the low prevalence of other diagnoses (eg, substance abuse). Questions on PTSD symptoms were from the CIDI 3.0. All symptom questions from the CIDI 3.0 PTSD instrument were included; however, questions on traumatic events were altered. Questions on antisocial behavior were based on the standard DSM-IV criteria and developed by Lish et al.[32] This instrument has been used in prior studies with island and mainland Puerto Ricans.[33] Specific questions on PTSD and antisocial behavior are listed in Tables E2 to E3 of this article's Online Repository at www.jacionline.org.

A diagnosis of a major depressive episode was based on algorithms developed by the originators of the CIDI based on the DSM-IV.[34] Paternal PTSD and antisocial behavior and maternal depressive symptoms were assessed on a continuous scale with the answer of "yes" to any one question equaling 1 point in the score and a higher score representing more symptoms of each disorder. The total possible scores for PTSD, antisocial behavior, and depression were 17, 13, and 11, respectively. For the analysis considering depression in both parents, maternal depression was treated as a dichotomous variable, with a score for depressive symptoms of 2 or higher considered positive for depression.

Other measures. Other measures considered for inclusion in the multivariate analysis were child's sex, zygosity of the twins (monozygotic vs dizygotic), exposure to environmental tobacco smoke (ETS; including both *in utero* exposure and exposure from any active smoker in the household), paternal history of asthma, maternal history of asthma, parental (either parent with) history of asthma, gestational age, parental togetherness (defined as maternal report that the parents were living together), and indicators of socioeconomic status (household income, parental education [defined as the highest level attained by either parent], and receipt of public assistance).

Outcomes. Outcomes assessed at 1 year of age included parental report of asthma symptoms in the previous 4 weeks (nighttime symptoms, daytime symptoms, or use of albuterol), use of oral steroids in the previous year for asthma, asthma hospitalizations in the previous year, and physician-diagnosed asthma (see Table E4 in this article's Online Repository at www.jacionline.org). At age 3 years, parents for 312 (92%) of the 339 original families completed follow-up interviews. Outcomes assessed at age 3 years included parental report of an unplanned clinic or emergency department visit for asthma in the previous year, use of oral steroids in the previous year for asthma, asthma hospitalizations in the previous year, and asthma diagnosis (defined as physician-diagnosed asthma with wheezing in the previous year; see Table E5 in this article's Online Repository at www.jacionline.org). All outcomes combined the responses from mother and father such that an answer of "yes" by either the father or the mother was considered positive.

Statistical analysis

To control for the correlation between twins in a household, we used generalized estimated equation analysis as implemented in PROC GENMOD in SAS version 9.1 (SAS Institute, Inc, Cary, NC). Stepwise regression was used to build multivariate models. Variables associated at a P value of less than .20 and potential confounders were included in initial models for each outcome. The final models included all variables that were associated with the outcome at a P value of less than .05, those that caused a change of greater than 10% in the effect estimate for the psychosocial exposure of interest, or both. All final models for outcome at age 1 year included ETS, household income, gestational age, and parental history of asthma. Models examining paternal psychosocial stress controlled for maternal depressive symptoms, and models examining maternal depressive symptoms controlled for paternal depression. Final models for outcomes at age 3 years included household income and parental history of asthma because no other variables (eg, ETS) were significant confounders. At both time points, we also examined parental depression as a linear variable, with values of 0, 1, or 2 representing the number of parents with depression.

In addition, for the outcomes that were in common at the 2 time points (steroid use, asthma hospitalizations, and asthma diagnosis), we performed a combined analysis of a binary outcome that represented an answer of "yes" at both time points or "no" at both time points. For this analysis, those with an answer of "yes" at one time point and "no" at the other were excluded to have a clear separation of the 2 groups.

RESULTS

Baseline characteristics of the participating children (twins) and their parents are shown in Table I. Of the 339 fathers, 226