Disparities in allergy testing and health outcomes among urban children with asthma

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Background: Previous research has found that treating allergies and reducing exposure to allergens can reduce asthma morbidity.
Objective: We sought to examine whether urban asthmatic children were receiving care for allergies as part of a comprehensive asthma management plan.
Methods: A cross-sectional study, consisting of a parent-reported questionnaire, was conducted in 26 randomly selected New York City public elementary schools during the 2002-2003 school year.
Results: In a sample of 5250 children aged 5 to 12 years, 13.0% were found to have current asthma. The prevalence of allergy diagnosis was 21.0%. Less than half (47.3%) of the subjects with current asthma reported a physician's diagnosis of allergies. The frequency of a reported allergy diagnosis varied with race/ethnicity, ranging from 14.4% in Mexican American children to 67.9% in white children. Only 54.9% of asthmatic children with an allergy diagnosis reported allergy testing. Children from lower-/middle-income households and children with public forms of health insurance were the least likely to report testing (adjusted odds ratios, 0.18 and 0.46). Higher frequencies of reported allergy testing were associated with education on allergen avoidance, use of allergy medications, lower exposure to household allergens, and lower prevalence of wheezing.
Conclusions: Many children do not receive comprehensive asthma treatment that includes management of allergies and education on avoidance of household allergens. Lower reported allergy testing might indicate lower access to medical care among middle-income families who are ineligible for public programs but who do not have the income to access higher-quality care. Interventions aimed at improving medical care and adherence to treatment guidelines are necessary to decrease asthma morbidity. (J Allergy Clin Immunol 2008;122:748-53.)

Key words: *Allergies, medical care, asthma management, health disparities, minority children*

Abbreviation used
NHLBI: National Heart, Lung, and Blood Institute

Comprehensive treatment of childhood asthma is complex, involving medication for both active treatment and prevention of symptoms. It should also include a plan for avoidance of known triggers that can contribute to exacerbations. For a majority of asthmatic children, triggers include environmental allergens that can be present in the home. For example, results from the National Childhood Inner-City Asthma Study, a multicenter inner-city study of more than 1000 asthmatic children, found that 77% had at least 1 positive skin test response after undergoing allergy testing, and almost half were sensitized to at least 3 allergens.[1] Similarly, the global International Study of Allergies and Asthma in Childhood study found significant associations between allergic sensitization and asthma symptoms in almost all affluent nations among children ages 8 to 12 years.[2] Allergic sensitization has also been found to be associated with increased medication use for asthma, both β-agonists and controllers.[3]

Avoiding exposure to allergens can directly prevent asthma exacerbations and symptoms in the lower airways among allergic asthmatic subjects. In addition, previous research suggests that treating inflammation and symptoms in the upper airways associated with allergies or allergic rhinitis can have a beneficial effect on asthma control.[4-6] The converse is also true: failure to treat symptoms of the upper airways can have a negative effect on health outcomes and contribute to the onset of asthma exacerbations, strengthening the rationale for including allergy evaluation and treatment in asthma management plans.

The current guidelines issued by the National Heart, Lung, and Blood Institute (NHLBI) call for all asthmatic subjects, regardless of severity level, to be asked about their exposure to allergens and informed of ways to reduce or eliminate exposure. Subjects with persistent asthma should be more thoroughly evaluated for allergies, including conducting skin or *in vitro* tests to determine the specific allergens to which a patient is sensitized.[7] Previous research has found that asthmatic patients benefit from allergy evaluation and associated treatments.[8,9] In a study conducted in London, Bobb and Ritz[9] demonstrated that adult asthmatic patients benefited from a structured allergy evaluation, although the benefits of allergy skin testing were unclear in their study. Abramson et al[8] conducted a systematic review of the use of allergen immunotherapy as a treatment for asthma and concluded that treatment of allergies through immunotherapy reduced asthma symptoms, medication use, and improved bronchial hyperreactivity. In addition, use of inhaled nasal steroids has been found to improve both upper and lower airway inflammation.[5] Interventions aimed at reducing allergen exposures in the home environment have also been found to improve clinical outcomes among asthmatic children.[10,11]

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Allergy testing for asthmatic patients is relevant in urban areas, where aspects of both the indoor and outdoor environment have strong effects on allergic asthmatic subjects. Previous research has found that cockroach exposure and sensitivity are more prevalent in the inner-cities of the Northeast United States, and its effect on asthma morbidity can be greater than other household allergens, such as dust mite or pet dander.[12] In terms of the outdoor environment, the odds of having allergic asthma are greater in areas with higher levels of airborne particulate matter.[13] Studies with animal models have found that exposure to diesel particles increase airway hypersensitivity and exacerbate the allergic response.[14,15]

New York City, a large urban center, has high levels of childhood asthma prevalence and morbidity.[16,17] The objective of this study was to determine whether urban children with asthma were being evaluated for allergies as part of a comprehensive asthma management plan. Based on previous research, the authors hypothesized that children with reported allergy care would have better asthma outcomes than those without allergy care and that allergy care would differ based on race/ethnicity and household income level. It was hypothesized that these differences could be partially attributed to differences in access to care, such as insurance coverage and source of usual care. Therefore this study sought to examine the sociodemographic factors associated with receiving allergy care among an ethnically and economically diverse sample of urban asthmatic children, with the aim of providing empiric information on populations that might not receive asthma care as recommended by current clinical guidelines.

METHODS

Data were collected as part of a cross-sectional study of asthma prevalence during the 2002-2003 school year.[16] The project was reviewed and approved by the Mount Sinai Institutional Review Board, the Mount Sinai Health Insurance Portability and Accountability Act Office, and the New York City Department of Education's Division of Assessment and Accountability.

Study design

Methodology for this study has been reported in previous publications.[16,17] Briefly, New York City ZIP Codes were ranked and grouped according to their childhood asthma hospitalization rate. To obtain an accurate representation of distinct New York City populations, the 3 groups with the highest, median, and lowest asthma hospitalization rates were eligible to be included in the study. Within these 3 strata, one public elementary school per ZIP Code was randomly selected, with probability proportional to size. A total of 26 schools were selected, 8 within each strata and 2 additional schools in the area of low asthma hospitalization to compensate for the lower expected prevalence. Schools from each of the 3 groups were assessed concurrently during overlapping 2-week periods to control for seasonality of asthma symptoms. These 2-week periods were scheduled so that equal numbers of schools were assessed during the fall, winter, and spring seasons. This sampling strategy allowed for control of seasonal symptom variability among the groups.

Within each school, questionnaires were distributed in 2 randomly selected classrooms per grade level, kindergarten through fifth grade, and up to 2 self-contained special education classrooms, where available. Children were instructed to bring the questionnaire home to their parent/guardian and return the completed form within 2 weeks. Both children and teachers were given nominal incentives, such as school supplies, to encourage participation.

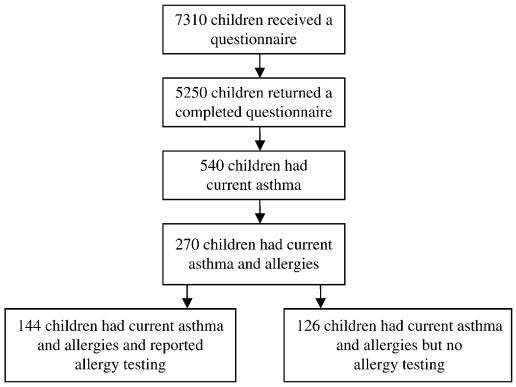

FIG 1. Flow chart illustrating the number of unweighted respondents in each of the primary analysis groups.

Survey instrument

The parental questionnaire, containing standardized items on demographics, household environment, asthma diagnosis and symptoms, allergy diagnosis and testing, medication use, and healthcare use, was adapted from a previous study of childhood asthma.[18] The questionnaire was available in English, Spanish, or Chinese. The questionnaire was pilot tested among groups of native speakers before the study to ensure clarity and cultural appropriateness. *Ever having asthma* was defined as having received a diagnosis of asthma from a physician. *Current asthma* was defined as having a physician's diagnosis of asthma and wheezing in the previous 12 months. Parents were also asked to report their child's demographic information, including race/ethnicity, household income of the child's primary residence, and type of health insurance.

The presence of allergies among all respondents was assessed by using the following question: "Have you or your child ever been told by a doctor or nurse that he/she has allergies?" The prevalence of allergy testing among asthmatic children was assessed by using the following question: "Has your child ever been tested for allergies?"

Parents of asthmatic children were further queried to determine whether their child had received an asthma plan containing information on ways to remove asthma triggers from the home and whether they were currently taking prescription allergy medications. The questionnaire included a table of commonly prescribed medications used to treat asthma or allergies, which allowed respondents to indicate which asthma medications, allergy medications, or both their children were currently using. There was also an area where parents could include medications not listed. Allergy medications were defined as oral antihistamines, nasal corticosteroids, and nasal anti-inflammatory agents. Asthma medications included short-term β-agonists, long-term β-agonists, inhaled corticosteroids, and cromolyn.

Data analysis

Data were weighted to represent the number of children attending public elementary schools within their respective ZIP Codes. Missing data were excluded from calculations of percentages and statistical tests. All data analyses were conducted with the Surveymeans and Surveyfreq procedures in SAS version 9.1 (SAS Institute, Inc, Cary, NC). These methods account for the clustering by school and stratification by neighborhood asthma hospitalization rate in the sampling design. A flow chart indicating the number of children in each primary analysis group is shown in Fig 1. The prevalence estimates of the different disease-related subgroups are weighted and thus do not match the percentages obtained by means of simple division of the numbers included in Fig 1.

Descriptive statistics of the sample's demographic characteristics were calculated, as were the prevalence of asthma, allergies, and allergy testing among demographically defined subgroups. To determine the socioeconomic factors that predict allergy testing, a multivariate model was computed by using logistic regression procedures in SAS to calculate odds ratios and

corresponding 95% CIs. Demographic characteristics, including ethnicity, household income, medical insurance, usual source of asthma care, language in which the survey was completed, and sex, were included as indicator variables. Age was entered as a continuous variable. The model was constructed by using backward elimination, and significance was determined at a P value of .05.

Use of allergy medication, having an asthma plan that included information on removing asthma triggers, or both was compared between the 2 groups by using corrected χ^2 tests to measure the association to determine whether asthmatic subjects who reported both an allergy diagnosis and allergy testing received different care than those who only reported an allergy diagnosis. Respondents were queried about the presence of common household sources of allergens and irritants to determine whether there was a significant relationship between allergy testing and the household environment, and results were compared by using corrected χ^2 tests in SAS. Additionally, the percentage of respondents reporting wheezing symptoms in the previous 2 weeks were calculated for each group and compared in SAS to determine whether allergy testing was associated with health outcomes.

RESULTS

Description of the population

Overall, 5250 children returned a questionnaire, yielding an absence-adjusted response rate of 76.9%. As described in previous publications, the sample is highly comparable with the overall New York City public elementary school population, as well as the populations of the surrounding ZIP Codes.[16,17] The demographic profiles of the study respondents are highly correlated with the Department of Education's enrollment figures on student race/ethnicity of the individual schools. This is evidenced by Spearman correlation coefficients for white, black, Hispanic, and Asian subjects of 0.957, 0.945, 0.972, and 0.931, respectively ($P < .01$). By randomly selecting 1 school from each ZIP Code, we also were able to produce a sample with an ethnic distribution that was significantly correlated with the overall 5- to 12-year-old population of the surrounding ZIP Codes, as reported by the US Census Bureau. The Spearman correlation coefficients obtained in this analysis for white, black, Latino, and Asian subjects were 0.847, 0.738, 0.902, and 0.905, respectively ($P < .001$).

The average age of the sample was 8.11 years (SD, 1.81), and 46.8% were male. Approximately 39% of the sample was Latino, 22.3% was African American, 15.2% was white, and 12.3% was Asian. Six percent classified themselves as "other," which included multiracial children. Forty-one percent had household incomes of less than $20,000. Only 5% had household incomes of greater than $75,000.

The prevalence of ever having received an asthma diagnosis was found to be 20.1% (95% CI, 17.2-23.0), whereas the prevalence of current asthma (having had symptoms within the past year) was 13.0% (95% CI, 10.8-15.3). The overall prevalence of parent-reported physician- or nurse-diagnosed allergies (regardless of asthma status) in the sample was 20.1% (95% CI, 15.7-24.5). The prevalence of allergies was greatest among subjects with current asthma because 47.3% of them indicated a physician's diagnosis of allergies compared with 30.4% among asthmatic subjects with no current symptoms and 14.9% of nonasthmatic subjects.

Sociodemographic characteristics of the asthmatic population

There were marked racial/ethnic disparities in reported allergy diagnosis among subjects with current asthma (Table I). White subjects had the highest level of codiagnosis of asthma and allergies at 67.9%. The lowest prevalence of comorbidity was among Mexican American children, for whom the prevalence was 14.4%. In general, asthmatic children with Spanish-speaking parents were less likely to report a diagnosis of allergies when compared with children from English-speaking households. Subjects with current asthma and private health insurance had a greater prevalence of codiagnosed allergies than children with public insurance. Although the prevalence of reported/diagnosed allergies was greatest among those without insurance coverage, the number of children in that category was small (n = 10). The prevalence of allergy diagnosis was dependent on a child's usual source of care (Table I). Classifications for usual sources of asthma care included emergency departments, private physician's offices, and community clinics/hospital outpatient clinics, as well as not having a usual source of care. No differentiation was made between primary care and specialists. Allergy diagnosis prevalence was highest among children who used a physician's office and lowest among children who identified the emergency department as their usual source of care.

Approximately half of the subjects with current asthma who reported an allergy diagnosis indicated that they underwent allergy testing (54.9%). Because the NHLBI guidelines recommend that all subjects with persistent asthma be tested for

TABLE I. Prevalence of reported allergy diagnosis among subjects with current asthma (n = 540) by demographic subgroup

Demographics (total no. of children within each category)*	Percentage of children reporting an allergy diagnosis	*P* value
Sex		.203
Male (n = 306)	45.2	
Female (n = 232)	50.2	
Ethnicity		<.0001
Latino (n = 232)		
Dominican (n = 44)	36.1	
Mexican (n = 21)	14.4	
Puerto Rican (n = 104)	47.3	
Other Latino (n = 63)	45.1	
African American (n = 107)	52.4	
White (n = 76)	67.9	
Asian (n = 52)	47.3	
Other (n = 53)	49.1	
Income		.004
<$20,000 (n = 218)	45.2	
$20,000-$39,999 (n = 143)	53.1	
$40,000-$74,999 (n = 72)	50.3	
>$75,000 (n = 33)	59.4	
Language of survey		<.0001
English (n = 456)	49.1	
Spanish (n = 75)	34.8	
Insurance		<.0001
No insurance (n = 10)	69.1	
Public insurance (n = 286)	43.7	
Private (n = 172)	58.1	
Other (n = 43)	53.0	
Usual source of care		<.0001
Physician's office (n = 205)	57.2	
Community or hospital clinic (n = 149)	46.5	
Emergency department (n = 69)	42.7	
Other/no usual source of care (n = 92)	45.6	

*Includes nonresponders, and therefore not all subgroups total 540.

TABLE II. Demographic factors associated with allergy testing among subjects with current asthma who reported an allergy diagnosis (n = 270)*

	Odds ratio	95% CI
Ethnicity		
Asian	0.17	0.08-0.39
African American	1.26	0.63-2.49
Dominican	0.81	0.33-1.98
Mexican	—†	—
Puerto Rican	1.16	0.48-2.81
Other Latino	2.06	0.69-6.17
Other	0.53	0.20-1.45
White	Reference	—
Insurance		
None	0.13	0.02-0.80
Public insurance	0.46	0.19-0.95
Private insurance	Reference	—
Income		
<$20,000	0.64	0.20-2.00
$20,001-$39,999	0.18	0.07-0.52
$40,000-$74,999	0.28	0.08-1.06
≥$75,000	Reference	—

*Model adjusted for age, race/ethnicity, insurance, and median household income.
†Unstable estimate because of low n value (n = 4).

TABLE III. Differences among subjects with current asthma with and without allergy testing (n = 257)*

	Current asthma with allergies and no allergy test (n = 113)	Current asthma with allergies and allergy test (n = 144)	*P* value comparing respondents with and without allergy tests
Health outcomes			
Percentage with at least 1 d with wheezing symptoms in the past 2 wk	55.9	41.2	<.0001
Use of preventive strategies (%)			<.0001
Have both an asthma plan with trigger avoidance and taking an allergy medication	11.5	29.6	
Have an asthma plan including trigger avoidance only	22.3	30.0	
Currently taking an allergy medication only	28.8	21.5	
Household exposures (%)			
Wall-to-wall carpet	29.5	19.0	<.0001
Cats	10.3	7.36	.005
Mold	8.50	4.70	.013
Water leaks	12.1	7.93	.034
Roaches	60.5	51.7	.359
Mice	32.3	33.6	.698
Rats	9.91	10.4	.757

*Thirteen respondents with current asthma and allergies did not specify an answer to the allergy test question.

allergies, we examined the 23.4% of subjects with current asthma who reported having 1 or more nighttime symptoms per week, classifying them as having moderate or severe persistent asthma. Of these, only 59.5% indicated that they underwent allergy testing. Because such a large proportion of children with a codiagnosis of asthma and allergies did not report allergy testing, we sought to determine which demographic factors, access-to-care factors, or both were associated with allergy testing (Table II). Univariate and multivariate analyses were similar, and therefore only multivariate analyses are presented in Table II.

Allergy testing was less frequent among children living in middle-income households when compared with upper-income children because children living in a household with an annual income between $20,000 and $40,000 were 0.18 times as likely as children living in a household with an annual income of greater than $75,000 to report allergy testing. Children with no insurance or receiving public insurance, such as Medicaid or supplemental state-funded insurance, were significantly less likely to report allergy testing than children with private health insurance (odds ratios, 0.13 and 0.46, respectively). The association between allergy testing and the usual source of care was found not to be statistically significant in the multivariate analysis, and thus this variable was removed from the final model.

Health outcomes

Children who reported allergy testing had a lower prevalence of recent symptoms; greater prevalence of allergy education and treatment; and lower reported exposure to common sources of household allergens (Table III). Among children with a codiagnosis of asthma and allergies, we found that children who reported allergy testing were less likely to respond that they had a wheezing episode in the previous 2-week period than children who did not report allergy testing (41.2% vs 55.9%). More than 80% of subjects with current asthma and allergy testing indicated receiving either education on trigger avoidance or allergy medication from their physician compared with 63% of those without allergy testing ($P < .001$). Children with allergy testing were also twice as likely as those without testing to receive both education and medication.

Children who responded that they received allergy testing were significantly less likely to report the presence of wall-to-wall carpets, cats, visible mold, and water leaks in their household. They were also less likely to indicate exposure to cockroaches, a major source of allergen in the US urban environment,[19] although these results did not reach statistical significance. There was also no significant difference in the presence of mice or rats among the groups. These exposures are more common among low-income households, and thus it is possible that confounding played a role in the observed relationship between exposures and allergy testing.

DISCUSSION

This study shows that many urban children with asthma are not receiving diagnoses or care for allergies that could improve their asthma outcomes. In this study less than half of subjects with current asthma reported an allergy diagnosis, with marked racial/ethnic disparities in the frequency of this diagnosis, although not in the odds of allergy testing, after adjusting for factors such as insurance and household income. Although some of these disparities are consistent with previous research, the prevalence of allergy diagnosis in our sample is lower than the prevalence obtained in studies using skin tests of asthmatic children. Previous research on urban asthmatic children with active symptoms found that 77% had positive allergy skin test responses,[1] which is

markedly greater than the 47.3% of diagnoses in our sample. These results suggest that many children are not having their allergies diagnosed, potentially hindering their ability to successfully manage their asthma.

Disparities in allergy diagnoses and lack of testing

This disparity in diagnosis is more pronounced among minority populations. For example, research done by Recio-Vega et al[20] in Mexico found that more than one third of patients with newly diagnosed asthma had a positive allergy skin test response.[20] Our study showed that less than 15% of Mexican American children had received an allergy diagnosis, despite research that shows Mexican Americans have a higher prevalence of both asthma and hay fever than their counterparts living in Mexico.[21] Our results show children who used a physician's office as their usual source of care were more likely to respond that they were given a diagnosis of allergy than children using other sources of care. It is possible that other factors related to differences in access to care among different racial/ethnic groups can explain some of our results. For example, parents might be more likely to report an allergy diagnosis if they have consistent contact with their child's health care provider and have been told about their child's allergies on multiple occasions.

Of those who did receive an allergy diagnosis, a significant percentage reported not having undergone allergy testing to determine the specific allergens relevant to the child and to confirm whether the allergy diagnosis was indeed accurate. According to NHLBI guidelines, all subjects with persistent asthma should undergo allergy testing,[7] but more than 40% of the subjects with persistent asthma in our sample reported that they were never tested. Our findings are consistent with other research studies that have documented differences in various aspects of pediatric asthma care and the standardized national guidelines.[22,23] These results illustrate the need for the implementation of interventions aimed at improving clinical compliance with the national guidelines. Previous work by Cabana et al[24] has shown that physician education on asthma management can improve both physician knowledge and patient health outcomes in a number of communities throughout the United States.

Allergy testing as a marker for other aspects of care

The need for education of physicians and patients on the importance of allergies in the overall management of asthma is supported by the results of this study that found a higher prevalence of treatment and education, as well as better health outcomes, among those who indicated undergoing allergy testing. There are a number of potential mechanisms that could explain why allergy testing was associated with positive health outcomes. Allergy testing can lead to a more tailored form of care because patients are able to identify specific triggers to avoid medications, take medications, or both designed to prevent symptoms in the upper airways, which can help prevent exacerbations in the lower airways.[6] Second, it is plausible that some of the children who underwent allergy testing went on to receive immunotherapy as treatment for those exposures. Previous studies describe beneficial effects of immunotherapy on health outcomes.[8,25] It is also likely that allergy testing might be a marker for comprehensive care that includes awareness and treatment of allergies as a way to reduce asthma symptoms and exacerbations. Health care providers who refer patients for allergy testing might be more likely to follow other aspects of the NHLBI guidelines, including patient education, appropriate medication use, and adequate follow-up visits.

It is also possible that some children might have been referred for allergy testing but did not receive it because of barriers to follow-up care. Although adjusting for insurance and household income level in the analysis might have accounted for some of the economic barriers to follow-up care, inconsistency of care, lack of quality communication with the provider, and other potential barriers could prevent a parent from complying with a physician's recommendation for allergy testing.[26] This could contribute to our finding of parents not reporting allergy testing, despite reporting an allergy diagnosis.

Although our study did not find differences in allergy care associated with a patient's usual source of care, previous research has shown that children who are treated by specialists, such as allergists, are more likely to receive comprehensive care. Schatz et al[27] examined a random sample of asthmatic patients enrolled in a health maintenance organization. They found that those who reported an allergist as their usual source of care had better scores on health symptom and quality-of-life scales, as well as a lower risk of hospitalizations and unscheduled office visits compared with patients visiting only a primary care provider.[27] Work in adults conducted by Frieri et al[28] found similar results, including differences in the number of patients with allergy skin testing. The differences in care received by patients who are treated by allergists compared with those who receive care exclusively from primary care providers extend to their learning of preventive measures as well. For example, among a sample of children with a positive skin test response for dust mite, Callahan et al[29] documented that families who saw an allergist for their child's asthma were significantly more knowledgeable of techniques to reduce exposure to dust mite allergen than those who did not see an allergist.

Relationship between allergy testing and health insurance

Previous research also shows that children with public health insurance are less likely to receive specialty care for asthma,[24] which could partially explain our finding that children with public health insurance were among the least likely to report having received allergy testing. Yoon et al[30] found that Medicaid patients were less likely to attend scheduled visits with asthma specialists, such as allergists, when compared with patients with private insurance, whereas Valerio et al[26] suggested that difficulty in maintaining continuity of care because of turnover in physicians participating in Medicaid programs can contribute to the differences in asthma outcomes experienced by patients with public health insurance.

Our study also shows an income-related disparity in allergy testing, with the middle-income groups having lower odds of reporting allergy testing when compared with both the lowest and highest income levels. The boundary between the middle-income groups in our sample ($40,000) lies between the 2000 US Census median household income levels for New York City ($38,293) and the overall US population ($41,994), illustrating that this range of household income accurately represents middle-income families. The lower prevalence reported of allergy testing among these households could be related to differences in insurance coverage that were not captured in our study. Previous research has documented differences in access to specialists depending on the child's type of health care–delivery plan.[31] The public

insurance plans in New York City are managed care plans, which offer consistent coverage,[32] whereas private insurance plans can be managed care or fee-for-service, with differences in coverage, copayments, and other factors that could affect access to specialists among the less affluent.

Similar to any questionnaire study, the data are subject to recall bias and limitations related to self-report data. Additionally, differences in educational attainment and health literacy can play a role in reporting health outcomes and compliance.[33,34] Previous work in hypertensive adults found that agreement between self-report of medication use and the medical record was lower in patients with lower measured levels of health literacy.[34] We attempted to minimize the chance of these problems affecting our results by pilot testing the questionnaire multiple times for clarity and understanding. Additionally, we found no association between parental educational level and reporting allergy testing after adjusting for race/ethnicity and household income level.

Conclusion

This study shows that many urban children do not receive comprehensive asthma treatment that includes diagnosis and management of associated allergies and education on avoidance of common household allergens. These study results are generalizable to the overall New York City pediatric population, as well as to children living in other US urban environments that share similar demographic profiles, insurance coverage, and asthma prevalence. Additionally, this study raises the possibility that allergies remain untreated or poorly treated among many children with asthma, a finding with the potential for international relevance. Interventions aimed at improving medical care and adherence to treatment guidelines in regard to the management of allergies among asthmatic subjects, especially among children with public insurance, could have the potential to decrease asthma morbidity in urban areas.

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Clinical implications: Successful asthma management includes proper diagnosis of allergies and allergy testing. Allergy testing can be used to tailor allergen avoidance instruction and treatment and to guide patients to reduce exposure to allergens that can trigger asthma exacerbations.

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