



Are maternal and community risk factors associated with the presence of asthma among children placed in foster care?

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ABSTRACT

Objective: The occurrence of pediatric asthma has been associated with exposure to chronic stress. This study examined the relationship between maternal and community risk factors and asthma in a sample of maltreated children in foster care.

Method: Interviews were conducted with 365 maltreated children in foster care. Measures included youth/caregiver reports of asthma, an index of maternal risk based on data abstracted from child welfare records and community violence exposure.

Results: After controlling for demographic variables, maternal risk was associated with the presence of asthma (OR = 1.314, 95% CI = 1.09–1.58). Community violence exposure, however, was not related to the presence of asthma.

Conclusion: Maternal risk factors were significantly associated with the presence of asthma in a foster care population. Physicians who care for maltreated children in foster care should be particularly attuned to the presence of these additional risk factors that may place high-risk children at increased risk for chronic health problems.

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1. Introduction

Asthma is one of the leading causes of pediatric hospitalization (Valentine et al., 2000), affecting approximately seven million children in the US at one time (US Department of Health and Human Services, 2010). Due to the high burden of illness, it is important to accurately identify risk factors for asthma. While there are many variables that play a role in the pathogenesis of asthma, this health condition is linked to chronic stress via a variety of proposed mechanisms (Wright, Cohen, & Cohen, 2005). One theory is that in an already genetically-susceptible population, the addition of adverse environmental and psychosocial factors may contribute to the presentation of asthma (Kaugars, Klinnert, & Bender, 2004). Extensive research has demonstrated that chronic family stress, especially in the prenatal or early childhood period, has a significant impact on children's later health. It is this early exposure to chronic stress that appears to have long-lasting effects on important physiological systems and which may contribute to the development of asthma (Wright, 2011). Given that high-stress environments seem to play such an important role in the pathogenesis of asthma, one population that would seem to be at particularly high risk is children who have

been removed from their homes due to maltreatment and placed in foster care.

It is well-documented that children in foster care have elevated rates of health problems and estimates of chronic medical conditions range from 40 to 76% (Hochstadt, Jaudes, Zimo, & Schachter, 1987; Schor, 1982; Takayama, Wolfe, & Coulter, 1998). In comparison, the US Department of Health and Human Services estimates that between 2 and 16% of children in the general population are in fair/poor health (US Department of Health and Human Services, 2010). Asthma is one of the most frequent chronic physical health conditions of children in foster care (Jee et al., 2006; Leslie et al., 2005). It is hypothesized that children in foster care may be at a higher risk of developing stress-related sequelae such as asthma because of their history of abuse and neglect and because they have been exposed to other stressors frequently associated with maltreatment (Repetti, Taylor, & Seeman, 2002). Some of these stressors include exposure to a dysfunctional home environment and to community violence.

Repetti et al., 2002 concluded that there is strong evidence of a link between physical health problems and childhood exposure to "risky" family environments that are characterized by abuse, neglect, instability, aggression, and conflict. More specifically, family dysfunction, particularly maternal dysfunction, has been hypothesized to be associated with the course of pediatric asthma (Kaugars et al., 2004). Family and maternal risk factors are likely to increase children's exposure to environmental stress which puts them at risk for the development of asthma and for asthma exacerbations. Risk factors include

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parental mental illness, family violence, and children's exposure to criminal activity. While some studies have shown an association between maternal psychiatric illness and child asthma (do Carmo et al., 2009; Kaugars et al., 2004), the relationship between other maternal risk factors, such as criminal activity or domestic violence, and child asthma has not been as well documented. In addition to the home environment, there may be circumstances outside the family such as living in a violent area, which promote high levels of stress. For example, studies conducted with high-risk samples have documented an association between asthma and community violence, even after controlling for other potential confounds, such as socioeconomic status and ethnicity (Gupta et al., 2010; Sternthal, Jun, Earls, & Wright, 2010).

The current study sought to examine the association between maternal and community risk factors and rates of asthma in a maltreated, foster care sample. We hypothesized that many of the same maternal and community risk factors found in studies with other high risk samples would be associated with asthma prevalence in a maltreated, foster care sample.

2. Materials and methods

2.1. Participants

Each summer, from 2002 to 2009, children 9–11 years of age who entered foster care in a large, metro area over the prior year were recruited to participate in a randomized controlled trial of a prevention program (see Taussig, Culhane, & Hettleman, 2007, for a description of the program). Children and their caregivers were invited to participate if youth met five criteria: 1) they had been court-ordered into foster care within the preceding 12 months, 2) the court order was due to maltreatment, 3) they remained in foster care at the time of the baseline interview, 4) they were not monolingual Spanish speakers, and 5) they were not known to be cognitively impaired. If multiple siblings were interviewed, one was selected at random to be included in the current study. Ninety-one percent of the eligible children and their caregivers were successfully recruited. The study protocol was approved by the University's Institutional Review Board and informed assent and consent were obtained from each participant and his/her legal guardian. This study analyzed baseline data collected during the recruitment period (pre-randomization) and included interviews with 365 children and their caregivers.

2.2. Measures

2.2.1. Asthma prevalence

Youth responded yes/no to the question "Do you have any physical health problems that you've had for a long time (chronic)?" If they responded 'Yes' participants were asked to identify their health problem(s) in an open-ended fashion. Similarly, the child's caregiver (e.g. foster parent) at the time of interview was also asked if their child had any "illness or disability" and was then asked to specify those conditions. If, in response to the open-ended questions, either the child or the caregiver (or both) reported "asthma," the child was coded as having asthma. Both caregivers' and children's reports were used to determine asthma status in the child because foster parents may not have known the asthma status of a child newly placed in their care, and children may not have understood the phrase "physical health problems." Chronic health conditions were assessed using similar methodology in the National Survey of Child and Adolescent Well-Being (Jee et al., 2006).

2.2.2. Maternal risk factors

Two trained research assistants consensus coded county Dependency and Neglect petitions and caseworker-written social histories for the presence of nine maternal risk factors. The maternal risk

factors were chosen based on exposures that would be likely to increase the level of household stress the child was exposed to while living with his/her biological mother. The prevalence was highest for maternal controlled substance use (66.0%), followed by criminal history (57.3%), domestic violence exposure (55.6%), mental illness (37.5%), alcohol abuse (33.7%), housing issues (32.1%), incarceration (21.6%), maltreatment exposure (20.3%), and having a history of foster care involvement as a child (6.8%). A cumulative Maternal Risk Index was created by summing the binary risk factors, as has been shown to be predictive in other studies with this population (Raviv, Taussig, Culhane, & Garrido, 2010).

2.2.3. Community violence exposure

Youth completed an adapted, eight-item version of the validated "Things I have Seen and Heard" scale to report on their exposure to community violence (Richters & Martinez, 1993). This scale quantifies the level of neighborhood and community violence children are exposed to. They were asked to indicate the number of times (0 = never to 4 = four or more times) in the past year they had seen/heard each of the following: *guns being shot; somebody gets arrested; somebody being beaten up; drug deals; somebody gets threatened; gangs in the neighborhood; own house broken into; somebody steals something from a store or another person's house.* The most frequent types of witnessed violence included seeing someone get arrested ($M=2.12$ times), seeing someone beaten up ($M=1.53$ times) and hearing gunshots ($M=1.43$ times). The community violence score was created by taking the mean of all eight responses.

2.3. Statistical analyses

2.3.1. Bivariate analyses

T-test and chi-square analyses were used to examine the relationships between the presence of asthma and demographic variables, including age, gender, and ethnicity. Because ethnicity was not exclusively coded, three separate race/ethnicity variables were included in the analyses: Caucasian (Y/N), Hispanic (Y/N) and African American (Y/N).

2.3.2. Multivariate analyses

Multivariate analyses were performed to examine the relationship between self-reported asthma and maternal risk factors as well as between self-reported asthma and community violence exposure. The results of the multivariate equations are shown in Table 1.

Table 1

Multivariate regression analysis of the relationship between Maternal Risk Index, community violence and asthma.

Variables	OR	95% CI
<i>Controls and Maternal Risk Index</i>		
Age	1.12	0.77–1.63
Gender	1.016	0.53–1.96
African-American	1.51	0.68–3.38
Hispanic	1.16	0.59–2.23
Caucasian	1.25	0.60–2.60
Maternal Risk Index*	1.31	1.09–1.58
<i>Controls and community violence</i>		
Age	1.13	0.78–1.63
Gender	1.07	0.59–2.05
African-American	1.38	0.62–3.06
Hispanic	1.14	0.57–2.26
Caucasian	1.24	0.60–2.55
Community violence exposure	1.004	0.69–1.47

Abbreviation: OR, odds ratio; CI, confidence interval.

* $p<0.005$.

3. Results

3.1. Sample characteristics

The mean age of participants was 9.84 years ($SD=0.91$) and half of the sample (50.1%) was female. Half (51.5%) of the participants were Hispanic, 26.8% were African American and 50.7% were Caucasian (non-exclusive categories). The types of maltreatment precipitating children's placement in foster care included: supervisory neglect (80.5%), physical neglect (50.1%), emotional abuse (63.3%), physical abuse (28.8%), and/or sexual abuse (11.2%). The majority of children (79.5%) experienced multiple types of maltreatment. Children had been in foster care an average of 7.26 months at the baseline interview.

Eleven percent (11.5%, $n=42$) of children in the study were reported to have asthma by either youth or caregiver report. As expected, there was only moderate concordance between children's and caregiver's reports ($\kappa=0.56$). There were no significant differences between rates of asthma as a function of gender, age or ethnicity. However, to be conservative, the demographic variables were all entered as control variables in the multivariate analyses.

3.2. Maternal risk factors

The Maternal Risk Index had a range of 0–8 with a mean of 3.31 ($SD=1.83$) risk factors. The results of the multivariate equations are shown in Table 1. Binary logistic regression examined whether the Maternal Risk Index was associated with asthma after controlling for age, gender and ethnicity. The Maternal Risk Index significantly predicted the presence of asthma ($OR=1.314$, 95% $CI=1.09$ – 1.58 , $p=0.004$) over and above the control variables and accounted for 5.4% of the variance. A graph of the relationship between maternal risk factors and child asthma is shown in Fig. 1.

3.3. Community violence exposure

The community violence exposure variable had a range of 0–3.75 with a mean of 1.14 (SD of 0.87). Four youth did not complete all community violence exposure questionnaire items and they were dropped from the community violence exposure analysis. In a second binary logistic model, mean community violence exposure and the control variables were entered as predictors. Community violence exposure

was not a significant predictor of asthma over and above the control variables.

Finally, to examine whether community violence exposure moderated the effect of maternal risk factors on asthma, the interaction between exposure to community violence and maternal risk was included in a model. After controlling for age, gender and ethnicity, the interaction was non-significant. None of the control variables were significant in any of the multivariate models.

4. Discussion

The objective of this study was to determine if the presence of factors that may increase stress, such as exposure to maternal risk factors and community violence, increases the odds of having asthma in an already high-risk population of maltreated children placed in foster care. The rate of asthma in the current study was 11.5% which is comparable to the rate of asthma (9.8%) found in foster children in the National Survey of Child and Adolescent Well-Being (Jee et al., 2006). The presence of maternal risk factors (substance abuse, criminal history, etc.) was significantly associated with child asthma, however, community violence was not related to an increased risk of asthma. Further, as the number of maternal risk factors increased, the likelihood of having asthma rose roughly in a linear fashion.

The literature offers some possible explanations for the relationship between a high Maternal Risk Index (stress) and asthma. One theory is that stress may play a role in the onset of asthma by impairing the body's ability to adapt to perceived external and internal stress (McEwen, 2008). It does so by altering the cardiovascular, metabolic, and immune systems as well as activating the hypothalamic–pituitary–adrenal (HPA) axis. Chronic stress can lead to allostatic load which is essentially a dysfunction of these systems and an inability to further respond to stress in an adaptive manner (Logan & Barksdale, 2008). Dysregulation of these systems, in particular the HPA axis, the sympathetic and adrenomedullary (SAM) system and various immunomodulators, is among the many proposed mechanisms for the development of atopic illness, such as asthma (Wright et al., 2005).

Another possible explanation for the observed relationship between high scores on the Maternal Risk Index and reported asthma could be that our Maternal Risk Index is a surrogate for neonatal exposure to high maternal stress. Research suggests that perinatal exposure to many of the risk factors discussed, such as substance use, maternal psychopathology, or trauma, can have a dramatic impact on childhood development and that the effects may persist for many years (Wright, 2011). Moreover, prenatal exposure to substances also leads to a higher incidence of premature births; chronic lung disease, which often accompanies premature birth, may lead to childhood asthma.

While we were unable to assess maternal rates of poverty and the role that this risk factor may have played in the development of asthma in their offspring, the majority of children that come to the attention to the child welfare service come from very low-income families (Cancian, Slack, & Yang, 2010). This has implications for the housing environment these children grew up in, as children who live in poverty are more likely to be exposed to asthma triggers (such as dirt, pollution, etc.) which could contribute to developing or exacerbating existing asthma conditions. In fact, research has shown that rates of asthma among homeless children are about three times higher than the national average, suggesting that the environment in which these children live has a huge impact on their health status (Cutuli, Herbers, Rinaldi, Masten, & Oberg, 2009). Our study was unable to assess children's exposure to poor housing conditions or second-hand smoke, but we recognize that these may have played a role in the development of asthma and that in some respects, the Maternal Risk Index may serve as a surrogate marker for many of these risk factors.

In contrast to previous studies regarding pediatric asthma, race/ethnicity was not a significant predictor of reported asthma in this sample. Prior research has shown that asthma is most prevalent in

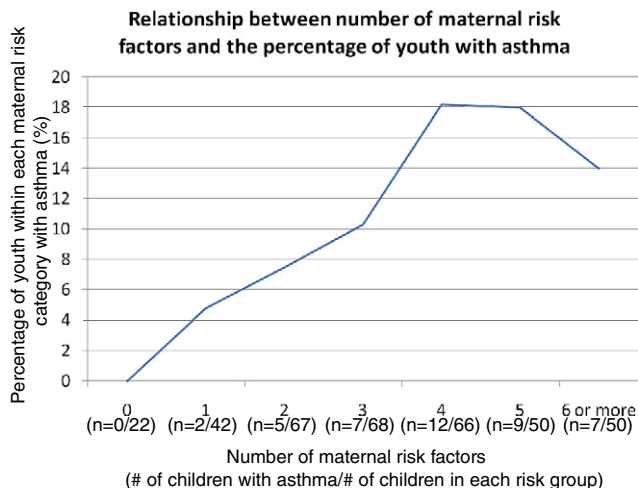


Fig. 1. Relationship between the Maternal Risk Index score and the percentage of youth with reported asthma.

non-Hispanic black children whose family income is less than half the poverty level, and that racial differences remain even after controlling for socioeconomic status (Miller, 2000; Smith, Hatcher-Ross, Wertheimer, & Kahn, 2005). Associations between neighborhood crime and the prevalence of asthma have also been demonstrated, after controlling for socioeconomic status and ethnicity (Gupta et al., 2010). While we were unable to examine the impact of socioeconomic status in the current study, it is interesting that our analyses did not replicate what other studies have found in regard to the association between asthma and race/ethnicity or community environment. One hypothesis is that because children in foster care are already at such high risk for chronic health problems, race/ethnicity and neighborhood environment may not explain any additional variance. Contrary to this hypothesis, however, was the finding that the maternal risk factors did demonstrate an association with reported asthma in the current study; the variance they accounted for, however, was small. Further studies should seek to examine these relationships, and their underlying mechanisms, more closely.

Strengths of the current study include a high recruitment rate (thereby enhancing generalizability) and the use of multiple methods for collecting data (i.e., youth and caregiver reports as well as records abstraction). While there was no physician verification of the asthma diagnosis, previous research has demonstrated that children and their caregivers are able to reliably report on asthma symptoms (as assessed by the Pediatrics Quality of Life inventory) (Seid et al., 2010). Another strength of the study is that the maternal risk factors were not self-reported variables but instead were documented by an independent party (Department of Human Services' caseworkers) for the initial purpose of a court hearing.

Despite these strengths, the study was limited by the lack of measurement of the severity of the children's asthma and asthma exacerbations. A stressful home environment may not only influence the pathogenesis of chronic illness but also asthma severity and exacerbations. Future studies should aim to examine these relationships more closely. Another limitation of the current study is that children recently placed into foster care may have undiagnosed medical problems due to unmet medical needs prior to placement in foster care. Therefore, the health problems reported are most likely an underestimate and may include more of the severe cases that had received medical attention. In addition, this study utilized a cross-sectional design and therefore no inferences can be made as to cause and effect; by study design, the findings are limited to association only. Finally, our understanding of each child's exposure to stress in utero is limited and therefore it is possible that we are measuring the sequelae of events that occurred a decade prior.

5. Conclusion

Nevertheless, what is important is that in an already vulnerable, maltreated population, exposure to an increased number of maternal risk factors prior to removal is associated with higher rates of reported asthma. Next steps include exploring the relationship of perceived stress to asthma and determining if children's coping strategies mediate the impact of stress on asthma exacerbations. It will also be important to repeat the study with physician-verified diagnoses of asthma as well as employ administrative records from health-care providers to determine whether high stress environments have an impact on asthma exacerbations. This potentially serves as an opportunity for intervention by health professionals who treat maltreated children. For those children whose maternal history is fraught with incarceration, abuse, or mental illness, health care workers should be especially diligent in assessing these children for asthma.

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