

Immigration to the United States and acculturation as risk factors for asthma and allergy

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Abbreviation used

NHANES III: Third National Health and Nutrition Examination Survey

When compared with Mexican-born Mexican American children, US-born Mexican American children had higher rates of wheeze, asthma, and hay fever in a report based on cross-sectional Third National Health and Nutrition Examination Survey (NHANES III) data and published in this issue of the *Journal of Allergy and Clinical Immunology*.¹ US-born Mexican American adults also had higher rates of asthma compared with Mexican American adults born in Mexico in a recently published report on NHANES III and National Health Interview Survey data.² Moreover, the prevalence of asthma in Mexican-born adults with fewer than 10 years of residence in the United States was half the asthma prevalence of Mexican-born adults who had lived in the United States for 10 or more years.

Prior US studies have focused on between-ethnic group differences rather than within-ethnic group differences in asthma prevalence and have suggested that asthma prevalence, asthma morbidity, and asthma mortality rates are lower among Mexican Americans than among Americans of other Hispanic ethnicities or among African Americans. For example, blacks in Los Angeles and New York City had similar rates of hospitalization, but Mexican Hispanics in Los Angeles had far lower rates than Puerto Rican Hispanics in New York City.³ Puerto Ricans had the highest asthma mortality rates among Hispanics, followed by Cuban Americans and Mexican Americans, in a report using national vital statistics.⁴ Compared with Mexicans from the United States or Mexico, Puerto Ricans with

asthma had reduced lung function, greater morbidity, longer asthma duration, and poorer responsiveness to β_2 -adrenergic agonists in a report from the Genetics of Asthma in Latino Americans study.⁵ The relative importance of genes versus the environment in explaining these between-ethnicity differences in wheeze/asthma is an active area of investigation. The finding of within-ethnicity differences in Mexican American wheeze/asthma rates that are dependent not only on place of birth but also on length of residence time in the United States points toward the importance of the environment in the development and persistence of asthma symptoms among Mexican Americans.

Studies from Europe, Australia, and Israel have also documented the importance of immigration and acculturation in the development of asthma and allergy. Immigrant children born outside of Western Europe, the United States, and Australia had fewer admissions to hospital for asthma than other children in a report from the Swedish National Patient Discharge Registers.⁶ In a study from Uppsala, Sweden, native Swedes and immigrants living in the country for less than 10.5 years differed in terms of total IgE levels and specific allergy, which were similar for native Swedes and immigrants living in the country for greater than 10.5 years.⁷ Australian studies of asthma, allergy, and atopy in Southeast Asian immigrants in Australia provide the most in-depth evaluation of the effects of migration on asthma, hay fever, and allergy. In a cross-sectional study from Melbourne, Australia, of Asian immigrants of ethnic Chinese origin, the prevalence of wheeze or asthma was higher in Australian-born non-Asians and Australian-born Asians than in Asian immigrants.⁸ In contrast, regardless of where they were born, hay fever prevalence was higher in Asian immigrants than in Australian-born non-Asians. The prevalence of hay fever and asthma in Asian immigrants increased with length of stay in Australia. Regardless of place of birth, pollen and mite sensitivities were also more common in

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Asian-born than in non-Asian-born subjects. The high rates of pollen and mite allergy among the Asian immigrants to Melbourne, believed to relate to new exposure to high levels of these allergens after migration, contrasted with the lower rates of these specific allergies among populations in China, Hong Kong, and other areas of Southeast Asia.⁹ However, despite the higher mite and pollen allergy rates among Asian immigrants, a significant proportion of the immigrants were asymptomatic.⁹ Leung⁹ has suggested that the discordant relationship between allergic sensitization, hay fever symptoms, and asthma symptoms in Asian immigrants might be explained by environmental influences that act as adjuvant or protective factors influencing the clinical expression of symptoms in sensitized Asian Australian individuals.

Wheeze, hay fever, atopy (eg, any positive skin test result), and specific allergy were investigated as independent outcomes related to migration of Mexican American children, but their interrelationship was only partially evaluated in this issue's report. Mexican American children born in the United States had higher rates of sensitization to allergens that might be more prevalent in the US environment: cat, house dust mite, *Alternaria* species, peanut, and common US pollens. In contrast, they had a markedly lower prevalence of sensitization to cockroach (23% for Mexican American children born in the United States compared with 40% for Mexican American children born in Mexico), perhaps because cockroaches were more ubiquitous in their Mexico environment. However, the authors did not describe whether place of birth influenced the risk of atopy (eg, having any allergy), nor did they evaluate the prevalence of wheeze symptoms among Mexican versus US-born children with cockroach allergy. Although cockroach allergy has been presented as an important risk factor for asthma prevalence and asthma morbidity in US children,¹⁰ it would be of value to assess whether there are additional environmental factors that might protect cockroach-sensitized American children who were born in Mexico from expressing wheeze symptoms.

To evaluate whether environmental factors related to migration protect against wheeze in allergic children will require the distinction of allergic from nonallergic asthma as an outcome. A significant proportion of the wheeze in younger children from NHANES III might represent nonallergic transient wheezing. However, the wheezing reported in the older children is more likely to represent airway inflammation in allergic subjects.

Unfortunately, although NHANES and other national health surveys can be used to evaluate differences in wheeze, asthma, hay fever, and allergy prevalence between US- and Mexican-born Americans, these surveys provide insufficient detail regarding many environmental exposures and cultural characteristics that might explain these differences. Moreover, the surveys are not always sufficiently powered to adjust for confounders or to investigate potential effect modifiers. The effect of place of birth on wheeze rates in Mexican American children was not confounded by maternal or household smoking,

pet ownership, body mass index, poverty/income ratio, area of residence (urban-rural), census region of participants, having a regular place for health care, and level of parental education. The authors did not evaluate factors that might confound or explain the associations of place of birth with hay fever, perhaps because even in this large US study, the number of Mexican-born children with this disease was too small ($n = 2$). Asthma rates in adults remained higher in adults from the NHANES III and National Health Interview Survey studies after adjustment for smoking status, body mass index, region of survey, language, and health care access.² Unmeasured environmental exposures in Mexico or in the United States might be adjuvant risk or protective factors influencing asthma and allergy in these studies.

In utero or early childhood environmental exposures in Mexico might have protected children from allergy, persistence of wheeze, or asthma. As in the European farming studies,¹¹ for those Mexican immigrants coming from rural farming communities, early-life exposure to high levels of endotoxin, raw milk, and early-life infections might have had at least a transient protective effect against the development of allergy and asthma, although we do not yet have strong evidence for overall reduction in allergy rates in Mexican-born children. As reported by Holguin et al,² approximately 45% of Mexican immigration into the United States is from rural areas. Recently, 3 predominant patterns of migration from Mexico have been identified: the traditional migration from rural, central-western Mexico; migration from interior cities, and a circular pattern of migrants from border towns, such as Tijuana. However, migration patterns have been changing over time.¹² Mexican Americans who are recent immigrants might also settle in different parts of the United States and have different jobs than less recent immigrants, thus changing exposures in their children in a manner not captured by the crude geographic adjustments available in NHANES data.

Increased exposure to pollution in cities like Los Angeles might contribute to the increase in wheeze and asthma rates in Mexican Americans born or living for a prolonged period in the United States. However, a significant number of Mexican Americans born in Mexico (those migrating from the cities) might be coming from equally polluted Mexican cities.¹³

Acculturation might be associated with dissociation from family and neighborhood support networks that protect against stress, which in turn might increase the risk of wheeze and allergy.¹⁴ The term *acculturation* generally refers to the process of change experienced by members of immigrant groups as they adopt the culture (ie, language, norms, and values) of the culturally and demographically dominant group in the host society.¹⁵ Only recently, a few studies have begun to address socioeconomic factors, contextual factors, and discrimination in the host society that might be encountered during immigrant acculturation and might influence health.¹⁶ When compared with non-Hispanic whites, Mexican Americans were less likely to have any psychiatric disorder in a study using the National

Comorbidity Survey, a national probability sample of 8098 US adults aged 15 to 54 years.¹⁷ However, acculturation to American society predicted greater risk of having any Diagnostic and Statistical Manual III-R psychiatric diagnosis for Mexican Americans. In a Chicago study neighborhood "collective efficacy," a measure of trust and attachment to community, was protective against asthma and breathing problems.¹⁸

Acculturation has been shown to increase the risk of smoking among Mexican American adolescents.¹⁹ It might also include changes in the keeping of pets, diet, activity patterns, and body mass index, as well as access to health care, and these changes might vary by Hispanic subgroup. Acculturation among Mexican American children might involve increased consumption of fast food and soda associated with obesity and consumption of n-6 or trans fatty acids, which likely contribute to obesity and perhaps to asthma risk.²⁰ However, there are few studies on the relation of acculturation to changes in specific nutrient intake, fat intake, and overall dietary patterns among Hispanics, and their results have been inconsistent.²¹ The potentially protective value of traditional Mexican diets, which vary widely by region and socioeconomic status, has not been adequately explored. Fish and omega-3 fatty acids, which have been hypothesized to protect against asthma risk, are not available to many Mexican Americans.²² The availability of fresh fruits and antioxidants, shown to improve response to ozone in asthmatic children from Mexico City, is also highly variable.²³

Reporting bias might also be partially responsible for the protective effect of being born in Mexico on wheeze, asthma, and hay fever. Longer time of residence in the United States is also associated with increased access to health care, which, as discussed by Holguin et al.,² might lead to a higher rate of asthma diagnosis and might change perception of the definition of wheeze and increase the reporting of this symptom.

Understanding patterns of allergy and asthma among ethnic populations that are highly diverse in regard to national origin and immigrant status calls for a reevaluation of study designs. For example, studies will require new survey tools and greater power to capture differences in environmental exposures within and between Latino subgroups at the individual, neighborhood, and community level. Optimally, studies would include retrospective or prospective assessment of environmental exposures before and after immigration. Longitudinal studies of the development of allergy and asthma among migrants moving from Latin American to US communities will be exceedingly difficult to conduct. Nevertheless, even carefully designed cross-sectional national and geographically specific surveys might provide additional insight into the relationship between immigration, acculturation, and the risk of allergy and asthma.

If environmental exposures in the United States that are increasing asthma rates can be identified, then it is possible that measures can be taken to protect susceptible Mexican American children from these exposures. Similarly, iden-

tification of the protective aspects of Mexican/Mexican American culture or environment might provide important lessons in public health and the potential to reduce asthma or allergy symptoms in the United States.

REFERENCES

1. Eldeirawi K, McConnell R, Freels S, Persky V. Associations of place of birth with asthma and wheezing in Mexican American Children. *J Allergy Clin Immunol* 2005;116:42-8.
2. 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. *Am J Respir Crit Care Med* 2005;171:103-8.
3. Ray NF, Thamer M, Fadilliglu B, Gergen PJ. Race, income, urbanicity, and asthma hospitalization in California: a small area analysis. *Chest* 1998;113:1277-84.
4. Homa DM, Mannino DM, Lara M. Asthma mortality in U.S. Hispanics of Mexican, Puerto Rican, and Cuban heritage, 1990-1995. *Am J Respir Crit Care Med* 2000;161:504-9.
5. Burchard EG, Avila PC, Nazario S, Casal J, Torres A, Rodriguez-Santana JR, et al. Lower bronchodilator responsiveness in Puerto Rican than in Mexican subjects with asthma. *Am J Respir Crit Care Med* 2004;169:386-92.
6. Hjerm A, Haglund B, Bremberg S, Ringback-Weitoft G. Social adversity, migration and hospital admissions for childhood asthma in Sweden. *Acta Paediatr* 1999;88:1107-12.
7. Kalyoncu AF. Symptoms of asthma, bronchial responsiveness and atopy in immigrants and emigrants in Europe. *Eur Respir J* 2002;19:980-1.
8. Leung RC, Carlin JB, Burdon JG, Czarny D. Asthma, allergy and atopy in Asian immigrants in Melbourne. *Med J Aust* 1994;161:418-25.
9. Leung R. Asthma, allergy and atopy in South-east Asian immigrants in Australia. *Aust N Z J Med* 1994;24:255-7.
10. Morgan WJ, Crain EF, Gruchalla RS, O'Connor GT, Kattan M, Evans R 3rd, et al. Results of a home-based environmental intervention among urban children with asthma. *N Engl J Med* 2004;351:1068-80.
11. Braun-Fahrlander C, Riedler J, Herz U, Eder W, Waser M, Grize L, et al. Environmental exposure to endotoxin and its relation to asthma in school-age children. *N Engl J Med* 2002;347:869-77.
12. Roberts B. The new geography of emigration: emerging zones of attraction and expulsion, continuity and change. The Center for Migration and Development: working paper series, Princeton University. Available at: <http://cmd.princeton.edu/papers/wp05021.pdf>. Accessed April 10, 2005.
13. Borja-Aburto VH, Castillejos M, Gold DR, Bierwinski S, Loomis D. Mortality and ambient fine particles in Southwest Mexico City, 1993-1995. *Environ Health Perspect* 1998;106:849-55.
14. Wright RJ, Finn P, Contreras JP, Cohen S, Wright RO, Staudenmayer J, et al. Chronic caregiver stress and IgE expression, allergen-induced proliferation, and cytokine profiles in a birth cohort predisposed to atopy. *J Allergy Clin Immunol* 2004;113:1051-7.
15. Acevedo-Garcia D. Encyclopedia of health and behavior. Thousand Oaks (CA): Sage Publications; 2004.
16. Finch BK, Kolody B, Vega WA. Perceived discrimination and depression among Mexican-origin adults in California. *J Health Soc Behav* 2000;41:295-313.
17. Ortega AN, Rosenheck R, Alegria M, Desai RA. Acculturation and the lifetime risk of psychiatric and substance use disorders among Hispanics. *J Nerv Ment Dis* 2000;188:728-35.
18. Cagney KA, Browning CR. Exploring neighborhood-level variation in asthma and other respiratory diseases: the contribution of neighborhood social context. *J Gen Intern Med* 2004;19:229-36.
19. Unger JB, Cruz TB, Rohrbach LA, Ribisl KM, Baezconde-Garbanati L, Chen X, et al. English language use as a risk factor for smoking initiation among Hispanic and Asian American adolescents: evidence for mediation by tobacco-related beliefs and social norms. *Health Psychol* 2000;19:403-10.
20. Krebs NF, Jacobson MS. Prevention of pediatric overweight and obesity. *Pediatrics* 2003;112:424-30.
21. Bermudez OI, Falcon LM, Tucker KL. Intake and food sources of macronutrients among older Hispanic adults: association with ethnicity,

- acculturation, and length of residence in the United States. *J Am Diet Assoc* 2000;100:665-73.
22. Holguin F, Tellez-Rojo MM, Hernandez M, Cortez M, Chow JC, Watson JG, et al. Air pollution and heart rate variability among the elderly in Mexico City. *Epidemiology* 2003;14:521-7.
23. Romieu I, Sienna-Monge JJ, Ramirez-Aguilar M, Tellez-Rojo MM, Moreno-Macias H, Reyes-Ruiz NI, et al. Antioxidant supplementation and lung functions among children with asthma exposed to high levels of air pollutants. *Am J Respir Crit Care Med* 2002;166:703-09.

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