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Sensitization to mouse allergen and asthma and asthma morbidity among women in Boston

Wanda Phipatanakul, MD, MS[a,b,c], **Augusto A. Litonjua, MD, MPH**[b,c], **Thomas A. E. Platts-Mills, MD, PhD**[d], **Lisa M. Naccara, BA**[d], **Juan C. Celedón, MD, DrPH**[b,c], **Hassen Abdulkerim, MS**[b,c], **Elaine B. Hoffman, PhD**[e], and **Diane R. Gold, MD, MPH**[b,c]

a*Department of Pediatrics, Division of Allergy and Immunology, Children's Hospital, Boston, Mass*

b*Channing Laboratory, Department of Medicine, Brigham and Women's Hospital, Boston, Mass*

c*Harvard Medical School, Boston, Mass*

d*Asthma and Allergic Diseases Center, University of Virginia, Charlottesville, Va*

e*Department of Biostatistics, Harvard School of Public Health, Boston, Mass*

To the Editor:

Recent studies have shown that mouse allergen is prevalent and potentially important in both urban and suburban environments, particularly in homes of subjects with asthma sensitized to this allergen.[1-4] However, little is known about the relation of sensitization to mouse allergen to asthma morbidity in adults with asthma outside the occupational laboratory setting. In this study, we evaluated whether sensitization to mouse allergen is a cause of morbidity in women with asthma from a range of socioeconomic back-grounds from a large metropolitan area in the United States.

This study involved women who were screened for participation in the Epidemiology of Home Allergens and Asthma Study, which has previously been described in detail[5-7] (see this article's Online Repository at www.jacionline.org). This analysis includes 853 women for whom serum IgE to mouse allergen was measured. The study was approved by the Human Research Committee of the Brigham and Women's Hospital. Information on race was determined from the woman's response to questions asking her in which ethnic or racial groups she would classify herself (white, black, Hispanic, Asian, or other) as previously described[5] (see this article's Online Repository at www.jacionline.org). Other demographic and socioeconomic variables were obtained from screening questionnaires and have been previously described.[7]

A serum sample drawn at screening was analyzed for total IgE and IgE specific to a panel of allergens using the UNICAP system (Pharmacia, Uppsala, Sweden).[7] Furthermore, sera were assayed for IgE to mouse urinary allergen (Pharmacia ImmunoCAP e88) and to recombinant Mus m 1 (*Mus musculus*) using the streptavidin technique.[8] Results for recombinant Mus m 1 showed a strong quantitative correlation with IgE antibody to mouse allergen ($r = 0.92$; $P < .001$). We defined sensitization to each allergen as CAP class level 1 or above (≥0.35 IU/mL).

Each woman was asked detailed questions regarding her current and past history of respiratory disease, as previously described.[9] In the screening questionnaire, women were asked, "Has a doctor ever said that you have asthma?" These women were asked questions regarding asthma morbidity in the past 12 months. A bout of asthma lasting 1 week or more was defined as

E-mail: wanda.phipatanakul@childrens.harvard.edu..

"prolonged illness," treatment in a hospital emergency room (ER) for asthma was defined as "use of a hospital ER," use of an oral steroid for asthma exacerbation was defined as "use of steroid," and having wheezing or whistling in the absence of a cold (upper respiratory viral infection) was defined as "wheeze without a cold." A positive response to any of the above defined asthma morbidity indicators ("prolonged illness," "use of hospital ER," "use of steroid," and "wheeze without a cold") was defined as "overall asthma morbidity."

The univariable analysis was conducted using χ^2 for categorical variables and 2-tailed t tests for pairs of continuous and categorical variables. Multivariable models were created by using stepwise logistic regression while adjusting for potential confounders and examining interactions. For the interaction between mouse allergen sensitization and race, we dichotomized the data into those who were white and non-Hispanic versus black or Hispanic. The interaction between race and asthma and asthma morbidity was examined by using adjusted logistic regression models to compute odds ratios (ORs; see this article's Online Repository at www.jacionline.org for details on statistical methods).

Of the 853 women in this analysis, 60 (7.0%) were sensitized to mouse allergen, 134 (16.3%) were sensitized to cockroach allergen, and 325 (38.1%) had been diagnosed with asthma by a physician. Of the 325 women with asthma, 49 (15.1%) were sensitized to mouse allergen. Characteristics of the population are in Table E1 in this article's Online Repository at www.jacionline.org. Most of the women were white and non-Hispanic (519 or 60.8%). Sensitization to mouse allergen was more common among nonwhites (11.9% for Blacks, 14.4% for Hispanics, 14.2% for Asians/others, and 3.3% for white non-Hispanics), among subjects living within the city of Boston, in areas of poverty, and in areas where the population had lower household incomes.

In univariable analyses, sensitization to mouse allergen was associated with 8-fold increased odds of doctor-diagnosed asthma (OR, 8.3; 95% CI, 4.3-16.3; $P < .0001$). After adjustment for potential confounders, including sensitization to cockroach and other allergens, race, poverty, health insurance status, and living within Boston, sensitization to mouse allergen was associated with more than twice the odds of physician-diagnosed asthma (95% CI for OR, 1.2-5.7; $P = .02$). In addition, we created multivariable models for each of the measured indicators of socioeconomic status and did not find them to be significant confounders of the effect of mouse allergen sensitization on asthma.

Table I shows the results of unadjusted and adjusted analyses of the relation between mouse allergen sensitization and indicators of asthma morbidity. In these analyses, mouse allergen sensitization was strongly associated with use of steroids, use of hospital ER, wheeze without a cold, prolonged illness, and overall asthma morbidity. Similar results were seen in the association between mouse allergen sensitization and asthma morbidity after adjustment for sensitization to all of the allergens other than mouse (see this article's Table E2 and E3 in the Online Repository at www.jacionline.org).

Although mouse allergen sensitization was a risk factor for asthma prevalence and morbidity regardless of race or ethnicity, the magnitude of the relation of mouse sensitization with asthma morbidity risk was modified by race. The interaction between race and overall asthma morbidity was significant in the unadjusted and adjusted models (for details, see this article's Online Repository at www.jacionline.org); unadjusted OR for asthma morbidity in non-Hispanic whites, 16.3; 95% CI, 2.1-127.8; unadjusted OR for blacks or Hispanics, 1.8; 95% CI, 0.8-3.9; adjusted OR for non-Hispanic whites, 16.4; 95% CI, 2.0-132.3; adjusted OR for blacks or Hispanics, 1.6; 95% CI, 0.6-3.92; P for interaction, .04.

Among 853 women in Boston, sensitization to mouse allergen was associated with physician-diagnosed asthma and several markers of asthma morbidity and overall asthma morbidity,

regardless of race/ethnicity. This finding remained significant after adjusting for indicators of socioeconomic status at the personal and community level and for sensitization to other allergens. We therefore report the unique contribution of mouse allergy to asthma prevalence and morbidity, adjusting for other allergies. Mouse allergy was more prevalent in women from economically disadvantaged areas and ethnic minority groups. Mouse allergy was also associated with asthma prevalence and asthma morbidity, regardless of race/ethnicity. However, white women who were sensitized to mouse allergen had a higher rate of asthma morbidity compared with women from minority ethnic groups who were sensitized to mouse allergen, suggesting that the relation of mouse sensitization with asthma morbidity risk was modified by race.

To our knowledge, this is the first report of a significant association between mouse sensitization and asthma and asthma morbidity in adults outside the laboratory setting. In a previous study,[7] we showed that black and Hispanic women had an increased risk of having an elevated total serum IgE and of being sensitized to multiple allergens (other than mouse, which was not included). In that study, which evaluated indoor and outdoor allergens, sensitization to cockroach, cat, dog, and mite allergens was higher in women of low socioeconomic status and was independently associated with asthma.[9,10]

Our finding of the interaction between mouse sensitization and asthma by race/ethnicity was independent of measured indices of poverty (which are correlated with race/ethnicity). Black and Hispanic women are sensitized to more allergens than white women in our cohort. Because sensitization to multiple allergens is a risk factor for asthma morbidity, the unique contribution of mouse allergen sensitization to the risk of morbidity among minority women may consequently be smaller for minority women than for white women.

This study is limited in that it may be generalizable only to women of childbearing age from the urban United States. It is also limited by the absence of mouse allergen data and by the absence of additional information to confirm the diagnosis of asthma. However, this study is relevant to a large, at-risk portion of the population of women of childbearing age.

In summary, regardless of race, ethnicity, or socioeconomic status, women sensitized to mouse allergen have higher rates of a physician's diagnosis of asthma and asthma morbidity. Although the effect of mouse allergen sensitization on asthma and asthma morbidity was some-what lower in minorities, mouse sensitization was present in a higher proportion of the minority population. Thus, the population at risk for mouse allergy-associated asthma may be greater among the African American and Hispanic compared with the non-Hispanic white women of childbearing age. Exposure patterns and other factors associated with the sensitization to mouse allergen should be examined more closely in the future.

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TABLE I

Mouse sensitization as a predictor of disease morbidity* among women with asthma (N = 325)†‡

Mouse allergy	Steroid use (n = 37)†		ER visit (n = 53)†		Wheeze without a cold (n = 148)†		Prolonged illness (n = 50)†		Overall morbidity (n = 175)†	
	OR (95% CI) Unadjusted	OR (95% CI) Adjusted	OR (95% CI) Unadjusted	OR (95% CI) Adjusted	OR (95% CI) Unadjusted	OR (95% CI) Adjusted	OR (95% CI) Unadjusted	OR (95% CI) Adjusted	OR (95% CI) Unadjusted	OR (95% CI) Adjusted
Negative	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Positive	4.4 (2.1-9.4)	3.2 (1.2-8.4)	3.7 (1.9-7.3)	3.3 (1.4-7.8)	2.6 (1.4-4.9)	2.5 (1.2-5.3)	3.0 (1.5-6.1)	3.7 (1.5-8.9)	3.1 (1.5-6.2)	3.0 (1.3-6.6)

*Definitions of asthma morbidity: steroid use, use of oral steroids during worse bout of illness; ER visit, treatment in a hospital ER for asthma in the past 12 months; wheeze without a cold, wheezing or whistling in the chest in the absence of a cold (upper respiratory viral infection) in the past 12 months; prolonged illness, a bout of asthma during the past 12 months lasting 1 week or more; overall morbidity, a positive response to any of these indicators.

†n = Number of women who had these symptoms of asthma morbidity in the previous year of the 325 women who were diagnosed with asthma. Total population was 853 women.

‡All multivariate models were adjusted for age, race, area poverty, living in inner-city Boston, cockroach allergen sensitization, cat allergen sensitization, and health insurance.