



Maternal depressive symptoms, maternal asthma, and asthma in school-aged children



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ABSTRACT

Background: Little is known about the joint effects of maternal asthma and maternal depression on childhood asthma.

Objective: To examine whether maternal depression and maternal asthma lead to greater risk of childhood asthma than maternal asthma alone.

Methods: Cross-sectional studies of children (6–14 years old) in San Juan, Puerto Rico (n = 655) and Sweden (n = 6,887) were conducted. In Puerto Rico, maternal depressive symptoms were defined using the Center for Epidemiologic Studies Depression Scale (CES-D) questionnaire. In Sweden, maternal physician-diagnosed depression was derived from national registries, and maternal depressive symptoms were defined using an abbreviated CES-D questionnaire. Childhood asthma was defined as physician-diagnosed asthma plus current wheeze (in Puerto Rico) or plus medication use (in Sweden). Logistic regression was used for multivariable analysis.

Results: Compared with Puerto Rican children whose mothers had neither asthma nor depressive symptoms, those whose mothers had asthma but no depressive symptoms had 3.2 times increased odds of asthma (95% confidence interval [CI] = 2.1–4.8) and those whose mothers had asthma and depressive symptoms had 6.5 times increased odds of asthma (95% CI = 3.3–13.0). Similar results were obtained for maternal depression and maternal asthma in the Swedish cohort (odds ratio for maternal asthma without maternal depression = 2.8, 95% CI = 2.1–3.7; odds ratio for maternal asthma and maternal depression = 4.0, 95% CI = 1.7–9.6). Although the estimated effect of maternal asthma on childhood asthma was increased when maternal depressive symptoms (Puerto Rico) or maternal depression (Sweden) was present, there were no statistically significant additive interactions.

Conclusion: Maternal depression can further increase the risk of asthma in children whose mothers have a history of asthma.

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Introduction

Asthma is the most common chronic disease of childhood and a major public health problem in the United States and worldwide.^{1,2} In the United States, the burden of childhood asthma is unequally distributed across racial or ethnic groups, with Puerto Ricans and non-Hispanic blacks being more affected with this disease than non-Hispanic whites or Mexican Americans.³ In Nordic countries, including Sweden, the incidence of childhood asthma increased until the 1990s and then reached a plateau in the 2000s.⁴

Depression is a common mental illness that affects 8% to 16% of women of reproductive age.⁵ Depression is frequent during and after pregnancy, affecting 10% to 15% of all gravid and postpartum

mothers.^{6,7} Among Hispanics, Puerto Rican mothers have twice the risk of mental health disorders (including depression) as Mexican Americans.⁸ In large studies of adults, depression has been associated with asthma.^{9,10}

The high frequency of comorbid depression and asthma in women of reproductive age can increase the risk of childhood asthma. Maternal depression can affect asthma in preschool and school-age children through indirect mechanisms, including secondhand smoke and nonadherence to prescribed controller medications. When present during pregnancy, maternal depression has been associated with increased odds of childhood wheeze (an asthma symptom) from 1 to 4 years old (odds ratio [OR] = 1.5, 95% confidence interval [CI] = 1.2–1.8),¹¹ with 1 study suggesting a dose-response relation between maternal depressive symptoms and severity of childhood wheeze.¹²

Maternal history of asthma is one of the strongest risk factors for childhood asthma. Children born to mothers with a history of asthma have up to 5-fold higher odds of asthma than those born to mothers without a history of asthma (95% CI = 1.7–14.9).¹³

Although depression and asthma are common in women of reproductive age,^{1,14–17} no study has assessed whether maternal depressive symptoms or maternal depression accentuates the detrimental effects of maternal asthma on childhood asthma. We hypothesized that maternal depressive symptoms or maternal depression would increase the risk of asthma in children whose mothers have asthma. We examined this hypothesis using 2 different study populations: a cohort of Puerto Rican children living in San Juan, Puerto Rico and then a cohort of Swedish children. By replicating the study in 2 populations that differ in genetics, environmental exposures, socioeconomic factors, cultural practices, and diet, we hoped to decrease false positive findings and confounding bias.

Methods

Puerto Rican Cohort

Subject recruitment

Details on study design and subject recruitment have been previously reported.^{18,19} In brief, from March 2009 through June 2010, children were chosen from randomly selected households in the metropolitan area of San Juan, Puerto Rico using a multistage probability design. Primary sampling units were randomly selected neighborhood clusters based on the 2000 US Census, and secondary sampling units were randomly selected houses within each primary sampling unit. A household was eligible if at least 1 resident was a child 6 to 14 years old. In households with more than 1 eligible child, only 1 child was randomly selected for screening. Based on the sampling design, 7,073 households were selected and 6,401 (90.5%) were contacted. Of these 6,401 households, 1,111 had at least 1 child within the age range of the study who met other eligibility criterion (see below). To reach a target sample of approximately 700 children (which would provide $\geq 90\%$ power to detect an OR ≥ 2 for exposures with a prevalence $\geq 25\%$), we attempted to enroll a random sample ($n = 783$) of these 1,111 children. Parents of 105 of these 783 eligible households refused to participate or could not be reached. There were no significant differences in age, sex, or area of residence between parents of eligible children who did ($n = 678$ [86.6%]) and did not ($n = 105$ [13.4%]) agree to participate.

The main recruitment tool was a screening questionnaire given to parents of children 6 to 14 years old to obtain information about the child's general and respiratory health. We selected as cases children with parental report of physician-diagnosed asthma and wheeze in the previous year. We selected as control subjects children who had neither parental report of physician-diagnosed asthma nor wheeze in the prior year. All participants had to have

4 Puerto Rican grandparents to ensure their Puerto Rican descent. Of the 678 study participants, 655 (~97%) had complete information on maternal depressive symptoms and were included in the present analysis.

Study procedures

Study participants completed a protocol that included administration of questionnaires and measurement of height and weight. One of the child's parents (usually [$>93\%$] the mother) completed a questionnaire that was slightly modified from the one used in the Collaborative Study of the Genetics of Asthma.²⁰ This questionnaire was used to obtain information about the child's general and respiratory health, sociodemographic characteristics, and family history. In children, asthma was defined as physician-diagnosed asthma and wheeze in the previous year.

Maternal history of asthma was defined as a positive answer to the question, "Has the child's mother ever had asthma?" Maternal depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D), a 20-item questionnaire that has been widely used and validated for epidemiologic studies in the general population.^{21,22} The overall CES-D score is calculated by summing the scores for each item and ranges from 0 to 60 points.

Maternal depressive symptoms were considered present if the CES-D score was at least 21 points, an adequate cutoff score for significant depressive symptoms in Puerto Rican adults and an indicator of severe depressive symptoms in non-Puerto Rican adults.^{21,22}

Written parental consent was obtained for participating children, from whom written assent also was obtained. The study was approved by the institutional review boards of the University of Puerto Rico (San Juan, Puerto Rico; protocol 0160507), Brigham and Women's Hospital (Boston, Massachusetts; protocol 2007-P-001174/9), and the University of Pittsburgh (Pittsburgh, Pennsylvania; protocol PRO-10030498).

Statistical analysis

We used 2-sample t tests to compare pairs of binary and continuous variables and χ^2 tests for comparison of binary variables. A stepwise approach was used to build the multivariable logistic regression models of maternal depressive symptoms, maternal asthma, and childhood asthma. Because of their well-established association with depression and/or asthma, all final models included age, sex,²³ household income (less than vs at least \$15,000/y [near the median income for households in Puerto Rico in 2008–2009]),^{24–26} and early-life exposure (in utero or in the first 2 years of life) to environmental tobacco smoke (ETS).²⁷ Other covariates considered in the initial multivariate models included body mass index as a z -score (based on 2000 Centers for Disease Control and Prevention growth charts) and current exposure to ETS; these covariates were removed from the final models because they were neither associated with asthma at a P value less than .05 nor changed the parameter estimate (β) for maternal depressive symptoms by at least 10%. After the final multivariable models were built, we tested for a first-order interaction (on a multiplicative scale) between maternal depressive symptoms and maternal asthma on childhood asthma. Next, we examined the odds of childhood asthma in 4 subgroups: (1) no maternal asthma and no maternal depressive symptoms, (2) no maternal asthma but maternal depressive symptoms, (3) maternal asthma but no maternal depressive symptoms, and (4) maternal asthma and depressive symptoms. Additive interactions were examined using the Relative Excess Risk due to Interaction (RERI).²⁸

All statistical analyses were performed with SAS 9.4 software (SAS Institute, Cary, North Carolina).

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