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Maria Beatriz Barreto do Carmo · Darci Neves Santos · Leila Denise Alves Ferreira Amorim · Rosemeire Leovigildo Fiaccone · Sergio Souza da Cunha · Laura Cunha Rodrigues · Mauricio L. Barreto

Minor psychiatric disorders in mothers and asthma in children

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Abstract *Objective* Recent studies have shown that asthma represents a major health issue not only in children of developed countries but also in urban centers in some middle-income countries. Brazil has one of the highest prevalences of asthma worldwide. Recently, interest has grown in the relationship between psychosocial factors and asthma. This article examines the relationship between maternal mental disorders and the prevalence of asthma in low-income children from an inner city area of Salvador in the state of Bahia, Brazil, and is part of the SCAALA program (Social Change, Allergy and Asthma in Latin America). *Patients and methods* A total of 1,087 children between the ages of 5 and 12 were investigated, together with their mothers. The mothers' mental health was evaluated using the SRQ-20, an instrument for the psychiatric screening of minor psychiatric disorders (depression, anxiety and somatic complaints). The prevalence of asthma was investigated using the ISAAC survey, a standardized, validated questionnaire for asthma and other allergic diseases. Cases were defined as asthma if the patient reported having had wheezing in the previous

12 months in addition to at least one of the following: having asthma, wheezing while exercising, waking during the night because of wheezing, or having had at least four episodes of wheezing in the previous 12 months. Atopy was defined as a positive skin prick test to allergens. *Results and conclusion* The presence of minor psychiatric disorders in the mothers was significantly associated with the presence of asthma in the children, and this association was consistent with all forms of asthma, irrespective of whether it was atopic or nonatopic. Future studies should be carried out to further investigate this association and the potential biological mechanisms involved. Programs for asthma control should include strategies for stress reduction and psychological support for the families of asthmatic children.

Key words minor psychiatric disorders – mothers – childhood asthma – SCAALA programme

Abbreviations SCAALA: Social changes, asthma and allergy in Latin America · ISAAC: International study of asthma and allergy in childhood · SRQ: Self report questionnaire · HPA: Hypothalamic-pituitary-adrenal · SPT: Skin prick test · GEE: Generalized estimating equations · ICC: Intraclass correlation coefficient

M.B. Barreto do Carmo (✉) · D. Neves Santos
S. Souza da Cunha · M.L. Barreto
Institute of Collective Health
Federal University of Bahia
Salvador, Brazil
Tel.: +55-71/3336-0695
Fax: +55-71/3336-0695
E-Mail: mariabeatrizbc@uol.com.br

L.D. Alves Ferreira Amorim · R.L. Fiaccone
Dept. of Statistics, Institute of Mathematics
Federal University of Bahia
Salvador, Brazil

L. Cunha Rodrigues
London School of Hygiene and Tropical Medicine
London, UK

Introduction

Asthma is a major health issue in children living in urban centers and results in an increasing burden to developed countries in terms of hospitalization. Recently, studies have indicated a similar burden in middle-income countries. Brazil has one of the highest prevalences of asthma worldwide [7]. The causes of asthma are not yet completely understood. In addition to a large body of research on the etiology of asthma ranging from genetic studies to the role of infections in early life, interest has recently grown

with respect to the relationship between psychosocial factors and asthma [4, 13, 16, 17, 19–21].

There is evidence that psychosocial factors are associated with a high prevalence and increased severity of asthma [4, 13, 17]. Proposed mechanisms behind these associations include maternal mental health problems that lead to poor management of the child's asthma [17] such as difficulties in complying with treatment regimens. Moreover, evidence suggests that psychosocial factors may play a more direct role in the expression of asthma in children. The behavioral and emotional changes activated by contact with stressful events may be capable of triggering a series of neuroendocrine and immunological changes involved in allergic inflammation [22]. Studies carried out in animals suggest an effect of prenatal stress and contact with stressful situations in early infancy in programming the hypothalamic-pituitary-adrenal (HPA) axis of the child with consequent deregulation of the immune system and implications for the development of asthma [23].

The protocol of the present study was developed due to the worldwide relevance of this subject and this unique opportunity to investigate the relationship between maternal psychological symptoms as an indicator of stress and the expression of asthma in a developing country population. In the cross-sectional study reported here, the association between minor psychiatric disorders and the presence of asthma was investigated using standardized instruments and controlling for potential confounders.

Patients and methods

Site and study design

This is a cross-sectional survey undertaken as part of the social changes, asthma and allergy in Latin America (SCAALA) programme [2] conducted in the city of Salvador in the state of Bahia, Brazil in 2006. The SCAALA project was composed of a set of research activities carried out in Brazil and Ecuador. In Brazil, the principal objective of the study was to investigate the association between the prevalence of asthma and other allergic diseases and potential risk factors such as early exposure to infections and environmental, nutritional, immunological and psychosocial factors [2]. The study population was selected by randomized sampling, and recruited from 24 geographical micro-regions representative of the population resident in areas of Salvador which had recently undergone the installation of basic sanitation.

Participants

Of the 1,445 children of both sexes, aged 5–12 years, and their respective mothers, who participated in the SCAALA programme, 1,087 participated in the present study. Three hundred and fifty-eight children were excluded, 66 due to missing data on common mental disorders in their mothers and 292 because the person who answered the study questionnaires was not the mother of the child. Of the 358 excluded, information on three study variables was missing for 28 individuals: 2 relating to the presence of mould, 12 to maternal schooling and 14 to maternal asthma. Three hundred and thirty of

the excluded children were therefore compared to participating children and no difference was found between these two groups in relation to potential confounding variables (data not shown).

Main outcome

Asthma

Maternal report of asthma in the children was ascertained using the questionnaire standardized by the international study of asthma and allergies in childhood (ISAAC), which had been previously validated for use in Brazilian Portuguese in a sample population of Brazilians [2]. The survey was carried out during home visits conducted between June and October, 2005.

The child was classified as asthmatic if he/she was defined according to the ISAAC questionnaire as having had wheezing in the previous 12 months as well as at least one of the following factors: asthma at some time in their lives, chest wheezing during or after exercise in the previous 12 months, at least four crises of chest wheezing and waking up during the night due to wheezing at least once a week in the last 12 months.

Atopic and nonatopic asthma

Suspected cases of asthma were classified with respect to atopy using the skin prick test (SPT). Cases were considered positive if the mean of the two larger perpendicular diameters of the reaction was at least 3 mm greater than the mean of the two larger perpendicular diameters of the negative control reaction area [2]. Children were 7 ± 1.69 years old (mean \pm SD) when they were tested for the following antigens: *Dermatophagoides pteronyssinus*, *Blomia tropicalis*, *Blattella germanica*, *Periplaneta americana*, *fungi*, *dog and cat epithelia* [2].

Measures

Main exposure

Common mental disorders: Psychologists and psychology students administered the self report questionnaire (SRQ-20) during an in-home interview. This instrument was developed by the World Health Organization [18] and validated in Brazil by Mari and Williams [12]. It is composed of 20 questions with dichotomous (yes/no) answers referring to the presence or absence of symptoms of depression, anxiety and somatic disorders in the previous month. A cut-off point for the definition of suspected cases of minor psychiatric disorders was established as 8 or more positive answers, a condition that, although not characterizing a psychiatric diagnosis, indicates significant psychic suffering. This cut-off point was defined in accordance with studies previously carried out in Brazil [6]. One such study reported sensitivity of 85% and specificity of 80% for this instrument, the gold standard being a psychiatric interview [12]. These data were collected between January and November, 2006 and at the time of this survey the children were aged between 5 and 12 years.

Potential confounders

These included information on the sex and age of the child, the mother's education level, history of maternal asthma, the presence of damp or mould in the home (inspected by the interviewers) and child contact with dogs and cats. This information was supplied by

the child's care-giver using the standardized questionnaire. These data were collected in the year 2005 during the same period in which the data on asthma and respiratory problems were collected.

These confounding variables were selected on the basis of previous studies that showed their association with asthma. For example, asthma was shown to be one of the most frequent chronic diseases in the parents of children who suffer from this condition [11]; in addition, there is a tendency towards a low education level in the parents of asthmatic children [9]. Asthma has also been associated with the male sex, particularly in younger age-groups [11]. With respect to environmental risk factors, the presence of domestic animals and exposure to mould in the home are factors that have also been associated with this condition [5, 15].

Data management and analysis plan

The data were double-entered into the Epi Info software program, version 6.0, in order to reduce consistency errors. Univariate analysis was performed to compare the prevalence of asthma according to the variables of interest. Generalized estimating equations (GEE) were considered in accounting for the potential cluster effect due to the sampling design of the study [1, 8, 10, 14, 24]. Odds ratios (OR) and their 95% confidence intervals (CI) were estimated with GEE. Confounding variables were considered to be present when the measurement of association of the complete model and that of the reduced model differed by 10% or more. In this analysis, suspected cases of asthma ($n = 290$) were compared to the rest of the sample ($n = 797$). Similar analyses were conducted to evaluate the effect of maternal mental illness on atopic and nonatopic asthma.

A secondary analysis was performed using only children who had never reported wheezing in their lives ($n = 467$) as a reference group and following the same pattern of analytic procedures previously described. The intraclass correlation coefficient (ICC) was calculated using the ANOVA estimator, with the between and within variances estimated from a one-way random-effects ANOVA model.

The estimated intraclass correlation coefficient (ICC) was 9.3×10^{-8} , indicating a lack of correlation in the occurrence of asthma in children living in the same micro-region (neighborhoods).

The Stata software program, version 9.0, was used for data analysis.

Ethical considerations

The protocol used in this study was approved in 2004 by the Internal Review Board of the Federal University of Bahia and by the appropriate regulatory authorities of the Brazilian Ministry of Health. Informed consent forms were signed by the legal guardian of each subject. All relevant clinical results were sent to the subjects' caregivers and specific recommendations were made by a trained clinician in each case. The caregivers who were found to have severe symptoms of mental distress or who spontaneously requested psychological support were advised to seek help within the public mental healthcare service network.

Results

According to the criteria used, the prevalence of asthma in the sample ($n = 1,087$) was 26.6% ($n = 290$). Of the mothers, 37.4% (406/1087) were found to be positive for common mental disorders. In

the univariate analysis, higher prevalence rates of asthma were found among male children (27.3%) and among those 7 years of age or younger (29.7%). The prevalence of asthma was higher among children whose mother was positive for common mental disorders (35.2%), for mothers with a lower education level (35.1%), and among those with a positive history of asthma (41.6%). Higher prevalence rates of asthma were also found in homes with damp or mould (29.2%) and in those with dogs or cats (28.4 and 30.2%, respectively). A statistically significant difference was found in the prevalence of asthma according to age and a maternal history of asthma (Table 1).

The logistic regression results were adjusted for all the covariables in the model. An OR of 1.78 (95% CI: 1.34–2.35) was found for the association of common mental disorders and asthma in children (Table 1). When the analysis was repeated considering only those children who reported no wheezing during their life ($n = 467$) as a reference group and excluding those who had wheezing in the previous 12 months but who had not had any of the other four criteria used to define cases, the association between common mental disorders in the mothers and asthma in the children became stronger: OR 2.08 (95% CI: 1.52–2.86) (data not shown).

A further analysis was carried out in which atopic and nonatopic asthma were considered as end-points. In this analysis, of the suspected cases of asthma ($n = 290$) nine individuals were withdrawn because

Table 1 Prevalence and odds ratio of asthma in accordance with associated factors

Associated factors	Asthma		
	N (%)	Non-adjusted OR (95% CI)	Adjusted OR (95% CI)
Maternal mental health			
Suspect	406 (35.2)	1.97 (1.50–2.59)	1.78 (1.34–2.35)
Not suspect	681 (21.5)		
Potential confounders			
Sex			
Male	575 (27.3)	1.08 (0.82–1.42)	1.11 (0.84–1.47)
Female	512 (25.9)		
Age			
≤7 years	784 (29.71)	1.83 (1.36–2.45)	1.69 (1.22–2.36)
≥8 years	303 (18.3)		
Maternal education			
Primary school	145 (35.1)	0.78 (0.63–0.96)	0.75 (0.60–0.93)
High school or equivalent	608 (26.4)		
At least college	334 (23.3)		
Maternal asthma			
Yes	96 (41.6)	1.97 (1.27–3.04)	2.00 (1.29–3.12)
No	991 (25.2)		
Mould			
Yes	714 (29.2)	1.46 (1.08–1.96)	1.37 (1.01–1.86)
No	373 (21.7)		
Presence of pets (cats)			
Yes	96 (30.2)	1.14 (0.71–1.81)	1.07 (0.66–1.73)
No	991 (26.3)		
Presence of pets (dogs)			
Yes	246 (28.4)	1.11 (0.81–1.53)	1.04 (0.75–1.45)
No	841 (26.1)		

Table 2 Prevalence and odds ratio of atopic and nonatopic asthma in accordance with maternal mental health

Atopic asthma			
	N (%)	Non-adjusted OR (95% CI)	Adjusted OR (95% CI)
Maternal mental health			
Suspect	406 (12.3)	1.77 (1.75–2.67)	1.72 (1.13–2.62)
Not suspect	681 (7.3)		
Nonatopic asthma			
	N (%)	Non-adjusted OR	Adjusted OR ^a
Maternal mental health			
Suspect	406 (22.4)	1.89 (1.37–2.61)	1.66 (1.19–2.32)
Not suspect	681 (13.2)		

^aAdjusted for the same associated factors as in Table 1

no information was available regarding atopy (skin test results). Of the suspected cases of asthma considered in this analysis ($n = 281$), 34.4% were found to have atopic asthma ($n = 100$) and 62.4% nonatopic asthma ($n = 181$). In the logistic regression carried out using GEE, an OR of 1.72 was found (95% CI: 1.13–2.62) for the association between common mental disorders in the mothers and atopic asthma (Table 2). With respect to nonatopic asthma, logistic regression using GEE showed a measurement of 1.66 for the association between nonatopic asthma in the children and common mental disorders in the mothers (95% CI: 1.19–2.32) (Table 2).

Discussion

These results showing a higher prevalence of asthma in children whose mothers are suspected of having more mental health problems are consistent with findings reported in the literature. The results were adjusted for potential confounding variables.

Another two studies have also reported an increase in the severity of asthma associated with maternal mental disorders. Ortega et al. [13] found an association between maternal mental disorders including depression, and a history of asthma crises in children, as reported by their parents. Weil et al. [17] found an association between mental disorders among caregivers and a greater number of days of hospitalization among asthmatic children. One possibility that may explain this result refers to the fact that mothers with common mental disorders have more difficulties with the child's treatment, care and adherence to treatment schedules, thereby increasing the severity of the disease.

In addition, in the present study, common mental disorders in the mothers were associated both with atopic and nonatopic asthma according to the results obtained in the skin prick test (SPT). In this study, the data on atopy and its consequent association with

maternal mental health should be analyzed with caution, bearing in mind that the literature describes predisposition to an IgE-mediated inflammatory response even in individuals classified as nonatopic according to the SPT, implying that this technique is ineffective in detecting this type of inflammatory response [3].

The fact that the data on respiratory problems were collected prior to collecting the data on maternal mental health constitutes another limitation of this study; however, we opted for the opportunity to conduct a multidisciplinary research program on a topic that is highly relevant and inadequately studied in this region.

In view of the complexity of the factors analyzed and considering the reciprocity among them, the present study is unable to establish whether the relationship between minor maternal psychiatric disorders and asthma is the result of increased perception and reporting by mothers, or whether it reflects an increase in maternal mental health problems caused by the child's asthma or an increase in the severity or the incidence of asthma as a consequence of the mother's mental health problems. If the latter is the case, then the only plausible mechanism that has been suggested so far is that maternal mental health problems may cause stress in the child leading to a disturbance in its hypothalamic-pituitary-adrenal axis, resulting in an increased prevalence of asthma.

Further research is required to establish the direction of causality. If the relationship is causal, investigating mechanisms, both psychological and biological, that could mediate such a relationship would be of great interest. A recent review on the relationship between psychosocial factors and atopic diseases [4] indicated a positive association between psychosocial factors and future atopic disease, as well as between atopic disease and subsequent mental health problems. Moreover, when groups of healthy individuals were compared with atopic populations, the psychosocial factors were presented as part of the etiology and also as a consequence of atopic disorders. A study carried out by Shalowitz et al. [16] found a greater prevalence of depressive symptoms among mothers of asthmatic children compared to mothers of non-asthmatic children. In this study, the authors were interested in investigating the role of asthma in children as a risk factor for symptoms of depression in the mothers.

Nonetheless, irrespective of the direction of this association, greater attention should be given to the effect of psychosocial factors on the development of asthma in children. The findings of this study support results of previous studies, with the advantage that this study was carried out in a population representative of a developing country, unlike the majority of other studies that were conducted in developed urban centers, showing that these findings are broadly generalizable. It is our recommendation that clinicians

should be made aware of this relationship in order to identify families at risk and encourage more effective clinical decisions including recommending family interventions. Integrating pediatric services with psychological healthcare services or maintaining multidisciplinary teams that include the presence of psychologists to aid diagnosis and refer and treat family members and children may options that enable an overall integrated management of asthma.

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