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High Prevalence of Depression amongst Mothers of Children with Asthma

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congenital heart disease, acquired immune deficiency syndrome, neuropathy, and nephropathy.

The sample size was determined on the assumption that prevalence of depression was 35% among mothers of children with asthma and 12% among mothers of children without asthma (5, 6, 8). We recruited 2 non-exposed participants for each exposed participant, and our sample size calculation (power = 95%, alpha level = 0.05) determined that we would need to include at least 70 mothers of children with asthma and 140 mothers of children without asthma.

Measures

After obtaining informed written consent, the child's mother was interviewed by one of five appropriately trained investigators. Demographic and socioeconomic information as well as stressful life events (job loss, divorce, death of a loved one, and violent experiences) in the last 30 days were obtained from the mother using a standard questionnaire. Depressive symptoms were evaluated by an investigator-administered Portuguese version of the Beck Depression Inventory (BDI) (9). The BDI is a widely used and reliable 21-item multiple-choice rating inventory that measures characteristic symptoms and signs of depression in the preceding 2 weeks. Each item was rated on a four-point scale ranging from 0 to 3, with higher scores reflecting more severe depression. BDI scores that were higher than or equal to 16 were defined as the cut-off point for depression. This cut-off point has been widely used to identify depressive symptoms in a variety of populations (10–13).

Statistical Analysis

Data were entered into the Epi-Info version 6.4 database. Statistical analysis was performed using the intercooled Stata 9.2 for Windows (Stata Corporation, College Station, Texas, USA). Chi-square and Fisher's exact tests were used for cate-

gorical data, and the two-tailed unpaired Student's *t* test was used for continuous data when comparing the two groups. Childhood asthma as the risk factor for maternal depression was estimated by prevalence ratio (PR), that is, prevalence of maternal depression among mothers of children with asthma divided by prevalence of maternal depression among mothers of children without asthma. We used PR rather than odds ratio because the latter may produce inflated estimates of risk when the prevalence of the outcome is high, as in this study. Poisson regression was used to calculate crude PR and Poisson regression with robust variance was used to derive adjusted PR, controlling for the effects of potential confounders. For statistical analysis, the cut-off probability for rejecting the null hypothesis was defined as less than 5% ($p < 0.05$).

Results

We interviewed 80 mothers of children with asthma and 160 mothers of children without asthma. Table 1 summarizes the baseline characteristics of the study sample. There were no significant differences between the two groups of mothers in terms of demographic and socioeconomic factors. The low family income and low education level in both groups reflect the typical socioeconomic profile of the Brazilian population that uses the public health care service.

The prevalence of depression was higher among mothers of children with asthma than among mothers of children without asthma (43.8% vs. 17.5%, $p < 0.001$). After adjusting for all potential confounders, childhood asthma was an independent risk factor for maternal depression, with an adjusted PR of 2.52 (95% CI: 1.68–3.79) (Table 2).

Compared with mothers of children with intermittent asthma, mothers of children with persistent asthma had a higher prevalence of depression (62.8% vs. 21.6%, $p < 0.001$). The severity of childhood asthma was significantly associated with maternal depression (adjusted PR 2.77, 95%

TABLE 1.—Baseline characteristics of the study sample.

Characteristics	Mothers of asthmatic children (n = 80)	Mothers of non-asthmatic children (n = 160)	P value
Mean age, years (95% CI)	32.4 (31.1–33.6)	32.3 (30.4–34.2)	0.92
Race, n (%)			0.12
White	70 (87.5)	127 (79.4)	
Non-white	10 (12.5)	33 (20.6)	
Education level, n (%)			0.29
≤ 11 years	66 (82.5)	140 (87.5)	
> 12 years	14 (17.5)	20 (12.5)	
Employment status, n (%)			0.64
Full or part-time	35 (43.8)	65 (40.6)	
Not employed	45 (56.2)	95 (59.4)	
Monthly family income, R\$, n (%)			0.75
≤ 249	17 (21.3)	41 (25.6)	
250–599	41 (51.2)	79 (49.4)	
≥ 600	22 (27.5)	40 (25.0)	
Marital status, n (%)			0.32
Married	62 (77.5)	124 (77.6)	
Separated or divorced	17 (21.3)	29 (18.0)	
Widowed	1 (1.2)	7 (4.4)	
Practice of religion, n (%)			0.49
Yes	22 (27.5)	51 (31.8)	
No	58 (72.5)	109 (68.2)	
Stressful life events in the last 30 days, n (%)			0.63
Yes	51 (63.8)	107 (66.9)	
No	29 (36.2)	53 (33.1)	
Cigarette smoking, n (%)			0.67
Yes	21 (26.3)	39 (24.4)	
No	59 (73.7)	121 (75.6)	
Mean age of child, years (95% CI)	5.1 (4.53–5.64)	4.9 (4.59–5.36)	0.74
Mean number of siblings at home, (95% CI)	2.1 (1.89–2.25)	2.1 (1.82–2.36)	0.55

TABLE 2.—Association between maternal depression and childhood asthma.

	Asthmatic children n/N (%)	Non-asthmatic children n/N (%)	PR (95% CI) Crude	Adjusted*
Maternal depression	35/80 (43.8)	28/160 (17.5)	2.50 (1.52–4.11)	2.52 (1.68–3.79)

*PR adjusted for age, race, education, family income, employment status, marital status, cigarette smoking, religious practice, siblings at home, child's age, and stressful life events.

CI: 1.46–5.27) (Table 3). No significant association was observed between the duration of childhood asthma and maternal depression (Table 4).

DISCUSSION

This study demonstrated that the prevalence of depression was higher among mothers of asthmatic children than mothers of non-asthmatic children (43.8% vs. 17.5%). After adjusting for potential confounders, mothers of children with asthma were more than twice as likely to have depressive symptoms than mothers of children without asthma.

The prevalence of depression among mothers of children with asthma reported by two previous studies (5, 6) (45% and 38%, respectively) were comparable to the findings of this study (48%). This was despite differences in study populations, measures, and baseline values in the non-exposed groups. The cross-sectional nature of all three studies precludes a causal relationship from being established between asthma in the child and maternal depression.

Complex and possibly multiple pathways may be involved in the association between childhood asthma and maternal depression. The development of maternal mental health problems such as depression may be a direct result of the burden of caring for a child with a chronic disease such as asthma. (1, 2, 14). Conversely, maternal depression may be an etiological factor in the development of asthma in the child. Parental psychopathology may influence caregiver behaviors such as smoking, breast-feeding, or home hygiene, which in turn could potentially be risk factors for early asthma in the child (15, 16). Alternatively, parental mental illness may adversely impact on the infant stress response, which in turn could affect immune system function and promote airway inflammation and wheeze in early life (17). A shared genetic liability has also been postulated to explain the association between childhood atopic disorders and maternal psychopathology (18). Further prospective studies are needed to better understand the nature of the association between childhood asthma and maternal depression.

This study specifically addressed the association between severity and duration of childhood asthma and maternal

TABLE 3.—Association between maternal depression and severity of childhood asthma.

	Persistent asthma n/N (%)	Intermittent asthma n/N (%)	PR (95% CI) Crude	Adjusted*
Maternal depression	27/43 (62.8)	8/37 (21.6)	2.90 (1.32–6.39)	2.77 (1.46–5.27)

*PR adjusted for age, race, education, family income, employment status, marital status, cigarette smoking, religious practice, siblings at home, child's age, and stressful life events.

TABLE 4.—Association between maternal depression and duration of childhood asthma.

Duration, years	Maternal depression n/N (%)	PR (95% CI) Crude	Adjusted*
≤ 1	2/10 (20.0)	1.00	1.00
> 1-3	14/33 (42.4)	2.12 (0.48–9.33)	2.31 (0.61–8.72)
> 3-5	13/22 (59.1)	2.95 (0.67–13.09)	3.04 (0.78–11.87)
> 5	6/15 (40.0)	2.00 (0.40–9.91)	2.59 (0.56–12.01)

*PR adjusted for age, race, education, family income, employment status, marital status, cigarette smoking, religious practice, siblings at home, child's age, and stress life events.

depression. It found that mothers of children with persistent asthma were approximately three times more likely to present with depressive symptoms than mothers of children with intermittent asthma. It seems plausible that the more severe the childhood asthma, the greater the burden on maternal mental health. Alternatively, depressed mothers may be less able to manage their child's illness effectively, which could result in increased morbidity from childhood asthma.

There was no significant association between duration of childhood asthma and maternal depression, and this could be due to a double-edged effect. For some mothers, the impact of the child's illness on their mental health may decrease over time as they are able to adapt to the situation. But for others, the chronic and incurable nature of asthma in their child may increase the burden on their mental health over time.

Despite the uncertainty of the precise mechanism of the association between childhood asthma and maternal depression, pediatricians who attend asthmatic children should be aware of and alert to the possibility of maternal health problems and the potential negative impact that this may have on the management of childhood asthma. Further prospective studies could evaluate the effectiveness of interventions to treat maternal psychopathology on outcome of childhood asthma.

This study has two strengths. First, to our knowledge, this is the first study to provide substantial evidence regarding the relationship between severity and duration of childhood asthma and maternal depression. These data may be useful for understanding the nature of the association between childhood asthma and maternal depression. Additionally, the diagnosis and severity classification of asthma was made by a specialist, but not based solely on the parent's report of symptoms as in previous studies (2, 5, 6). Accurate diagnosis of asthma in this study may increase the validity of its conclusions.

The limitations of this study should also be considered when interpreting the results. We did not collect data regarding family history of depression or the mother's current health status. However as Table 1 shows, although these may act as confounders, no significant difference was found in any of the 11 baseline characteristics between the two groups of mothers. This suggests a homogeneous distribution of all the studied variables among the study population. From this one could infer that the distribution of potential confounders, such as family history of depression and maternal health status, could also be comparable between the mothers of children with asthma and the mothers of children without asthma. Moreover, this study demonstrated a strong association between childhood asthma and maternal depression and we

believe that the effects of the potential confounders may not significantly bias the results. As mentioned previously, the cross-sectional nature of this study does not allow us to make statements on causality. The study sample originated from a hospital-based population, so it may not be possible to extrapolate the results of this study to the community.

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