Ann Allergy Asthma Immunol 117 (2016) 43–49

Contents lists available at ScienceDirect

Sensitization to mouse and cockroach allergens and asthma morbidity in urban minority youth

Genes-environments and Admixture in Latino American (GALA-II) and Study of African-Americans, Asthma, Genes, and Environments (SAGE-II)

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ARTICLE INFO

Article history:
Received for publication March 3, 2016.
Received in revised form May 4, 2016.
Accepted for publication May 6, 2016.

ABSTRACT

Background: Pest allergen sensitization is associated with asthma morbidity in urban youth but minimally explored in Latino populations. Specifically, the effect of mouse sensitization on the risk of asthma exacerbation has been unexplored in Latino subgroups.
Objective: To evaluate whether pest allergen sensitization is a predictor of asthma exacerbations and poor asthma control in urban minority children with asthma.
Methods: Latino and African American children (8–21 years old) with asthma were recruited from 4 sites across the United States. Logistic regression models evaluated the association of mouse or cockroach sensitization with asthma-related acute care visits or hospitalizations.
Results: A total of 1,992 children with asthma in the Genes-environments and Admixture in Latino American (GALA-II) and Study of African-Americans, Asthma, Genes, and Environments (SAGE-II) cohorts were studied. Asthmatic children from New York had the highest rate of pest allergen sensitization (42% mouse, 56% cockroach), with the lowest rate in San Francisco (4% mouse, 8% cockroach). Mouse sensitization, more than cockroach, was associated with increased odds of acute care visits (adjusted odds ratio [aOR], 1.47; 95% CI, 1.07–2.03) or hospitalizations (aOR, 3.07; 95% CI, 1.81–5.18), even after controlling for self-reported race and site of recruitment. In stratified analyses, Mexican youth sensitized to mouse allergen did not have higher odds of asthma exacerbation. Other Latino and Puerto Rican youth sensitized to mouse had higher odds of hospitalization for asthma (aORs, 4.57 [95% CI, 1.86–11.22] and 10.01 [95% CI, 1.77–56.6], respectively) but not emergency department visits.

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Funding Sources: This study was supported in part by grants ES015794, AI077439, HL088133, HL078885, CA113710, AI079139, HL004464, HL104608, AI061774, HL079055, DK064695, and M01-RR00188; HHSN26120080001E; and MD006902 from the National Institutes of Health; the Flight Attendant Medical Research Institute; an Robert Wood Johnson Foundation Amos Medical Faculty Development Award (Dr Burchard); the Sandler Foundation; the American Asthma Foundation (Dr Burchard); and an Ernest S. Bazley grant (Dr Avila). In addition, the research reported in this publication was supported by award P60MD006902 from the National Institute on Minority Health and Health Disparities of the National Institutes of Health.

http://dx.doi.org/10.1016/j.anai.2016.05.004
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Conclusion: Pest allergen sensitization is associated with a higher odds of asthma exacerbations in urban minority youth. Puerto Rican and Other Latino youth sensitized to mouse were more likely to have asthma-related hospitalizations than Mexican youth.

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Introduction

Approximately 9% of US children have asthma, with an increased prevalence and burden of disease in minority children,[1,2] which is not accounted for by socioeconomic status or access to care.[3–5] Pest allergen sensitization is associated with increased asthma morbidity in urban minority youth.[6] Pest allergens, mouse and cockroach, in contrast to dust mite and other indoor allergens, are more significantly associated with asthma exacerbation.[7] Furthermore, 8% to 30% of urban children are allergic to mouse or cockroach,[8–10] with 50% to 95% of urban homes having detectable mouse or cockroach allergen levels.[11,12] This is a major public health concern because asthma exacerbations represent approximately $4 billion lost on an annual basis.[13] However, most studies on mouse sensitization and asthma focus on populations that are more than 70% African American and limited to certain cities with high levels of exposure.[9,14] Studies that adequately represent urban Latino subpopulations in the United States[15] are lacking.

Allergen sensitization among inner-city children with asthma is more common in minority groups compared with white populations.[16] In fact, there is evidence that certain Latino subgroups, such as Puerto Ricans, are more likely to develop indoor allergen sensitization compared with other Latino subgroups.[17,18] A few studies have purported a significant burden of mouse in Latino households,[19] with similar levels of sensitization compared with other minority populations.[20] However, these studies do not represent a national sample, and not all Latino subgroups are thought to have more poorly controlled asthma in the context of mouse exposure[21,22]; adequate representation of Latino subgroups is necessary to evaluate factors associated with asthma morbidity.[23] The largest study to date, the Inner-City Asthma Study (ICAC), did not address the affect of mouse or cockroach sensitization on the risk of asthma exacerbation distinguishing different Latino subgroups. Our aim was to evaluate whether pest allergen (mouse or cockroach) sensitization is a predictor of asthma exacerbations and poor asthma control within a nationwide sample of urban minority asthmatic children, including Latino subgroups.

Methods

Study Design

The Genes-environments and Admixture in Latino American (GALA II)[24] study and the Study of African-Americans, Asthma, Genes, and Environments (SAGE II)[25] are 2 parallel case-control studies with asthmatic and control participants that used identical protocols and questionnaires, initiated in 2008, and funded by the National Institutes of Health. Urban minority youth aged 8 to 21 years were recruited as part of the 2 gene-environment studies with GALA II focused on Latino Americans and SAGE II focused on African Americans. Children and adolescents with and without asthma aged 8 to 21 years were recruited for SAGE II (n = 908 cases and 616 controls) and the GALA II studies (n = 2,232 cases and 2,228 controls). Children were recruited from 5 community- and clinic-based centers (Chicago, IL; New York, NY; Houston, TX; San Francisco Bay, CA; and San Juan, Puerto Rico) during July 2008 through November 2011 for GALA II and for 1 clinic (San Francisco Bay, CA) for SAGE II. Our cross-sectional analysis focused on children with asthma from the mainland United States. Each participating center's institutional review board reviewed and approved the study. Written informed consent was provided by parent or legal guardian (if 18 years or older, by the study participant).

Patient Population

Asthmatic children were defined by a history of physician-diagnosed asthma and 2 or more symptoms (cough, wheezing, or shortness of breath) within 2 years before enrollment. For this cross-sectional analysis, we used the subset of children with asthma from the mainland United States with mouse and cockroach skin prick data (n = 1,922). We focus on pest allergen sensitization within the continental United States because allergen levels and other factors that affect control may be different within individuals living on the island of Puerto Rico. Furthermore, there were technique differences, which may limit comparability of skin tests in these sites to the other continental US sites. Other exclusion criteria included 10 or more pack-years of cigarette smoking, any smoking within 1 year of recruitment, history of other lung disease (other than asthma) or chronic illness, and third-trimester pregnancy.

Assessment of Pest Allergen Sensitization and Self-reported Exposure

Mouse epithelium (*Mus musculus*; Greer, Lenoir, North Carolina) and cockroach mix (*Blatella germanica* and *Periplaneta americana*; Hollister-Stier, Spokane, Washington) sensitization at the time of recruitment was determined by skin prick testing. Testing was performed on the volar aspect of the forearm with the Multi-Test II (Lincoln Diagnostics, Decatur, Illinois). Wheal diameter was measured using the mean length plus width and was considered positive if wheal size was 3 mm or more larger than saline, assuming adequate response to histamine (≥3 mm wheal larger than saline control). Trained interviewers administered comprehensive questionnaires and spirometry tests to gather baseline sociodemographic data, as well as information on general health and asthma-related health outcomes. As part of the recruitment questionnaire, participants were asked whether in the past 12 months they had problems with mice or cockroaches.

Outcomes

The coprimary outcomes (representing asthma exacerbation) were acute care visits for asthma or hospitalizations for asthma in the past 12 months. Secondary outcomes included asthma control via a composite index based on National Heart, Lung, and Blood Institute criteria and lung function measures of percentage predicted forced expiratory volume in 1 second (FEV_1) and ratio of FEV_1 to forced vital capacity (FVC).

With regard to the coprimary outcomes, individuals with asthma were categorized as having an acute care visit during the previous 12 months if they had 1 or more urgent care or emergency department (ED) visit(s) or hospitalized if they had 1 or more hospital admission(s). This was determined with the following questions: "How many times in the past 12 months has CHILD received asthma care that was not scheduled at least 24 hours ahead of time? (1, once; 2, 2–4 times; 3, ≥5)" and "How many times in the past 12 months has CHILD been hospitalized because of asthma? (1, once; 2, 2–4 times; 3, ≥5)."

The secondary outcome of asthma control was calculated via a composite index based on National Heart, Lung, and Blood Institute criteria as described in detail in previous articles,[26,27]

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