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ASTHMA, ALLERGY, AND IgE LEVELS IN NYC HEAD START CHILDREN

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Abstract

Background—Among preschool-age children in New York City neighborhoods with high asthma hospitalization rates, we analyzed the associations of total immunoglobulin E (IgE), specific IgE to common indoor allergens, and allergy symptoms with asthma.

Methods—Parents of children in New York City Head Start programs were asked to complete a questionnaire covering demographic factors, health history (including respiratory conditions), lifestyle, and home environment. Children's serum samples were analyzed for total IgE and specific IgE antibodies to cockroach, dust mite, mouse, and cat allergens by immunoassay. Logistic regression was used to model the association between asthma and IgE, controlling for age, gender, ethnicity/national origin, BMI, parental asthma, smokers in the household, and allergy symptoms (e.g., runny nose, rash).

Results—Among 453 participating children (mean age 4.0 ± 0.5 years), 150 (33%) met our criteria for asthma. In our multivariable logistic regression models, children with asthma were more likely than other children to be sensitized to each allergen, to be sensitized to any of the four allergens (OR=1.6, 95% CI 1.0–2.6), or to be in the highest quartile of total IgE (OR=3.1, 95% CI 1.5–6.4). Allergy symptoms based on questionnaire responses were independently associated with asthma (OR=3.7, 95% CI 2.3–5.9).

Conclusions—Among preschool-aged urban children, asthma was associated with total IgE and sensitization to cat, mouse, cockroach, and dust mite allergens. However, allergy symptoms were more prevalent and more strongly associated with asthma than was any allergen-specific IgE; such symptoms may precede elevated specific IgE or represent a different pathway to asthma.

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Keywords

asthma; allergy; IgE; children; Hispanic; indoor allergens

Introduction

Immunoglobulin E (IgE) is the class of antibody that is responsible for mediating hypersensitivity reactions, such as allergic asthma, by binding to high-affinity receptors on the surface of mast cells and basophils and triggering activation of these cells on contact with allergen [1]. Asthma has been associated with both respiratory allergies and total IgE measured in serum [2]. Studies have consistently shown higher IgE levels in asthmatic populations than in non-asthmatic populations [3–12]; however, the relationship between sensitization to specific indoor allergens and asthma in young children, especially those in low-income urban communities, is not well understood [13–16].

Studying asthma in preschool-aged children is challenging in part because symptoms and factors associated with asthma are heterogeneous [17–20]. Not all young children who present with wheeze have asthma later in life. However, those who present with wheeze in early childhood but are asymptomatic as adults are less likely than those who have asthma in adulthood to be sensitized to allergens [21–23]. In addition, children who have severe asthma are likely to continue to have severe asthma in adulthood [24–27]. Therefore, it seems worthwhile to try to identify modifiable factors that may contribute to asthma symptoms in children.

As markers of allergic sensitization, IgE levels may be relevant to this effort [28–31]. However, studies of the relationship between sensitization to specific indoor allergens and asthma have had conflicting results. Some studies have found an association between asthma/wheeze and an increased sum of specific IgEs to inhalant allergens, but not between asthma/wheeze and individual inhalant allergens [32–33]. Simpson et al. showed that the risk of current wheeze increased significantly with increasing IgE to dust mite, cat, and dog, as well as a sum of the three IgEs, but not with total IgE, suggesting that specific IgE may be more useful than total IgE for predicting asthma symptom development [34]. Conflicting results have also been reported regarding the association between asthma severity and sensitization to indoor allergens. Among adults with asthma in Eastern Harlem, those who were sensitized to indoor allergens did not experience significantly higher asthma morbidity than those who were not [35]. However, among children, asthma severity was associated with the level of IgE to dust mite; that finding suggested that specific IgE may be useful in identifying children who are at risk for severe asthma symptoms [5].

Although previous studies have shed some light on the relationship between asthma and sensitization to specific allergens, few have been conducted among high-risk children living in low-income urban areas. In New York City, the association between neighborhood income and asthma hospitalization rates is well established [36]. We therefore investigated the association between sensitization and asthma in a sample of children attending Head Start programs in New York City neighborhoods with high pediatric asthma hospitalization rates.

Methods

Subjects and Recruitment

Head Start is a federally funded program that provides preschool education for low-income children throughout the United States and supportive services for their families. We requested and received permission to recruit at 50 Head Start centers selected, from more than 250 in

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New York City, based on location in neighborhoods with high pediatric asthma hospitalization rates [36]. Overall, the 50 centers serve about 4000 children per year, and all children in their first year in the Head Start center were eligible for the study. At the centers, English- and Spanish-speaking recruiters presented the study to groups of parents. Written informed consent was obtained from interested parents for their child's and household's participation in the study. Monetary compensation was provided to those who participated. The study was approved by the Institutional Review Board of the Columbia University Medical Center.

Questionnaire data

Parents were asked to respond to a questionnaire that asked for a detailed history of their child's respiratory conditions (questions covered wheezing, difficulty in breathing, and a doctor's diagnosis of asthma), and information regarding family medical history, home environment, and demographic factors. The questionnaire also addressed parental tobacco use, educational attainment, and employment. Ethnicity was determined through questions about race, Hispanic national origin, and children's and parents' birthplaces. We categorized children born in the United States who had at least one parent born in a Spanish-speaking country as having that national origin. The category "other/mixed Hispanic" included children whose parents were born in a Spanish-speaking country other than the Dominican Republic, Mexico, or Puerto Rico, and children whose parents were not born in the same Spanish-speaking country. Children whose race was identified as black, African-American, or of African descent and who were not classified as having Spanish/Latino/Hispanic descent were categorized as "non-Hispanic black." Children who were neither Hispanic nor non-Hispanic black or whose parents did not provide information about race/ethnicity were categorized as "other/unknown."

Outcomes

Because the children participating in the study were too young to have a definitive asthma diagnosis and were not provided with physical examinations, children were categorized as having *asthma* if their parents reported that they had:

1. A history of physician-diagnosed asthma and any wheezing or difficulty in breathing in the past year, or
2. Wheezing or difficulty in breathing ≥ 3 times in the past year, or
3. Any urgent physician, emergency department, or hospital visit because of wheezing or difficulty in breathing

Children were categorized as having *allergy symptoms* if their parents described them as having had food allergies; runny nose or sneezing caused by house dust, cockroaches, pollens, cats, dogs, rats, mice, or other animals; or other allergy symptoms, such as skin rashes.

Home visit data

Children were weighed on a portable Seca electronic scale and their height was assessed with a portable height board. Age- and sex-specific body mass index (BMI) percentiles were calculated for each child using formulas available from the Centers for Disease Control and Prevention (http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html; last accessed May 28, 2009). The children were characterized as underweight or normal (below the 85^{th} percentile), at risk for overweight (85^{th} – 95^{th} percentile), or overweight (above the 95^{th} percentile).

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IgE Analysis

The IgE analyses have been described elsewhere [37]. In serum samples from the children, total IgE and specific IgE antibodies against dust mite (*Dermatophagoides farinae*), cockroach (German cockroach whole body extract), mouse (urinary proteins), and cat (dander) were measured by the ImmunoCAP method (Phadia, Portage, Mich). Children were classified as sensitized if they had specific IgE ≥ 0.35 IU/mL to any of the four allergens tested.

Statistical Analyses

Frequency distributions of gender, presence of smokers in the child's household (0 vs. ≥1), and body mass index categories by asthma/allergy status (categorization as having neither allergies nor asthma, allergies only, asthma only, or both allergies and asthma) were compared using chi-square tests of statistical significance. Because data (cell counts) were sparse in some categories, Fisher's Exact Tests were used to evaluate the statistical significance of differences in distribution of national origin and parental history of asthma. An ANOVA F-test was used to compare means of age by asthma status. Logistic regression models were used to analyze the association of asthma with total IgE and specific IgE levels, controlling for age, gender, national origin, home smoking exposure, the child's allergy status, and parental history of asthma. Total IgE was categorized as quartiles (<125, 126–249, 250–375, and >375 IU/ml). The relationship between asthma and sensitization to one or more of the four specific allergens and asthma was also assessed.

Results

Questionnaire data, anthropometric measurements, and serum samples were obtained for 453 children of mean age 4.0 (SD 0.5) years (Table 1). Boys and girls were equally represented. Almost 88% of the children were of Hispanic ethnicity; children of Mexican ethnicity were the largest single group. A total of 150 children met our criteria for asthma: 102 had a history of physician-diagnosed asthma and any wheezing or difficulty in breathing in the past year; 56 had had wheezing or difficulty in breathing ≥ 3 times in the past year; 129 had an urgent physician, emergency department, or hospital visit because of wheezing or difficulty in breathing; and 123 met more than one criterion. Of the 150 who met the study criteria for asthma, 42 (28%) were sensitized to cockroach, 33 (22%) to dust mite, 21 (14%) to cat, 28 (18.7%) to mouse, and 64 (42.7%) to one or more of the four allergens (Table 1). We found strong associations of asthma/allergy status with gender; national origin; living with smokers; parental history of asthma; total IgE; sensitization to cockroach, dust mite, cat, mouse, and one or more of the four allergens; and BMI (girls only).

In logistic regression models that included gender, body mass index, national origin, living with smokers, and parental history of asthma, asthma was associated with sensitization to cockroach allergen (odds ratio (OR) = 1.8, 95% confidence interval (CI) 1.1–3.1), dust mite allergen (OR = 2.2, 95% CI 1.2–4.0), cat allergen (OR = 2.8, 95% CI 1.2–6.4), mouse allergen (OR = 2.9, 95% CI 1.4–5.8), any of the four specific allergens (OR = 1.7, 95% CI 1.1–2.6), and the highest quartile of total IgE compared to the lowest (OR = 3.2, 95% CI 1.6–6.5) (Table 2). In models that controlled for allergy symptoms, the relationships of asthma with cockroach, dust mite, cat, mouse, any allergen and total IgE remained about the same. With and without inclusion of the total and specific IgE variables, allergy symptoms were strongly associated with asthma (OR = 3.7, 95% CI 2.3–6.0). In further univariate analysis, specific and total IgE were also associated with urgent doctor visits, emergency department visits, and hospitalizations associated with asthma symptoms (Table 3). In the logistic regression models, stratification on gender produced similar point estimates but wider confidence intervals (Table 4). In the models that included allergy symptoms, the association of asthma with national origin was generally weaker (Appendix Table 1 and Table 2).

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Discussion

Among study participants living in New York City neighborhoods with high asthma hospitalization rates, we found that children specifically sensitized to cockroach, dust mite, cat, or mouse allergens were more likely to have asthma symptoms and to require medical care for those symptoms than children who were not sensitized. Consistent with previous research [3–12], children in the highest quartile of total IgE were three times as likely to have asthma as children in the lowest quartile. Like other studies, ours found that children with asthma were more likely than those without asthma to live with smokers and to have parents with asthma [38–39]. Our study also showed that allergy symptoms were significantly associated with asthma, even in models that included IgE. These findings suggest that serum IgE may not have accounted for all the factors that triggered the allergy symptoms [40,41]. Because IgE levels usually peak between the ages of 8 and 12 years, the children may have been too young at the time of measurement for IgE to be a marker of all of the sensitizations that they would develop [3,10]. Or perhaps their symptoms were triggered by irritants or infectious agents as well as allergens. In any case, IgE and allergy symptoms were independently associated with asthma.

The children in our study were predominantly of Hispanic origin, and the relationship between asthma/allergy status and non-Mexican national origin was highly significant. Mexican families that participated in our study are part of a recent wave of immigration to New York City [42]. Genetic research has suggested that some of the variability in the association of Hispanic ethnicity with asthma is due to differences in ancestry [43]. However, we accounted for family history of asthma in all our models, and other studies have shown that asthma prevalence is higher among Mexicans living in the United States than among Mexicans living in Mexico [44–45]. Those observations seem consistent with the findings of the ISAAC Phase II Study Group, regarding the associations of asthma and atopy with economic development at the population level [46]. In that study of 8–12-year-old children, the association between current wheeze and skin test reactivity, country by country, was directly correlated with gross national income. Taken together, the studies implicate some aspect of the environment associated with modernization, rather than genetics, as playing a role in the relationship between sensitization and asthma.

Including allergy symptoms in the models weakened the association of asthma with national origin, although, with one exception, it remained statistically significant. Including allergy symptoms also weakened the association of asthma with parental asthma, except among the (seven) children who had two affected parents. The associations of asthma with national origin and with having one affected parent may have been mediated by allergy symptoms independent of IgE. Temporally, nationality and the asthma status of parents must precede the development of both allergy symptoms and asthma in the child, and allergy symptoms may be on the causal pathway between family background and asthma.

Although both cockroach and dust mite sensitization were more prevalent than cat or mouse sensitization, they were less strongly associated with asthma in both the univariate analyses and the logistic regression models. Similarly, Simpson et al found that both dog and cat IgEs were more strongly related to wheeze than dust mite IgE [34]. Mammalian allergens or the antibody response they stimulate may differ from insect allergens or IgE against insect allergens in propensity to cause symptoms in the lung.

One of the limitations of our study is that we categorized children's asthma status on the basis of questionnaire data alone. It is difficult to confirm an asthma diagnosis in preschool-aged children because many children stop wheezing as they grow older, and because relatively few can perform spirometric maneuvers consistently before the age of 6 years. In the absence of a gold standard for diagnosis, questionnaire data are generally accepted for the purpose of

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distinguishing children at high risk for asthma from others in population studies [39]. The criteria we used for baseline categorization of asthma are commonly used for preschool-aged children and therefore seemed reasonable for studying factors associated with asthma in this population. Moreover, the conditions that met our criteria represent a significant burden on the children who experience them and their families, whether or not they are considered asthma. The associations of specific and total IgE with urgent doctor visits, emergency department visits, and hospitalization that we observed suggest that IgE is relevant to asthma as a public health issue.

Another limitation is that we based our serologic assessment of atopic potential on a one-time measurement of total and specific IgE at mean age 4 years. We hope to analyze changes in those markers over time in a subset of the study participants.

Another limitation of the study is possible selection bias. We recruited parents in Head Start centers and offered them monetary incentives for participation. Parents who consented may also have been more likely than other Head Start parents to have a child with asthma. However, selection factors are unlikely to have influenced our results because the participants were enrolled independent of exposure status, and the same inclusion criteria were used for all participants. We recruited families of children enrolled in the Head Start program in the hope of overcoming the barriers associated with studying asthma in preschool-aged children without introducing bias. A study of non-inner city Head Start children noted that outside the Head Start population, preschool-aged children from low-income families are difficult to study; because few attend school and many lack access to care, they cannot be recruited through school or health care databases [47].

Our findings in our Head Start sample may not be generalizable to all preschool-age children, or to low-income children who are not enrolled in preschool, but given the high prevalence of asthma that we observed, we believe that our sample may be representative of the children in the communities most burdened by asthma.

Some [5,34], but not all [32,35] previous studies in industrialized countries have found that specific IgE was associated with asthma symptoms. For example, a Finnish study found no significant association between asthma and specific IgEs; however, sensitization to individual inhalant allergens was very rare and the sample size was very small [32]. Our findings are consistent with those of Simpson et al. [34], but we analyzed sensitization to specific allergen as a categorical rather than a continuous variable, and we tested for cockroach allergen instead of dog allergen because cockroach exposure is more common among low-income urban children and very few of the children in our study had lived with a dog [15].

Overall, we found that among preschool-aged children in low-income urban communities in New York City, those with high levels of total IgE or those with elevated IgE to cockroach, dust mite, cat, or mouse were more likely to have asthma as we defined it than other children. We also found a strong association of allergy symptoms with asthma. These findings are consistent with those of other studies. However, more than 25% of children *not* identified as having either asthma or allergies had detectable IgE to at least one of the four allergens, and most of the children with asthma were sensitized to none of them.

Experts warn that IgE responses should be evaluated in the context of symptoms [48]. However, the pathways to asthma need to be better understood. Prospective studies are needed to explore those pathways. If such studies find that sensitization precedes symptom development, we may derive insight from them about how to identify children who might develop asthma symptoms, and thus reduce asthma morbidity and mortality through IgE analysis. If our findings are confirmed by further research, children who are at an increased risk of developing asthma can be identified through testing as candidates for new treatments, perhaps including IgE-directed

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treatments or allergen avoidance, as primary prevention of asthma [49]. In any case, a better understanding of how IgE and allergy symptoms relate to asthma can help us reduce the burden of asthma among children in the United States.

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References

1. Platts-Mills TA. The role of immunoglobulin E in allergy and asthma. Am J Respir Crit Care Med 2001;164:S1–S5. [PubMed: 11704610]
2. Gern J, Lemanske R Jr, Busse W. Early life origins of asthma. J Clin Invest 1999;104:837–843. [PubMed: 10510321]
3. Borish L, Chipps B, Deniz Y, Gujrathi S, Zheng B, Dolan CM. Total serum IgE levels in a large cohort of patients with severe or difficult-to-treat asthma. Ann Allergy Asthma Immunol 2005;95:247–253. [PubMed: 16200815]
4. Burrows B, Martinez F, Cline MG. The relationship between parental and children's serum immunoglobulin E (IgE) and asthma. Am J Respir Crit Care Med 1995;152:1497–1500. [PubMed: 7582283]
5. Kovač K, Dodig S, Tješić-Drinković D, Raos M. Correlation between asthma severity and serum IgE in asthmatic children sensitized to Dermatophagoides pteronyssinus. Arch Med Res 2007;38:99–105. [PubMed: 17174732]
6. Naqvi M, Choudhry S, Tsai H, Thyne S, Navarro D, Nazario S, et al. Association between IgE levels and asthma severity among African American, Mexican, and Puerto Rican patients with asthma. J Allergy Clin Immunol 2007;120:137–143. [PubMed: 17498790]
7. Sears M, Burrows B, Flannery EM, Herbison GP, Hewitt CJ, Holdaway MD. Relation between airway responsiveness and serum IgE in children with asthma and in apparently normal children. N Engl J Med 1999;325:1067–1071. [PubMed: 1891008]
8. Sherrill DL, Stein R, Halonen M, Holberg CJ, Wright A, Martinez FD. Total serum IgE and its association with asthma symptoms and allergic sensitization among children. J Allergy Clin Immunol 1999;104:28–36. [PubMed: 10400836]
9. Siroux V, Oryszcyn MP, Paty E, Kauffmann F, Pison C, Vervloet D, Pin I. Relationships of allergic sensitization, total immunoglobulin E and blood eosinophils to asthma severity in children of the EGEA Study. Clin Exp Allergy 2003;33:746–751. [PubMed: 12801307]
10. Wittig H, Belloit J, De Fillipi I, Royal G. Age-related serum immunoglobulin E levels in healthy subjects in patients with allergic disease. J Allergy Clin Immunol 1980;66:305–313. [PubMed: 7419833]
11. Sporik R, Ingram JM, Price W, Sussman JH, Honsinger RW, Platts-Mills TA. Association of asthma with serum IgE and skin test reactivity to allergens among children living at high altitude. Am J Resp Crit Care Med 1995;151:1388–1392. [PubMed: 7735590]
12. Burrows B, Martinez FD, Halonen M, Barbee RA, Cline MG. Association of asthma with serum IgE levels and skin-test reactivity to allergens. N Engl J Med 1989;320:271–277. [PubMed: 2911321]
13. Halfon N, Newacheck PW. Childhood asthma and poverty: differential impacts and utilization of health services. Pediatrics 1993;91:56–61. [PubMed: 8416505]
14. Miller JE. The effects of race/ethnicity and income on early childhood asthma prevalence and health care use. Am J Public Health 2000;90:428–430. [PubMed: 10705865]
15. Chew GL, Perzanowski MS, Canfield SM, Goldstein IF, Mellins RB, Hoepner LA, et al. Cockroach allergen levels and associations with cockroach-specific IgE. J Allergy Clin Immunol 2008;121:240–245. [PubMed: 17936887]
16. Litonjua AA, Carey VJ, Weiss ST, Gold DR. Race, socioeconomic factors, and area of residence are associated with asthma prevalence. Pediatr Pulmonol 1999;28:294–401.

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17. Wright A. Epidemiology of asthma and recurrent wheeze in childhood. Clin Rev Allergy Immunol 2002;22:33–44. [PubMed: 11803801]
18. Sears M. Epidemiology of childhood asthma. Lancet 1997;350:1015–1020. [PubMed: 9329526]
19. Pearce, N. Asthma Epidemiology Principles and Methods. New York: Oxford University Press; 1998.
20. Eysink P, ter Riet G, Aalberse RC, van AAlderen WM, Roos CM, van der Zee JS, Bindels PJ. Accuracy of specific IgE in the prediction of asthma: development of a scoring forumula for general practice. Br J Gen Pract 2005;55:125–131. [PubMed: 15720934]
21. Illi S, von Mutius E, Lau S, Nickel R, Niggemann B, Sommerfeld C, Wahn U, et al. The pattern of atopic sensitization is associated with the development of asthma in childhood. J Allergy Clin Immunol 2001;108:709–714. [PubMed: 11692093]
22. Martinez FD, Wright AL, Taussig LM, Holberg CJ, Halonen M, Morgan WJ. Asthma and wheezing in the first six years of life. N Engl J Med 1995;332:133–138. [PubMed: 7800004]
23. Platts-Mills TA, Rakes G, Heymann PW. The relevance of allergen exposure to the development of asthma in childhood. J Allergy Clin Immunol 2000;105:S503–S508. [PubMed: 10669532]
24. Limb SL, et al. Irreversible lung function deficits in young adults with a history of childhood asthma. J Allergy Clin Immunol 2005;116:1213–1219. [PubMed: 16337448]
25. Limb SL, et al. Adult asthma severity in individuals with a history of childhood asthma. J Allergy Clin Immunol 2005;115:61–66. [PubMed: 15637548]
26. Louis R, Lau LC, Bron AO, Roldaan AC, Radermecker M, Djukanović R. The relationship between airways inflammation and asthma severity. Am J Respir Crit Care Med 2000;161:9–16. [PubMed: 10619791]
27. Sears MR, Greene JM, Willan AR, Wiecek EM, Taylor DR, Flannery EM, Cowan JO, et al. A longitudinal, population-based, cohort study of childhood asthma followed to adulthood. N Engl J Med 2003;349:1414–1422. [PubMed: 14534334]
28. Schwarz A, McVeigh KH, Matte T, Godman A, Kass D, Kerker B. Childhood Asthma in New York City. NYC Vital Signs 2008:1–4.
29. Høst A, Andrae S, Charkin S, Diaz-Vázquez C, Dreborg S, Eigenmann PA, Friedrichs F, et al. Allergy testing in children: why, who, when and how? Allergy 2003;58:559–569. [PubMed: 12823111]
30. Fahy JV. Anti-IgE: Lessons learned from effects on airway inflammation and asthma exacerbation. J Allergy Clin Immunol 2006;117(6):1230–1232. [PubMed: 16750979]
31. Perkin MR, Strachan DP. Which aspects of the farming lifestyle explain the inverse association with childhood allergy? J Allergy Clin Immunol 2006;117(6):1374–1381. [PubMed: 16751000]
32. Kotaniemi-Syrjanen A, Reijonen TM, Romppanen J, Korhonen K, Savolainen K, Korppi M. Allergen-specific immunoglobulin E antibodies in wheezing infants: the risk for asthma in later childhood. Pediatrics 2003;111:e255–e261. [PubMed: 12612281]
33. Wickman M, Lilja G, Söderström L, van Hagehamsten M, Ahlstedt S. Quantitative analysis of IgE antibodies to food and inhalant allergens in 4-year-old children reflects their likelihood of allergic disease. Allergy 2005;60:650–657. [PubMed: 15813811]
34. Simpson A, Söderström L, Ahlstedt S, Murray CS, Woodcock A, Custovic A. IgE antibody quantification and the probability of wheeze in preschool children. J Allergy Clin Immunol 2005;116:744–749. [PubMed: 16210045]
35. Wisnivesky JP, Sampson H, Berns S, Kattan M, Halm EA. Lack of association between indoor allergen sensitization and asthma morbidity in inner-city adults. J Allergy Clin Immunol 2007;120:113–120. [PubMed: 17531297]
36. Garg, R.; Karpati, A., et al. Asthma Facts, Second Edition. New York City: Department of Health and Mental Hygiene; 2003.
37. Canfield SM, Jacobson JS, Personowski MS, Mellins RB, Zemble RM, Chew GL, Goldstein IF. Total and specific IgE associations between New York City Head Start children and their parents. J Allergy Clin Immunol 2008;121:1422–1427. [PubMed: 18472147]
38. Bener A, Janahi I, Sabbah A. Genetics and environmental risk factors associated with asthma in schoolchildren. Eur Ann Allergy Clin Immunol 2005;37:163–168. [PubMed: 15984314]
39. Bener A, Ehlayel M, Sabbah A. The pattern and genetics of pediatric extrinsic asthma risk factors in polluted environment. Eur Ann Allergy Clin Immunol 2007;39:58–63. [PubMed: 17441417]

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40. Brockow I, Zutavern A, et al. Early Allergic Sensitizations and Their Relevence to Atopic Diseases in Children Aged 6 Years: Results of the GINI Study. J Investig Allergol Clin Immunol 2009;19(3): 180–187.
41. Arshad SH, Tariq SM, Mathews S, Hakim E. Sensitization to common allergens and its association with allergic disorders at age 4 years: a whole population birth cohort study. Pediatrics 2001;108 (2):E33. [PubMed: 11483843]
42. Jacobson JS, Mellins RB, Garfinkel R, Rundle AG, Perzanowski M, Chew G, Andrews HF, Goldstein IF. Asthma, body mass, gender, and Hispanic national origin among 517 preschool children in New York City. Allergy 2007;63:87–94. [PubMed: 18053018]
43. Salari K, Burchard EG. Latino populations: a unique opportunity for epidemiological research of asthma. Paediatr Perinat Epidemiol 2007;21:15–22. [PubMed: 17935571]
44. Eldeirawi K, McConnell R, Freels S, Persky VW. Associations of place of birth with asthma and wheezing in Mexican American children. J Allergy Clin Immunol 2005;116:42–48. [PubMed: 15990771]
45. Holguin F, Mannino DM, Anto J, Mott J, Ford ES, Teague WG, et al. Country of birth as a risk factor for asthma among Mexican Americans. Respir Crit Care Med 2005;171:103–108.
46. Weinmayr G, Weiland SK, Björkstén B, Brunekreef B, Büchele G, Cookson WO, et al. Atopic sensitization and the international variation of asthma symptom prevalence in children. Am J Respir Crit Care Med 2007;176:565–574. [PubMed: 17575099]
47. McGill KA, Sorkness CA, Ferguson-Page C, Gern JE, Havighurst TC, Knipfer B, Lemanske RF, Busse WW. Asthma in Non-Inner City Head Start Children. Pediatrics 1998;102:77–83. [PubMed: 9651417]
48. Cox L, Williams B, Sicherer S, Oppenheimer J, Sher L, Hamilton R, Golden D. American College of Allergy, Asthma and Immunology Test Task Force; American Academy of Allergy, Asthma and Immunology Specific IgE Test Task Force. Pearls and pitfalls of allergy diagnostic testing: report from the American College of Allergy, Asthma and Immunology/American Academy of Allergy, Asthma and Immunology Specific IgE Test Task Force. Ann Allergy Asthma Immunol 2008 Dec; 101(6):580–592. [PubMed: 19119701]
49. Holgate SC. Novel targets of therapy in asthma. Curr Opin Pulm Med 2009;15:63–71. [PubMed: 19077708]

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Table 1

Characteristics of participating children by asthma/allergy status

	No asthma or allergy symptoms		Allergy symptoms only		Asthma only		Both Asthma and allergy symptoms		Total		
	N	%*	N	%*	N	%*	N	%*	N	%*	P-value
N	179	39.5	124	27.4	37	8.0	113	24.9	453	100	
Mean age in years (SD)	4.0	(0.5)	3.9	(0.6)	4.0	(0.5)	3.9	(0.5)	4.0	(0.5)	0.44
Sex											0.005
Female	101	56.4	69	55.7	18	48.7	41	36.3	229	50.6	
Male	78	43.6	55	44.4	19	51.4	72	63.7	224	49.5	
Ethnicity/National Origin											
Dominican	36	20.1	23	18.6	13	35.1	23	20.4	95	21.0	0.002
Mexican	91	50.8	45	36.3	7	18.9	22	19.5	165	36.4	Referent
Puerto Rican	9	5.0	18	14.5	2	5.4	26	23.0	55	12.1	<0.0001
Other/Mixed Hispanic	32	17.9	22	17.7	11	29.7	17	15.0	82	18.1	0.01
Non-Hispanic Black	9	5.0	14	11.3	3	8.1	18	15.9	44	9.7	<0.0001
Other/Unknown	2	1.1	2	1.6	1	2.7	7	6.2	12	2.7	0.0005
Smokers in Household											0.0008
No	153	85.5	90	72.6	25	67.6	75	66.4	343	75.7	
Yes	26	14.5	34	27.4	12	32.4	38	33.6	110	24.3	
Parents with Asthma											
Neither	166	92.7	106	85.5	27	73.0	83	73.5	382	84.3	Referent
Mother only	10	5.6	11	8.9	6	16.2	16	14.2	43	9.5	0.02
Father only	2	1.1	7	5.7	3	8.1	9	8.0	21	4.6	0.01
Both	1	0.6	0	0.0	1	2.7	5	4.4	7	1.6	0.01
BMI for Age by Sex- Boys											
<85th percentile	39	50.0	32	58.2	10	52.6	45	62.5	126	56.3	Referent
85th–95th percentile	19	24.4	11	20.0	4	21.1	15	20.8	49	21.9	0.79
>95th percentile	20	25.6	12	21.8	5	26.3	12	16.7	49	21.9	0.46
BMI for Age by Sex- Girls											

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	No asthma or allergy symptoms		Allergy symptoms only		Asthma only		Both Asthma and allergy symptoms		Total		
	N	%*	N	%*	N	%*	N	%*	N	%*	P-value
<85th percentile	64	63.4	48	69.6	7	38.9	21	51.2	140	61.1	Referent
85th–95th percentile	12	11.9	12	17.4	3	16.7	10	24.4	37	16.2	0.25 0.03
>95th percentile	25	24.8	9	13.0	8	44.4	10	24.4	52	22.7	
Total IgE (IU/ml)											
<125	135	75.4	100	80.7	21	56.8	66	58.4	322	71.1	Referent
126–249	29	16.2	13	10.5	11	29.7	12	10.6	65	14.4	0.02
250–375	6	3.4	3	2.4	1	2.7	11	9.7	21	4.6	0.006
>375	9	5.0	8	6.5	4	10.8	24	21.2	45	9.9	<0.0001
Sensitized to											
Cockroach	26	14.5	22	17.7	9	24.3	33	29.2	90	19.9	0.02
Dust mite	21	11.7	11	8.9	7	18.9	26	23.0	65	14.4	0.009
Cat	5	2.8	7	5.7	3	8.1	18	15.9	33	7.3	0.0004
Mouse	8	4.5	10	8.1	5	13.5	23	20.4	46	10.2	0.0001
One or more of the above	46	25.7	36	29.0	16	43.2	48	42.5	146	32.2	0.009

*Percents for total Ns are row percents. All others are column percents.

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Table 2

Association of asthma with allergen-specific and total IgE and allergy symptoms

	Model 1*		Model 2**	
Exposure variables	**OR**	**95% CI**	**OR**	**95% CI**
Sensitized to cockroach				
No	1.0	Referent	1.0	Referent
Yes	**1.8**	1.1–3.1	**1.7**	1.0–3.0
Sensitized to dust mite				
No	1.0	Referent	1.0	Referent
Yes	**2.2**	1.2–4.0	**2.3**	1.2–4.2
Sensitized to cat				
No	1.0	Referent	1.0	Referent
Yes	**2.8**	1.2–6.4	**2.6**	1.1–6.0
Sensitized to mouse				
No	1.0	Referent	1.0	Referent
Yes	**2.9**	1.4–5.8	**2.5**	1.2–5.1
Sensitized to one or more of four				
No	1.0	Referent	1.0	Referent
Yes	**1.7**	1.1–2.6	**1.6**	1.0–2.6
Total IgE (IU/ml)				
<125	1.0	Referent	1.0	Referent
126–249	**1.1**	0.6–2.0	**1.4**	0.7–2.6
250–375	**2.5**	0.9–6.5	**2.4**	0.9–6.5
>375	**3.2**	1.6–6.5	**3.1**	1.5–6.4
Child has allergy symptoms				
No			1.0	Referent
Yes			**3.7**	2.3–6.0

*Controlling for age, sex, BMI for age by sex, national origin, number of smokers in the household, and parental asthma.

**Controlling for all of the above, plus child has allergy symptoms.

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Table 3

Associations of allergen-specific and total IgE with indicators of asthma severity

Indicator	Urgent doctor visit					Emergency department visit					Hospitalization overnight				
	No		Yes			No		Yes			No		Yes		
	N	%	N	%	P-value	N	%	N	%	P-value	N	%	N	%	P-value
	344	75.9	109	24.1		350	77.3	103	22.7		398	87.9	55	12.14	
Sensitized to cockroach					0.002					0.001					0.01
No	303	88.1	76	69.7		292	83.4	71	68.9		326	81.9	37	67.3	
Yes	41	11.9	33	30.3		58	16.6	32	31.1		72	18.1	18	32.7	
Sensitized to dust mite					0.003					0.003					0.004
No	304	88.4	84	77.1		309	88.3	79	76.7		348	87.4	40	72.7	
Yes	40	11.6	25	22.9		41	11.7	24	23.3		50	12.6	15	27.3	
Sensitized to cat					0.003					<0.0001					0.0009
No	326	94.8	94	86.2		334	95.4	86	83.5		375	94.2	45	81.8	
Yes	18	5.2	15	13.8		16	4.6	17	16.5		23	5.8	10	18.2	
Sensitized to mouse					<0.0001					<0.0001					<0.0001
No	322	93.6	85	78.0		326	93.1	81	78.6		367	92.2	40	72.7	
Yes	22	6.4	24	22.0		24	6.9	22	21.4		31	7.8	15	27.3	
Sensitized to any of four				0.001						0.0004					0.002
No	247	71.8	60	55.0		252	72.0	55	53.4		280	70.4	27	49.1	
Yes	97	28.2	49	45.0		98	28.0	48	46.6		118	29.6	28	50.9	
Total IgE (IU/ml)					<0.0001					0.002					0.0006
<125	262	76.2	60	55.0		260	74.3	62	60.2		290	72.9	32	58.2	
126–249	50	14.5	15	13.8		50	14.3	15	14.6		60	15.1	5	9.1	
250–375	10	2.9	11	10.1		15	4.3	6	5.8		16	4.0	5	9.1	
>375	22	6.4	23	21.1		25	7.1	20	19.4		32	8.0	13	23.6	

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Table 4

Odds ratios for the associations of allergen-specific and total IgE with asthma, by gender

	Model 1		Model 2	
	OR	**95% CI**	**OR**	**95% CI**
Boys				
Sensitized to cockroach	1.5	0.7–3.0	1.5	0.8–3.0
Sensitized to dust mite	**3.6**	**1.5–8.7**	**3.0**	**1.3–6.9**
Sensitized to cat	2.0	0.6–6.2	2.0	0.7–5.9
sensitized to mouse	2.4	0.9–6.1	**2.5**	**1.0–6.1**
Sensitized to one or more of four	**1.9**	**1.0–3.8**	1.8	0.9–3.3
Total IgE (IU/ml)				
<125	1.0	Referent	1.0	Referent
126–249	1.1	0.5–2.7	0.7	0.3–1.7
250–375	2.7	0.8–9.2	2.9	0.9–9.4
>375	**2.8**	**1.0–7.9**	2.3	0.9–6.0
Child has allergy symptoms			**4.1**	**2.1–8.0**
Girls				
Sensitized to cockroach	1.9	0.8–4.7	2.3	1.0–5.4
Sensitized to dust mite	1.5	0.5–3.9	1.7	0.7–4.4
Sensitized to cat	2.9	0.8–10.6	**4.2**	**1.2–14.9**
sensitized to mouse	2.7	0.8–8.9	**4.1**	**1.3–12.8**
Sensitized to one or more of four	1.2	0.6–2.6	1.5	0.8–3.2
Total IgE (IU/ml)				
<125	1.0	Referent	1.0	Referent
126–249	2.5	0.9–7.1	2.3	0.9–6.3
250–375	1.1	0.1–9.5	1.0	0.1–7.3
>375	**3.3**	**1.0–10.6**	**5.1**	**1.7–15.9**
Child has allergy symptoms			**4.1**	**1.9–8.6**

* Controlling for age, sex, BMI for age by sex, national origin, number of smokers in the household, and parental asthma.

** Controlling for all of the above, plus child has allergy symptoms.

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Appendix Table 1

Odds ratios (with 95% confidence intervals) for all the variables included in Model 1 (Table 2)

Exposure variables	Cockroach		Dust mite		Cat		Mouse		Any of Four		Total IgE quartiles	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age in months	1.0	0.9–1.0	1.0	0.9–1.0	1.0	1.0–1.0	1.0	1.0–1.0	1.0	0.9–1.0	1.0	0.9–1.0
Sex												
Male	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Female	0.5	0.3–0.8	0.5	0.3–0.8	0.5	0.3–0.8	0.5	0.3–0.8	0.5	0.3–0.8	0.5	0.3–0.8
BMI for age by sex												
<85th percentile	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
85th–95th percentile	1.2	0.9–1.6	1.2	0.9–1.6	1.1	0.8–1.5	1.1	0.9–1.5	1.2	0.9–1.5	1.1	0.9–1.5
>95th percentile	1.1	0.9–1.3	1.1	0.9–1.3	1.1	0.9–1.3	1.1	0.9–1.3	1.1	0.9–1.3	1.1	0.9–1.3
National Origin												
Mexican	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Dominican	2.8	1.5–5.1	2.8	1.5–5.0	2.7	1.5–4.9	2.7	1.5–5.0	2.7	1.5–4.9	2.6	1.4–4.9
Puerto Rican	3.3	1.5–7.0	3.2	1.5–6.9	2.6	1.2–5.7	3.5	1.6–7.4	3.1	1.4–6.7	3.2	1.5–6.9
Other/Mixed Hispanic	2.5	1.3–4.6	2.4	1.3–4.5	2.4	1.3–4.5	2.3	1.2–4.4	2.3	1.2–4.4	2.5	1.3–4.7
Non-Hispanic Black	3.7	1.8–7.9	3.5	1.7–7.5	3.2	1.5–6.9	3.4	1.6–7.2	3.6	1.7–7.7	3.1	1.4–6.7
Other/Unknown	9.7	2.6–36.1	8.8	2.3–32.9	8.1	2.1–30.8	8.7	2.3–33.1	9.2	2.4–34.3	8.8	2.3–33.7
Smokers in household												
No	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Yes	1.6	1.0–2.6	1.6	1.0–2.6	1.6	1.0–2.6	1.5	0.9–2.5	1.6	1.0–2.6	1.6	1.0–2.7
Parents with Asthma												
Neither	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Mother only	2.2	1.1–4.3	2.2	1.1–4.4	2.3	1.1–4.6	2.1	1.0–4.2	2.1	1.1–4.3	2.0	1.0–4.0
Father only	2.4	0.9–6.3	2.5	1.0–6.5	2.9	1.1–7.7	2.6	1.0–6.7	2.5	0.9–6.5	2.5	0.9–6.6
Both	7.2	0.8–65.6	7.7	0.8–71.2	8.3	0.9–76.8	5.4	0.6–50.0	6.7	0.7–61.1	4.2	0.5–39.8
Sensitized to cockroach												
No	1.0	Referent										
Yes	**1.8**	1.1–3.1										

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Exposure variables	Cockroach		Dust mite		Cat		Mouse		Any of Four		Total IgE quartiles	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Sensitized to dust mite												
No			1.0	Referent								
Yes			**2.2**	1.2–4.0								
Sensitized to cat												
No					1.0	Referent						
Yes					**2.8**	1.2–6.4						
Sensitized to mouse												
No							1.0	Referent				
Yes							**2.9**	1.4–5.8				
Sensitized to any of four												
No									1.0	Referent		
Yes									**1.7**	1.1–2.6		
Total IgE (IU/ml)												
<125											1.0	Referent
126–249											**1.1**	0.6–2.0
250–375											**2.5**	0.9–6.5
>375											**3.2**	1.6–6.5

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Appendix Table 2

Odds ratios (with 95% confidence intervals) for all the variables included in Model 2 (Table 2)

Exposure variables	Cockroach		Dust mite		Cat		Mouse	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age in months	1.0	1.0–1.0	1.0	1.0–1.0	1.0	1.0–1.0	1.0	1.0–1.0
Sex								
Male	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Female	0.6	0.4–0.9	0.5	0.3–0.9	0.5	0.3–0.8	0.5	1.0–1.0
BMI for age by sex								
<85th percentile	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
85th–95th percentile	1.2	0.9–1.6	1.2	0.9–1.6	1.1	0.8–1.5	1.1	0.8–1.5
>95th percentile	1.1	0.9–1.4	1.1	0.9–1.4	1.1	0.9–1.4	1.1	1.0–1.4
National Origin								
Mexican	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Dominican	2.8	1.5–5.2	2.8	1.5–5.2	2.7	1.4–5.0	2.7	1.5–5.1
Puerto Rican	2.2	1.0–4.9	2.2	1.0–4.9	1.9	0.8–4.1	2.4	1.1–5.2
Other/Mixed Hispanic	2.4	1.2–4.6	2.4	1.2–4.6	2.3	1.2–4.5	2.3	1.2–4.4
Non-Hispanic Black	2.9	1.3–6.2	2.7	1.2–5.8	2.5	1.1–5.5	2.6	1.2–5.7
Other/Unknown	7.9	2.0–31.7	7.1	1.8–28.1	6.8	1.6–27.7	7.2	1.8–29.2
Smokers in household								
No	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Yes	1.5	0.9–2.5	1.5	0.9–2.5	1.5	0.9–2.5	1.5	0.9–2.4
Parents with Asthma								
Neither	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Mother only	2.1	1.0–4.2	2.1	1.0–4.3	2.2	1.1–4.5	2.0	1.0–4.1
Father only	2.0	0.7–5.5	2.1	0.8–5.7	2.5	0.9–6.7	2.2	0.8–5.9
Both	9.1	0.9–90.9	10.5	1.0–107.9	11.1	1.1–113.5	7.2	0.7–70.7
Child has allergy symptoms								
No	1.0	Referent	1.0	Referent	1.0	Referent	1.0	Referent
Yes	**3.6**	2.2–5.9	**3.8**	2.3–6.1	**3.6**	2.2–5.8	**3.5**	2.2–5.7

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Exposure variables	Cockroach		Dust mite		Cat		Mouse	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Sensitized to cockroach								
No	1.0	Referent						
Yes	**1.7**	1.0–3.0						
Sensitized to dust mite								
No			1.0	Referent				
Yes			**2.3**	1.2–4.2				
Sensitized to cat								
No					1.0	Referent		
Yes					**2.6**	1.1–6.0		
Sensitized to mouse								
No							1.0	Referent
Yes							**2.5**	1.2–5.1
Sensitized to any of four								
No								
Yes								
Total IgE (IU/ml)								
<125								
126–249								
250–375								
>375								

	Any of four		Total IgE Quartiles		None	
	OR	95% CI	OR	95% CI	OR	95% CI
Age in months	1.0	1.0–1.0	1.0	1.0–1.0	1.0	1.0–1.0
Sex						
Male	1.0	Referent	1.0	Referent	1.0	Referent
Female	0.6	0.4–0.9	0.6	0.4–0.9	0.5	0.3–0.8

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	Any of four		Total IgE Quartiles		None	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
BMI for age by sex						
<85th percentile	1.0	Referent	1.0	Referent	1.0	Referent
85th–95th percentile	1.1	0.9–1.5	1.1	0.8–1.5	1.2	0.9–1.6
>95th percentile	1.1	0.9–1.4	1.2	1.0–1.4	1.1	1.0–1.4
National Origin						
Mexican	1.0	Referent	1.0	Referent	1.0	Referent
Dominican	2.7	1.5–5.1	2.6	1.4–4.9	2.7	1.4–5.0
Puerto Rican	2.2	1.0–4.7	2.2	1.0–4.9	2.1	1.0–4.5
Other/Mixed Hispanic	2.3	1.2–4.4	2.4	1.2–4.6	2.4	1.2–4.5
Non-Hispanic Black	2.8	1.3–6.0	2.4	1.1–5.3	2.7	1.3–5.9
Other/Unknown	7.5	1.9–29.8	6.9	1.7–28.5	7.0	1.8–28.1
Smokers in household						
No	1.0	Referent	1.0	Referent	1.0	Referent
Yes	1.5	0.9–2.5	1.5	0.9–2.5	1.5	0.9–2.6
Parents with Asthma						
Neither	1.0	Referent	1.0	Referent	1.0	Referent
Mother only	2.0	1.0–4.2	1.9	0.9–3.9	2.1	1.0–4.3
Father only	2.1	0.8–5.7	2.1	0.8–5.7	2.3	0.9–6.4
Both	8.1	0.8–78.9	5.8	0.6–59.5	10.4	1.1–102.7
Child has allergy symptoms						
No	1.0	Referent	1.0	Referent	1.0	Referent
Yes	**3.7**	**2.3–5.9**	**3.7**	2.2–6.0	**3.7**	2.3–6.0
Sensitized to cockroach						
No						
Yes						
Sensitized to dust mite						
No						
Yes						
Sensitized to cat						
No						

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	Any of four		Total IgE Quartiles		None	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Yes						
Sensitized to mouse						
No						
Yes						
Sensitized to any of four						
No	1.0	Referent				
Yes	**1.6**	1.0–2.6				
Total IgE (IU/ml)						
<125			1.0	Referent		
126–249			**1.4**	0.7–2.6		
250–375			**2.4**	0.9–6.5		
>375			**3.1**	1.5–6.4		