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The Effect of Poverty, Urbanization, and Race/Ethnicity on Perceived Food Allergy in the United States

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Food allergy is a common condition, affecting approximately 7% of children in the United States.[1] Previous studies have suggested that food allergy is more prevalent among children living in urban centers than those living in rural locations,[2] as well as among children of

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black race/ethnicity.[3] The relative contributions of urbanization, neighborhood poverty, and race/ethnicity to this health disparity, however, have not yet been examined.

In this study, data from the National Health Interview Survey (NHIS) were analyzed for years 2009-2011 in children younger than 17 years old. Perceived food allergy was assessed by the question, "During the past 12 months, has [your child] had any kind of food or digestive allergy?" Urbanization was assigned using the 2006 NCHS Urban-Rural Classification Scheme for Counties, and was categorized as "large central metro," "large fringe metro (surburban)," "medium metro," and "small metro/rural." Neighborhood poverty was assessed by linking census tract of residence to data from the 2000 US Census, and a "poor" neighborhood was defined as one in which ≥20% of households were below the poverty level.[4] "Poor" neighborhoods in "large central metro" urban classifications were considered "inner city." Possible confounders, such as household income and access to health care were then examined. Further details regarding NHIS and these methods are included in the Online Supplement.

To account for non-response and complex sampling methods, weights and survey strata were used for all analyses. Risk factors for self-reported food allergy were assessed by logistic regression, and all analyses were performed in STATA SE/11 (College Station, TX). Access to restricted data was approved by the NCHS Research Data Center (RDC), and all analyses were performed at the NCHS RDC Center in Hyattsville, Maryland.

A total of 35,128 children (mean age of 8.4 years) were surveyed between 2009 and 2011. The overall prevalence of perceived food allergy over the past year was 5.1%. In unadjusted analyses, children living in poor urban neighborhoods had the lowest prevalence of perceived food allergy (3.1%; 95% CI 2.4–4.0%) (eTable 1), whereas children living in suburban neighborhoods had the highest prevalence (6.0%; 95% CI 5.4–6.8%).

In analyses adjusted for gender, age, race/ethnicity, household income, geographic area, urban location, and access to healthcare services (Table 1), neighborhood-level poverty was found to be protective for perceived food allergy (OR 0.79; 95% CI 0.67–0.94; p=0.009). Similarly, in adjusted models, living in urban centers, as compared to suburban, was protective for perceived food allergy and approached significance (OR 0.84; 95% CI 0.69–1.00; p=0.054). Adjusted prevalence estimates are depicted in eTable2.

Black race/ethnicity, compared to white race/ethnicity was an independent risk factor for perceived food allergy (OR 1.26; 95% CI 1.06–1.50; p=0.01), while Hispanic ethnicity was protective (OR 0.72; 95% CI 0.68–0.96; p<0.001). Both black and Hispanic children were more likely to live in urban centers (eTable 3).

In this study, we found that perceived food allergy was least prevalent (3.1%) among those living in poor urban neighborhoods. This finding is in contrast to that reported by Gupta *et al*, where food allergy was found to be more prevalent in urban (9.8%) than rural (6.2%) locations.[2] Similarly, in the high-risk inner city Urban Environment and Childhood Asthma (URECA) birth cohort, the cumulative incidence of food allergy by age 5, based on clinical and serologic data, was found to be at least 9.9%,[5] which is higher than recently published national estimates.[1] It is possible that our lower overall and inner city estimates may be the

result of the fact that the URECA cohort was at high-risk for atopy and was predominantly of black race/ethnicity, and the different methods of assessment, definitions of food allergy and subject selection used among these studies.

In contrast, our estimate of food allergy prevalence in poor urban areas is similar to that of Taylor-Black *et al* (3.4%) from a low-income, general pediatrics clinic in East Harlem, NY, where fewer than half of the children diagnosed with food allergy were evaluated by an allergist or had confirmatory allergy testing.[6] As access to healthcare was associated with a higher risk of food allergy in our models, it is possible that food allergy in poor, urban communities may not be recognized as an important problem, which may contribute to the low estimate and differences by socioeconomic status and urbanicity seen in our study. If true, this would suggest a disparity in recognition of a potentially life-threatening condition among the parents, and possibly even physicians, of inner-city children, which warrants further study.

Alternatively, certain common exposures in poor urban communities may be protective for food allergy but not other allergic conditions, such as asthma, which appears to be more prevalent in socioeconomically disadvantaged populations.[7] For example, infant feeding practices are known to be different in inner city environments, and previous studies have shown that inner city children may be exposed to solid foods earlier than recommended.[8] It is thus possible that the early introduction of allergenic foods and differences in management of this condition during the first year of life may ultimately protect against the development of food allergy in this population or change its natural history. Further study is thus needed to distinguish between under-report of food allergy in inner city populations and the presence of protective factors in poor urban environments.

Although race/ethnicity, neighborhood-level poverty, and urbanization are closely related, when viewed independently through adjusted analyses in NHIS 2009-2011, black race appears to increase the risk of perceived food allergy whereas Hispanic ethnicity appears to be protective. This finding is consistent with previous national surveys, in which food allergy appears to be more prevalent among children of black race/ethnicity[1,3] and trends lower among those of Hispanic race.[9] The reasons for this disparity remain unclear but may be related to differences in genetic, dietary, or social factors.

Our analysis is limited in that it is based on self-reported food allergy, which has been shown to overestimate the true prevalence of food allergy when confirmed by oral food challenges.[10] Furthermore, a single question is used to define food allergy, which is very broad and could be answered affirmatively by individuals with other conditions, such as celiac disease and lactose intolerance. In addition, although we controlled for “access to health care” in our model, this was a crude measure, which does not capture differences in parental knowledge about food allergy or perception of health information. Similarly, there may be other unmeasured confounders, such as language barriers, that could influence the associations seen in this study. Finally, as individuals were surveyed in 2009-2011 but were assigned to 2000 census tracts in the NHIS, there is a potential for misclassification of neighborhood characteristics.

In conclusion, in the population-based 2009-2011 NHIS, we found a low prevalence of perceived food allergy in urban impoverished children, while again noting that black race/ethnicity appears to be a risk factor for this condition whereas Hispanic ethnicity appears to be protective. Whether the prevalence of food allergy is truly lower in inner city children, and if so, whether this is due to unique neighborhood-level characteristics, fragmentation of care, differences in perception of food allergy, or under-diagnosis and under-treatment remains unclear and warrants further study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Relationship between demographic and geographic characteristics and self-reported food allergy in NHIS 2009-2011

	Crude OR	p value	Adjusted OR	p value
Non-Neighborhood				
Female Gender	0.94 (0.83 – 1.07)	0.34	0.94 (0.83 – 1.07)	0.35
Age	1.0 (0.99 – 1.01)	0.88	1.0 (0.98 – 1.01)	0.71
Race/Ethnicity				
White	REF	REF	REF	REF
Black	1.15 (0.98 – 1.36)	0.09	**1.26 (1.06 – 1.50)**	**0.01**
Asian	1.23 (0.97 – 1.57)	0.09	1.17 (0.91 – 1.50)	0.23
Hispanic	**0.67 (0.57 – 0.78)**	**<0.001**	**0.72 (0.68 – 0.96)**	**<0.001**
Other	1.67 (0.61 – 4.6)	0.32	1.86 (0.70 – 4.97)	0.21
Income to Poverty Ratio*	**1.03 (1.01 – 1.05)**	**0.004**	1.01 (0.98 – 1.03)	0.56
Access to care**	**1.25 (1.06 – 1.49)**	**0.008**	**1.23 (1.04 – 1.47)**	**0.01**
Neighborhood				
Urbanization				
Urban	**0.76 (0.64 – 0.90)**	**0.001**	**0.84 (0.69 – 1.00)**	**0.054**
Suburban	REF	REF	REF	REF
Medium Metro	**0.81 (0.68 – 0.97)**	**0.02**	0.86 (0.71 – 1.03)	0.10
Small Metro/Rural	**0.80 (0.68 – 0.95)**	**0.01**	0.87 (0.72 – 1.05)	0.14
Geographic Location				
Northeast	REF	REF	REF	REF
South	0.91 (0.74 – 1.11)	0.35	0.92 (0.75 – 1.13)	0.44
Midwest	0.98 (0.81 – 1.17)	0.78	1.02 (0.85 – 1.23)	0.80
West	0.96 (0.79 – 1.17)	0.69	1.13 (0.93 – 1.37)	0.24
Neighborhood Poverty†	**0.76 (0.65 – 0.89)**	**0.001**	**0.79 (0.67 – 0.94)**	**0.009**

Values reported as odds ratios (95% CI)

Final model adjusted for gender, age, race/ethnicity, family income, access to care, urbanization, geographic location, and neighborhood-level poverty

*OR for 1 unit increase in the ratio of household income to poverty threshold

**Defined as having a well-child check-up in the past 12 months (yes/no)

†Defined as neighborhoods in which ≥20% of households are below the poverty level