ARTICLE

Behavior Problems Among Inner-City Children With Asthma: Findings From a Community-Based Sample

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ABSTRACT

OBJECTIVE. Previous studies have suggested a relationship between childhood asthma and behavior problems. However, few studies have used community-based samples to assess the prevalence of behavior problems among urban children with asthma symptoms. The objective of this study was to evaluate the relationship between asthma symptoms and behavior among a population-based sample of inner-city children and to determine the prevalence of behavioral comorbidity among children with asthma symptoms.

METHODS. In 2003, parents of children who were entering kindergarten in the city of Rochester completed a detailed survey regarding the child's background, medical history (with specific questions about asthma symptoms), and behavior. We compared children with no asthma symptoms, intermittent symptoms, and persistent symptoms with regard to positive peer social skills (eg, makes friends easily), negative peer social skills (eg, fights with other children), task orientation (eg, concentrates well), and shy/anxious behavior (eg, is withdrawn) (validated scales; range: 1–4). We used multivariate regression to determine the independent association between symptom severity and behavioral outcomes.

RESULTS. A total of 1619 children were included (response rate: 80%; mean age: 5.1 year), and 15% had asthma symptoms (8% persistent, 7% intermittent). Average negative peer scores were worse for children with persistent asthma symptoms compared with children with intermittent and no symptoms (mean scores: 1.88, 1.70, and 1.65). Children with persistent symptoms also scored worse than children with no symptoms on the assessment of task orientation (2.85 vs 3.03) and shy/anxious behavior (2.11 vs 1.89). Among children with persistent asthma symptoms, >20% scored >1 SD below average on 2 or more scales, compared with 16% of children with intermittent symptoms and 10% with no symptoms.

CONCLUSIONS. Urban children with persistent asthma symptoms demonstrate more behavior problems across several domains compared with children with no symptoms. These findings suggest a clear need for an early biopsychosocial approach to care for vulnerable children with asthma.

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Abbreviation
PACE—Parent's Appraisal of Children's Experiences

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Asthma is the most common chronic illness of childhood,[1–3] and hospitalization rates are increasing.[4–6] In the United States, impoverished children and children from minority ethnic and racial backgrounds suffer disproportionately from asthma.[7–13] The morbidity associated with asthma is extensive and includes emergency department visits,[6,14,15] hospitalizations,[4,5,16] and cost,[17,18] as well as less traditional factors, including impaired quality of life[19] and absenteeism.[20] In addition, co-existing medical conditions[21–23] as well as psychiatric conditions[24,25] now are considered issues that both children and adults with asthma face.

Several studies have documented the relationship between asthma and psychosocial problems, with the suggestion that significant comorbidity exists for some children. A recent meta-analysis[26] demonstrated that children with asthma, particularly children with significant symptoms, have a higher level of behavioral difficulties compared with healthy children. However, many of the studies included in this analysis were from selected samples of school-aged children from outpatient clinics, specialty clinics, and inpatient hospital units, thus limiting the ability to generalize these findings to young children in the general community. The extent of the comorbidity related to behavioral issues in young children with asthma is not well described.

The prevalence of behavioral difficulties among young inner-city children with asthma is important to document for several reasons. First, because this group is at risk for significant asthma morbidity, behavioral difficulties may be common.[26] Second, young urban children are the least likely group to receive appropriate preventive medications,[27–31] and behavioral and psychosocial stresses may impede the family's ability to adhere to treatment recommendations.[32] Thus, the identification and treatment of concomitant behavioral problems among these children potentially could lead to improved preventive care. Last, multiple issues such as family stress, poverty, and poor access to health care often challenge inner-city families, making the identification and treatment of additional stresses a priority.

The objective of this study was to evaluate the relationship between childhood asthma symptoms and behavior problems among a community-based sample of inner-city children and to determine the prevalence of behavioral comorbidity among children with asthma symptoms. This study is unique because we included young children from an entire urban school district to obtain a true community-based sample. In addition, we considered several important potentially confounding variables in our analysis.

METHODS

Study Design

We used a cross-sectional survey to obtain data from all children who were entering kindergarten in the Rochester City School District. The survey, called the Parent's Appraisal of Children's Experiences (PACE), was developed by a not-for-profit organization called the Children's Institute in collaboration with the Monroe County Department of Health and the Rochester City School District. The University of Rochester Institutional Review Board and the Rochester City School District's Department of Research, Evaluation, and Testing approved the study protocol.

PACE Survey

In 2003, parents of children who were entering kindergarten in the city of Rochester, NY, completed a detailed health and development survey regarding the child's demographic background, medical history, and behavioral functioning. This survey was developed to augment existing standard kindergarten screening with a parent perspective of their child's skills, health status, and family situation. The school district asked the family or another caregiver to complete the PACE survey along with other school registration materials. Assistance from a school nurse was available if needed, as well as Spanish-translated forms and interpreters. The response rate was 80%. The survey included demographic information, general health information (including specific questions about asthma, detailed below), and assessment of the child's behavior in several domains.

Identification of Behavioral Problems and Validation of the Scales

We assessed children's social, emotional, and behavioral functioning using 12 items from the PACE survey. Factor analysis on a previous sample yielded 4 behavioral subscales: positive peer social skills ("makes friends easily," "has many friends," "talks easily with other children"; Cronbach α reliability = .69), negative peer social skills ("hurts others," "fights with other children," "bothers other children"; α = .73), task orientation ("concentrates well," "has a short attention span," "completes things he/she starts"; α = .63), and shy/anxious behavior ("worries a lot," "gets nervous easily," "is withdrawn"; α = .61). Repeat factor analysis on the current sample yielded similar results. Scores on the 4 behavioral subscales were the primary dependent variables in this study.

The PACE behavioral scales were adapted from the Parent-Child Rating Scale,[33] a parent-report measure with adequate reliability and validity on varied samples (eg, urban, suburban, preschool, school age).[34–36] The briefer PACE behavioral scales have been shown to be a valid measure of children's behavioral functioning at kindergarten entry.[37] Specifically, the PACE's concurrent validity is supported by significant correlations among the PACE subscales with PACE demographic and health information and with teacher reports of observed children's behaviors at the beginning of kindergarten.[38]

Identification and Classification of Asthma Symptoms

Three questions about asthma symptoms were included in the PACE survey: (1) How many days a week does your child usually have wheezing, coughing, or shortness of breath? (2) How many days a week does your child usually wake up from sleep because of wheezing, coughing, or shortness of breath? (3) Over the past 12 months, how many times has your child needed emergency medical visits for asthma? On the basis of the guidelines put forth by the National Asthma Education and Prevention Program through the National Heart, Lung, and Blood Institute,[39,40] 3 categories were created to define children's asthma symptoms. We considered children with >2 days per week with symptoms, >1 night per month awakening with symptoms, or >3 emergency department visits for asthma during the past year to have "persistent symptoms" We defined children whose parents reported "none" to all 3 questions as having "no asthma symptoms" and those with some symptoms but of lesser severity than those in the persistent category as having "intermittent asthma symptoms."

Assessment of Covariates

Covariates in this study were standard demographic variables, as well as additional variables that are associated with both asthma and behavior problems. These include the child's gender, race (defined as white, black, or other) and ethnicity (Hispanic or not Hispanic), Medicaid insurance, and mother's education (less than high school or GED and higher). Additional variables included prenatal smoke exposure (never smoked during pregnancy versus smoked less than a pack per day or more than a pack per day),[41–43] current smokers in the home (none vs 1 or more),[44,45] history of prematurity (born 6 weeks early or earlier vs full term),[46–48] and whether the child had experienced a parent with depression ("Has your child experienced a parent who is depressed?" defined as none vs 1 or more times).[49–53] We also identified children with chronic illnesses other than asthma to evaluate the specificity of the relationship between asthma and behavior problems. Children were designated as having "other chronic illness" when they had no asthma symptoms but had 1 or more of the following problems: bone or joint problems, heart trouble, seizures or epilepsy, or sickle cell disease.

Analysis

Analysis was limited to children who were older than 4 years and younger than 6 years of age at the time of the survey to include only children who were entering kindergarten for the first time ($n = 1619$). We used χ^2 analyses to compare the demographic characteristics of the children in the 3 asthma groups (no asthma symptoms, intermittent asthma symptoms, or persistent asthma symptoms). We used analysis of variance statistics to compare mean scores on the behavioral subscales for the children in each asthma group. The behavioral scales also were split into dichotomous variables indicating scores >1 SD worse than the average scores from the sample. Separate logistic regression models were used for multivariate analysis to test the association between asthma symptoms and each behavioral outcome, including the behavior measures as the dependent variables, and asthma symptoms (no symptoms, intermittent symptoms, and persistent symptoms), other chronic illnesses, and the covariates listed above as independent variables. We performed all analyses using SPSS software (version 12.0 for Windows; SPSS Inc, Chicago, IL). A 2-sided $\alpha < .05$ was considered statistically significant.

RESULTS

A total of 1619 children were included in this sample (mean age: 5.1 years). Sixty percent were black, 16% were white, and 23% described other racial backgrounds. Twenty-two percent of the children were Hispanic. The majority of the children received Medicaid insurance (59%), and 20% of the mothers had less than a high school education. Fifteen percent of the children had asthma symptoms (7% intermittent, 8% persistent). Table 1 shows the demographic characteristics of the children in this study group with no asthma symptoms compared with those with intermittent and persistent symptoms. Girls and white children were underrepresented in the group with asthma symptoms (intermittent and persistent) compared with the group with no symptoms. In addition, a greater percentage of children in the persistent asthma symptoms group were born preterm. Other demographic characteristics did not differ among these groups.

Table 2 shows parent-reported mean behavior scores for positive peer social skills, negative peer social skills, task orientation, and shy/anxious behavior. The scores ranged from 1 to 4 for each factor that was measured. We compared mean scores for children with no asthma symptoms, intermittent symptoms, and persistent symptoms. Average negative peer social scores were higher (worse) for children with persistent asthma symptoms compared with children with intermittent and no symptoms (mean scores: 1.88, 1.70, 1.65; $P < .001$ for children with persistent symptoms, intermittent symptoms, and no symptoms, respectively). In addition, children with persistent symptoms scored worse than children with no symptoms on task orientation (2.85 vs 3.03; $P = .006$) and on the shy/anxious behavioral subscale (2.11 vs 1.89; $P < .001$). There were no differences in mean positive peer scores for the children in the 3 groups.

To assess the prevalence of behavioral difficulties among the groups of children with asthma symptoms, we compared the percentage of children who scored >1 SD worse than average on the scales in each study group. As shown in Table 3, a greater proportion of

TABLE 1 **Population Demographics by Asthma Symptom Severity**

	Overall, *n* (%) (*N* = 1619)	No Symptoms, *n* (%) (*N* = 1384)	Intermittent Symptoms, *n* (%) (*N* = 112)	Persistent Symptoms, *n* (%) (*N* = 123)
Male gender[a]	820 (51)	679 (49)	68 (63)	79 (59)
Race[a]				
White	252 (16)	233 (17)	8 (7)	11 (9)
Black	965 (60)	824 (61)	68 (62)	73 (61)
Other	370 (23)	300 (22)	34 (31)	36 (30)
Hispanic	348 (22)	284 (21)	31 (28)	33 (28)
Medicaid insurance	929 (59)	779 (58)	75 (68)	75 (62)
Maternal education <high school	316 (20)	473 (35)	39 (36)	45 (37)
≥1 smoker in the home	629 (39)	546 (41)	40 (37)	43 (37)
Child born premature[†]	149 (10)	117 (9)	7 (7)	25 (20)
Prenatal smoke exposure	305 (20)	265 (20)	19 (18)	21 (18)
Experienced depressed parent ≥1 time	376 (24)	311 (23)	28 (26)	37 (32)

[a] $P < .05$ for comparisons among children with no symptoms, intermittent symptoms, and persistent symptoms.

TABLE 2 **Mean Behavior Scores by Asthma Symptom Severity**

	No Symptoms, Mean (SD)	Intermittent Symptoms, Mean (SD)	Persistent Symptoms, Mean (SD)	*P*[a]
Positive Peer Social Scale	3.35 (0.55)	3.38 (0.55)	3.32 (0.54)	.76
Negative Peer Social Scale[b,c] (higher value indicates worse score)	1.65 (0.56)	1.70 (0.58)	1.88 (0.65)	<.001
Task Orientation Scale[c]	3.03 (0.59)	3.00 (0.65)	2.85 (0.59)	.006
Shy/Anxious Scale[c,d] (higher value indicates worse score)	1.89 (0.58)	2.03 (0.62)	2.11 (0.57)	<.001

[a] Overall significance for 1-way analysis of variance.
[b] Post hoc significant difference between intermittent symptoms and persistent symptoms.
[c] Post hoc significant difference between no symptoms and persistent symptoms.
[d] Post hoc significant difference between no symptoms and intermittent symptoms.

TABLE 3 **Percentage of Children with Scores >1 SD Worse Than Average by Asthma Symptom Severity**

	No Symptoms, *n* (%)	Intermittent Symptoms, *n* (%)	Persistent Symptoms, *n* (%)	*P*
Positive Peer Social Scale	178 (13)	16 (14)	18 (15)	.79
Negative Peer Social Scale	190 (14)	20 (18)	33 (28)	<.001
Task Orientation	231 (17)	25 (23)	30 (25)	.04
Shy/Anxious	179 (13)	22 (20)	27 (23)	.004
>1 SD worse than average on 2 or more scales	131 (10)	18 (16)	24 (20)	<.001

children with persistent symptoms scored >1 SD worse than average on the negative peer, task orientation, and shy/anxious scales compared with children with no symptoms. More than 20% of children with persistent symptoms scored >1 SD worse than average on 2 or more scales, compared with 16% of children with intermittent symptoms and 10% of children with no symptoms ($P < .001$).

We performed a multivariate logistic regression analysis to assess the independent relationship between asthma symptoms and negative behavioral factors, controlling for gender, race, ethnicity, mother's education, prenatal smoke exposure, prematurity, presence of smokers in the home, and whether the child had experienced a parent with depression. We also considered whether the child had any other chronic illness ($n = 57$) as a covariate in this model. The significant associations from the bivariate analyses remained significant in these multivariate analyses, with the exception that persistent symptoms were no longer associated with diminished performance on the task orientation scale. Having a chronic illness other than asthma did not predict any of the behavioral outcomes. Children with persistent asthma symptoms were 2-fold more likely than children without asthma symptoms to score >1 SD below average on 2 or more of the behavioral scales (odds ratio: 1.98; 95% confidence interval: 1.15–3.42; Table 4).

DISCUSSION

To our knowledge, this is the first survey to assess the association of asthma symptoms with specific behavior problems among an entire community of young, inner-

TABLE 4 **Logistic Regression Predicting Behavior Scores >1 SD Worse Than Average**

	n[a]	Intermittent Symptoms, OR (95% CI)	Persistent Symptoms, OR (95% CI)	Other Chronic Condition, OR (95% CI)
Positive Peer Social Scale	1363	1.00 (0.54–1.87)	1.15 (0.65–2.04)	1.21 (0.55–2.64)
Negative Peer Social Scale	1360	1.11 (0.62–1.98)	1.95 (1.19–3.17)	1.11 (0.50–2.45)
Task Orientation	1361	1.09 (0.64–1.87)	1.39 (0.85–2.27)	0.86 (0.39–1.88)
Shy/Anxious	1361	1.46 (0.82–2.58)	1.91 (1.15–3.20)	1.31 (0.59–2.88)
>1 SD worse than average on 2 or more scales	1359	1.53 (0.83–2.82)	1.98 (1.15–3.42)	1.18 (0.48–2.91)

Reference group is children with no asthma symptoms.
[a] Number of children included in each multivariate analysis.

city children entering school. A large proportion of the urban children in this sample experience asthma symptoms. Using parent report of behavioral functioning, we found that children in the group with persistent asthma symptoms had significantly more behavior problems across several domains compared with children with no asthma symptoms. This association was present even with analyses that adjusted for several potentially confounding variables. Furthermore, >20% of the children with persistent symptoms had difficulties on 2 or more of the behavioral subscales, suggesting substantial comorbidity for these children.

Consistent with previous studies, we found evidence of behavioral problems in both externalizing ("outer-directed," including aggressive, acting-out, and hyperactive behaviors) and internalizing ("inner-directed," eg, anxiety, depression, withdrawn behaviors) domains.[26] The negative peer social skills scale measures externalizing behaviors, including fighting with or bothering other children. Our finding of higher levels of negative peer sociability for children with persistent asthma is consistent with the results from the meta-analysis conducted by McQuaid et al,[26] which also reported higher levels of externalizing behavior among this group of children. The shy/anxious subscale measures internalizing behaviors and includes questions about nervousness, worry, and withdrawn behavior. Our findings agree with other studies, which showed a relationship between asthma and anxiety, specifically,[24,25,54,55] and between asthma and internalizing behaviors more generally.[26,56] The task orientation subscale assesses the child's ability to complete tasks, concentrate, and maintain an adequate attention span. Calam et al[57] documented lower scores on a measure of attention and concentration for children with wheezing. Although such an association was suggested by our initial bivariate assessment, it was not confirmed in our multivariate model. We also found the children with the most significant symptoms to have the highest rates of behavioral comorbidity, as has been reported previously.[25,26]

The findings presented here, based on data collected before children's kindergarten entry, suggest that behavioral problems for urban children with asthma begin in the preschool years or earlier. This is consistent with findings of Calam et al, which show a relationship between recurrent wheezing at 3 years of age and elevated behavioral problem ratings.[57,58] Similarly, Mrazek et al[56] found that children with early onset of asthma are at greater risk for behavior problems compared with children with later asthma onset and children who do not develop asthma. Because early childhood is a time of rapid physical, emotional, and intellectual development, the stress that asthma imposes on young children and their families may be significant.

A few studies also have considered the impact of asthma on psychiatric disorders and behavior problems in community-based samples of children. Ortega et al[25] explored the association between psychiatric problems and asthma in older children (9–17 years) using data from the Methods for the Epidemiology of Child and Adolescent Mental Disorders study. This evaluation included data from 4 different communities and found a relationship between having a history of asthma and having an anxiety disorder. Weil et al[50] evaluated a cohort of young inner-city children with asthma and found that children with behavioral problems had significantly more days of wheezing compared with children without behavioral problems. The current study expands on this work by evaluating a community-based sample of young urban children with and without asthma.

We were able to include a number of pertinent covariates in the multivariate model and still found a relationship between persistent asthma symptoms and behavioral difficulties. Our data did not show a relationship between the other noted chronic illnesses and behavior problems. It is possible that the children in this sample with other chronic illnesses were less severely affected by their illness than the children with persistent asthma symptoms and thus less apt to demonstrate behavior problems. This interpretation is supported because more parents of the children with other chronic illnesses reported excellent health compared with parents of children with persistent asthma (55% vs 36%; $P < .05$). Alternatively, the relationships noted in this study may be specific to asthma symptoms and/or treat-

ment. Other studies also have included children with other chronic illnesses and have shown a unique relationship between asthma and anxiety disorders.[25,54,55]

The explanation for the association between asthma symptoms and behavioral problems is not clear, but the stress related to having asthma symptoms might contribute to behavioral problems,[26,59,60] and the family's focus on the child's medical problem may make management of behavioral issues difficult.[58] Alternatively, children with behavior problems may have difficulty managing their asthma,[26] and stress on the child and the family as a result of behavioral issues may exacerbate asthma symptoms and inhibit optimal therapy.[61] A few studies have examined prospectively the relationship between behavioral problems and asthma and suggested that behavioral and mental health problems predict the subsequent development of wheezing.[50,57] Last, factors related to poverty and the inner-city environment may contribute to both asthma symptoms and behavioral problems.[26]

Because of the cross-sectional nature of this study, we cannot presume that asthma preceded the behavioral problems or vice versa. However, we can say with confidence that we have identified a group of children who are at extremely high risk for comorbidity. The children in this sample were entering kindergarten and thus had not yet begun their formal schooling. Thus, the opportunity for professionals to identify the behavioral challenges described by parents may not have occurred. Because behavioral problems are associated with poorer school adjustment and academic achievement,[62,63] the identification and treatment of problems at this young age potentially could prevent subsequent disruptive behaviors and school difficulties.

Limitations

There are some potential limitations to the study. First, all data were based on parent report, including both asthma symptoms and behavioral problems. Because the National Heart, Lung, and Blood Institute criteria for defining asthma severity depend on parent report, our data are consistent with this standard. Boys were overrepresented among the children with persistent asthma, which is consistent with the finding of higher levels of asthma severity and hospitalization rates for young boys compared with girls in this community.[64] It is plausible that families of children with asthma overreport behavioral problems in their children. However, parents are likely the most knowledgeable source of information about their child's behavior.[65]

Although caregiver mental health is associated with asthma morbidity,[50,51] we did not have a validated measure of the mental health of the caregiver to include in our multivariate model. We were able, however, to include the parent's report of a history of depression in a caregiver as a covariate. In addition, we did not have information on medication use among the children in this sample and therefore cannot assess the effect of medications on behavioral problems.[66–68] Last, only parents of children in the Rochester City School District participated in this survey. Therefore, these findings can be generalized only to similar urban populations of children.

CONCLUSIONS

Asthma is the most common chronic illness of childhood,[1–3] and young urban children experience the greatest burden of asthma morbidity.[7–13] This study showed an association between asthma symptoms and behavioral comorbidity, and a large proportion of children with persistent symptoms experienced behavioral problems across several domains. The combined burden of asthma, behavioral difficulties, and poverty likely has an impact on the quality of life of these children and families. These findings suggest a clear need for an early biopsychosocial approach to care for vulnerable children with asthma. Therapeutic plans to improve asthma management may need to include treatment of concomitant behavior difficulties to improve the outcomes for these young patients.

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