Published in final edited form as:

Acad Pediatr. 2015 ; 15(4): 421–429. doi:10.1016/j.acap.2014.11.005.

Asthma in U.S. Mexican-Origin Children in Early Childhood: Differences in Risk and Protective Factors by Parental Nativity

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Abstract

Objectives—Over 900,000 Mexican-origin children in the United States have asthma, but little is known about the extent to which development of this condition reflects early childhood exposure to social and environmental risks. The objectives of this research are to demonstrate the roles of risk and protective factors in the prevalence and severity of asthma in this population and provide comparisons with other racial/ethnic groups.

Methods—Nationally-representative data from the Early Childhood Longitudinal Study, Birth Cohort (n=6,900) with county-level ozone data appended to this file are analyzed using descriptive and multivariate regression methods.

Results—The odds of asthma diagnosis by 60 months are approximately 50 percent higher among Mexican-origin children than for non-Hispanic whites ($p<.05$) in multivariate analyses. Compared to those with foreign-born parents, Mexican-origin children with native-born parents have a lower likelihood of being breastfed and greater chances of having risks including a family history of asthma, having respiratory illnesses and allergies, living with a smoker, and attending center-based child care. Mexican-origin children live in counties with over three times more elevated ozone days annually than non-Hispanic whites.

Conclusions—Mexican-origin children experience a constellation of risk and protective factors, but those with U.S.-born parents have elevated asthma risks compared to those with foreign-born parents. Asthma incidence and severity will likely increase as this population becomes increasingly integrated into society.

Keywords

asthma; Mexican-origin; nativity; disparities; air pollution

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Conflict of Interest: The authors have no conflicts of interest or corporate sponsorship relevant to this research to disclose.

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Over 900,000 U.S. Mexican-origin children currently have asthma, and over 1.4 million are diagnosed with asthma at some point during their childhood years (1). However, there has been less research attention to asthma among this burgeoning population, perhaps because Mexican-origin children have historically had lower asthma rates than African American children with similar economic disadvantages (2–4). Indeed, social and environmental exposures other than socioeconomic status that are associated with asthma risk among Mexican-origin children are not well-understood, especially in early childhood when the prevalence of asthma-related pediatric care visits and hospitalizations is highest (1,2). A few studies suggest that heterogeneity exists in asthma risk among subgroups of Mexican-origin children (5,6), and that integration or acculturation into U.S. society may influence risk (7). Eldeirawi and Persky (6) show that Mexican-origin children in Chicago whose families lived in the United States for 10 years or more have a higher risk of developing asthma than those with shorter exposure. Holguin et al. (8) also find that Mexicans with long-term U.S. residence have a higher likelihood than more recent arrivals of developing asthma. These studies imply that asthma increases along with the prevalence of environmental, dietary, and lifestyle risks as families become integrated into U.S. society.

This study uses nationally-representative data from the Birth Cohort of the Early Childhood Longitudinal study (ECLS-B) to examine the prevalence of asthma, as well as associated risk and protective factors for its occurrence and severity among Mexican-origin children born in the United States. Intergroup differences are demonstrated with comparisons between U.S. Mexican-origin children and other Hispanics, non-Hispanic whites, African Americans, Asian Americans, and children of other races. Intragroup differences are examined in comparisons of risks among Mexican-origin children by parental nativity, a commonly used proxy for acculturation (7,9,10). The guiding hypothesis is that children with U.S.-born parents are more likely than those with Mexico-born parents to experience greater risks and less likely to be exposed to protective factors.

Methods

Study Design

The ECLS-B is a nationally representative longitudinal study of children randomly selected from 2001 U.S. birth certificates. Birth certificate information is combined with parent interview data at 9, 24, 48, and 60 months (see <http://nces.ed.gov/ECLS/birth>). The analytic sample consisted of 6,900 children participating in ECLS-B from birth through 60 months, including 1,050 Mexican-origin children. Sample sizes are rounded to the nearest 50 to comply with ECLS-B confidentiality requirements. Institutional Review Board approval was obtained for the study.

Asthma-Related Outcomes

The ECLS-B includes information on several asthma-related outcomes. The primary outcome examined is whether a child was ever diagnosed with asthma by 60 months. At the first assessment when children were 9 months of age, parents were asked whether a doctor, nurse, or other medical professional ever told them that their child has asthma. At 24, 48, and 60 months, parents were asked whether a doctor, nurse, or other medical professional

told them their child had asthma since the previous interview. A child is coded as having asthma if his/her parent ever responded “yes.” A second outcome of interest is the number of asthma attacks. At 48 and 60 months, parents were asked to report the number of times a doctor, nurse, or other medical professional told them their child had an “asthma attack” since the previous assessment. The numbers of asthma attacks reported were summed and analyzed as a continuous variable. Parents were also asked at 48 and 60 months whether their child had been hospitalized or taken to an emergency room for asthma since the previous survey. If a parent ever responded “yes,” their child was coded as having had a hospitalization or emergency room visit. Lastly, parents reported on children's asthma medication use. At 48 months, parents were asked: “Does the child take a prescription medicine every day?” If the parent said yes, they were asked why the child has to take the medicine. At 60 months, the medicine question was worded slightly differently: “Has your child taken a prescription medicine every day for the last 3 months?” As in the previous interview, if a parent said yes they were asked for the reason why their child has to take the medicine. Children were coded as taking asthma medication if parents reported at either time point that the child took prescription medicine for asthma.

Primary Independent Variable of Interest

The primary independent variable of interest is the measure of race and ethnicity. Following U.S. Census protocol, the ECLS-B included separate questions on “Hispanicity” and “race.” The survey first asked whether the child was Spanish/Hispanic/Latino and, if so, the specific origin-group (including Mexican/Mexican American/Chicano). A separate question on race included “white” and “black/African American” along with Asian and other groups. These questions were used with nativity to identify Mexican-origin children with one or more foreign-born parents and Mexican-origin children with two U.S.-born parents, along with other Hispanics.

Risk and Protective Factors for Asthma

Guided by previous asthma research, risk and protective factors were identified based on birth certificate and parent interview data (9,11–16). Demographic variables are gender, maternal education (< high school/high school graduate/some college/college graduate), and whether family income was below the federal poverty threshold. Lower maternal education and living in poverty are regarded as risk factors, while higher education and income are considered to be protective. Dichotomous variables indicated health and behavioral risks such as low birthweight, a history of health professional-diagnosed respiratory illness, food allergies, non-food allergies, family history of asthma, a smoker in the household, and attending center-based child care. Overweight or obese BMI is another risk factor. This was determined from height and weight measurements taken at each assessment, and was calculated based on CDC cutoff values for children. A history of being breastfed is regarded as protective.

A dichotomous variable identifies children who had been uninsured at any point, which may put children at comparatively higher risk. Parents also reported the number of well-child check-ups. This was divided by the number recommended in American Academy of

Pediatrics guidelines (17) to yield the percent of recommended visits received, with a higher percentage signifying greater protection.

Because poor air quality may exacerbate asthma (18,19), secondary analyses were conducted to examine exposure to elevated ozone levels. Ozone was selected for analysis because it is the most widespread air pollutant (<http://www.stateoftheair.org/>), and because the Environmental Protection Agency finds strong evidence of associations between ozone exposure and asthma complications such as symptom exacerbation and hospitalization (<http://www.epa.gov/eogaptil/ozonehealth/population.html>). Ozone levels are measured hourly in selected monitoring sites across the country, however these individual measurements are subject to anomalies of weather or other factors that can inaccurately reflect normal conditions. For this reason, the American Lung Association produces three-year weighted averages of the annual number of elevated ozone days for each U.S. county with at least one ozone monitor (<http://www.stateoftheair.org/>). The average numbers of elevated ozone days for residential counties for the period 2004-2006 were appended to the ECLS-B files, corresponding to the years when ECLS-B participants were between ages 36 and 60 months. These are the ages at which most asthma hospitalizations occurred. This information was available for 4,600 children.

Statistical Analyses—Descriptive analyses are presented for the full sample and for children with and without asthma. Group differences are evaluated with two-tailed t-tests. Risk and protective factors are tabulated for each racial/ethnic group, and by parental nativity for Mexican-origin children. Logistic regression analyses model the outcome of being diagnosed with asthma by 60 months. The first model includes only race/ethnicity and parental nativity. The second model adds risk and protective factors. Analyses are adjusted for the clustered sample design and weighted to account for over-sampling and attrition.

Logistic regressions for children with asthma (n=1,350) model whether the child was taking prescription asthma medication and whether the child was hospitalized or visited an emergency room for asthma. Negative binomial regression is used to analyze number of asthma attacks as a function of risk and protective factors. These models were repeated for children with ozone data. All analyses were conducted in SAS with missing data on predictor variables multiply imputed using the SAS IVEware add-on (20).

Results

Overall, 17.7% of children had been diagnosed with asthma at some point, but substantial variation is evident across ethno-racial categories. The rate for Mexican-origin children with one or more foreign-born parents (14.2%) was similar to that of white children (14.3%) and both were lower than the rate for Mexican-origin children with two U.S.-born parents (18.0%). Asians had the lowest rate (13.5%), and African Americans (31.6%), other Hispanics (21.5%), and “other” non-Hispanics (18.9%) had higher rates.

Table 1 presents descriptive statistics for children with asthma and without asthma. Children with asthma were more likely to be male, and to have: low birthweight, a history of respiratory illness, been formula-fed, a family history of asthma, food and non-food

allergies, an elevated BMI, lived with a smoker, and attended center-based child care. They were also more likely to be disadvantaged, as evidenced by lower maternal education and higher poverty rates. Health care access measures among children with asthma, however, were comparatively favorable. They were less likely than children without asthma to have been uninsured (10.3% vs. 13.2%; $p<.001$), and received a greater percentage of recommended check-ups (82.9% vs. 80.4%; $p<.001$).

Asthma-related risk and protective factors were not equally prevalent among racial/ethnic subgroups of children (Table 2). Compared with non-Hispanic white children, Mexican-origin children (regardless of parental nativity) had a higher prevalence of risks including elevated BMI, low maternal education, and poverty. Conversely, Mexican-origin children were also more likely to have protective characteristics than non-Hispanic white children: they were less likely to have food and non-food allergies, to have a history of respiratory illness, and to have been in center-based child care.

Risk and protective factors differed by parental nativity among Mexican-origin children, and in most cases those with U.S.-born parents were disadvantaged. Compared to those with one or more foreign-born parents, Mexican-origin children with U.S.-born parents were less likely to have been breastfed and more likely to have a family history of asthma, to have had respiratory illness, to have food and non-food allergies, to live in a household with a smoker, and to have attended center-based child care. These differences in health and behavioral risk and protective factors are illustrated in Figure 1.

Well-child care utilization and insurance status were notable exceptions to the pattern of advantage for children of foreign-born parents. The former was lower among Mexican-origin children with one or more foreign-born parents compared to those with U.S.-born parents, and their rate of being uninsured was the highest of any group. Mexican-origin children with U.S.-born parents, however, also had a higher rate of being uninsured than non-Hispanic whites.

Figure 2 shows that among children with ozone exposure data, Mexican-origin children in both nativity groups lived in counties with over three times more elevated ozone days per year than non-Hispanic white children, and over twice the number of elevated ozone days for children overall.

Odds ratios from analyses predicting receipt of an asthma diagnosis are shown in Table 3. The first model includes only race/ethnicity and Mexican parental nativity. African American children have the most elevated likelihood of asthma diagnosis compared with non-Hispanic white children. Regardless of parental nativity, the odds for Mexican-origin children are not significantly different than for non-Hispanic whites, although the point estimate is 1.31 for those with two U.S.-born parents. The second model controls for risk and protective factors. Mexican-origin children in both parental nativity groups have higher odds than white children (for one or more foreign-born parents, $OR=1.50$, 95% CI 1.05-2.14, $p<.05$; for U.S.-born parents, $OR=1.45$, 95% CI 1.00-2.09, $p<.10$). *Thus, on balance, Mexican-origin children have a protective profile, and once the full set of risk and protective factors is accounted for, their elevated risk of asthma emerges.* Other statistically

significant risk factors include sex (male), low birthweight, history of respiratory illness, family history of asthma, food and non-food allergies, elevated BMI, and living in poverty. Being uninsured is associated with lower odds of asthma diagnosis, while greater well-child care utilization is marginally associated with higher odds.

Table 4 presents results for the indicators of asthma severity: number of asthma attacks, taking prescription medicine for asthma, and asthma hospitalization or emergency room visit. Columns 1-3 present the full models for all children with asthma and column 4 presents the results for those with ozone data. Net of other factors, Mexican-origin children with asthma are not at elevated risk relative to non-Hispanic whites of experiencing these outcomes, and Mexican-origin children with one or more foreign-born parents experience a lower number of asthma attacks compared to non-Hispanic white children.

The final model predicts asthma hospitalization or emergency room visit among the subgroup of children with ozone data. Elevated ozone was significantly associated with higher risk, such that each additional day of elevated ozone exposure was associated with a 2 percent increase in the odds of hospitalization or emergency room visit. Interestingly, the estimates associated with race/ethnicity and SES categories are reduced in the final model that includes ozone, compared to model 3 which does not include the environmental exposure variable. As a check, we also reran model 3 on the smaller ozone sample, and the results were similar. This suggests that race/ethnicity and SES variables in model 3 are associated with coexisting environmental exposures that have implications for asthma.

We also conducted analyses to examine whether elevated ozone levels were related to chances of developing asthma, the number of asthma attacks, or asthma medication use. No statistically significant relationships were found (results not shown).

Discussion

U.S. Mexican-origin children have a mix of characteristics that both elevate and lower the risks of asthma. On one hand, they are disproportionately likely to live in poverty (21) compared to non-Hispanic white children, which is positively associated with asthma (9). Mexican-origin children also face increased asthma risk from their higher likelihood of overweight and obesity (22). On the other hand, lower prevalence of food allergies, non-food allergies (13,23), and respiratory illnesses reduces their asthma risk (24). They are also less likely to attend center-based child care. Although some evidence suggests that it may ultimately be protective for asthma at older ages (25), center-based care has been associated with risk for wheezing and infectious disease in early childhood (25,26). Taking these countervailing factors into account, we found the odds of diagnosed asthma by 60 months among Mexican-origin children were about 50 percent higher than the odds for non-Hispanic white children. Among children with asthma, our analyses suggest that Mexican-origin children with one or more foreign-born parents have somewhat fewer asthma attacks than those with two U.S.-born parents.

Prior studies show that Mexican-origin children with U.S.-born parents are at greater risk of developing asthma than children with one or more foreign-born parents (9,27). Lara et al.'s

(9) analysis of the National Health Interview Survey shows that the odds of childhood asthma were significantly higher for Mexican-origin children when both parents and the child were born in the U.S., compared to cases where one or more was foreign-born. Hamilton et al.(27) claim that asthma rates are higher among children with native-born parents, not only among Hispanic children but also in other race/ethnic groups. It is important to note that while we did not find significant differences in the unadjusted rates of asthma diagnosis among Mexican-origin children by parental nativity despite differences in asthma risk factors in early childhood, these differences could lead to increased asthma rates in future years. Those with two U.S.-born parents were more likely than those with foreign-born parents to experience behavioral risks such as lower likelihood of being breastfed and greater chances of living with a smoker, and physical health differences including family history of asthma and having allergies and frequent respiratory illness. This suggests that both social and biological/environmental exposures accompanying acculturation elevate children's asthma risk.

Our ozone findings are consistent with increasing attention to inequality in exposure to adverse environmental conditions (28–34). Elevated ozone is linked to the development of asthma and poor symptom control in previous research (18,19,35). The present analysis demonstrates a significant positive relationship between the average number of elevated ozone days and asthma hospitalization and emergency room visits. The finding that Mexican-origin children live in counties that experienced over twice the number of elevated ozone days per year compared to other children is of concern, and warrants further investigation.

Health care access and utilization are also significantly related to the likelihood of asthma diagnosis by a health care provider, and are issues of particular relevance to Mexican-origin children in both parental nativity groups. Consistent with previous research (36–39), uninsured children have lower odds of asthma diagnosis than the continuously insured. This suggests that under-diagnosis may occur with irregular medical care access. Controlling for insurance status, more frequent well-child check-ups are positively associated with the risk of asthma diagnosis. This may reflect the increased opportunities for pediatric care providers to observe children's symptoms, or the motivations of parents of children with asthma to closely monitor their children's health status.

Strengths of the present study include the nationally-representative, longitudinal design, the rich array of asthma risk and protective factors, and inclusion of ozone exposures. Reliance on parent report of asthma diagnosis is a limitation, although parental report of their children's chronic conditions has been found to be reliable (40). Another limitation is that ozone data were only available at the county level, and only for counties with ozone monitors. More populous urban areas are more likely than rural areas to have ozone monitors, and to monitor at multiple sites throughout the county, in which case values are averaged across monitors. Restricting the sample to the smaller number children for whom ozone data were available may have limited our ability to detect effects of ozone on outcomes including the number of asthma attacks and taking asthma medication. Further research on differential ozone exposure among children of different race/ethnicities is needed.

Conclusions

Mexican-origin children experience a constellation of risk and protective factors, and those with U.S.-born parents have elevated asthma risks compared to those with foreign-born parents. Asthma incidence and severity will likely increase as this population becomes increasingly integrated into society. Interventions to encourage breastfeeding and discourage parental smoking among U.S.-born Mexicans are likely to be beneficial, as are broader efforts to reduce children's exposure to air pollution. Ensuring consistent access to pediatric primary care for Mexican-origin children regardless of nativity status has the potential to reduce risk factors for asthma development, facilitate appropriate management of asthma symptoms, and reduce under-diagnosis.

Acknowledgments

This research was supported by NIH grants P01 HD062498 (PI Nancy Landale) and 2R24HD041025-11 (PI Jennifer Van Hook). The authors are grateful to Steven Maczuga for programming assistance.

References

1. Bloom B, Cohen RA, Freeman G. Summary health statistics for U.S. children: National Health Interview Survey, 2010. *Vital Health Stat.* 2011 Dec; 10(250):1–80.
2. Moorman J, Akinbami L, Bailey C, Zahran H, King M, Johnson C, et al. National surveillance of asthma: United States, 2001–2010. *Vital Heal Stat.* 2012; 3(35):1–57.
3. Akinbami LJ, Moorman JE, Garbe PL, Sondik EJ. Status of Childhood Asthma in the United States, 1980–2007. *PEDIATRICS.* 2009 Mar 1; 123(Supplement):S131–S145. [PubMed: 19221156]
4. Davis AM, Kreutzer R, Lipsett M, King G, Shaikh N. Asthma prevalence in Hispanic and Asian American ethnic subgroups: results from the California Healthy Kids Survey. *Pediatrics.* 2006 Aug; 118(2):e363–370. [PubMed: 16882779]
5. Martin MA, Shalowitz MU, Mijanovich T, Clark-Kauffman E, Perez E, Berry CA. The effects of acculturation on asthma burden in a community sample of Mexican American schoolchildren. *Am J Public Health.* 2007 Jul; 97(7):1290–6. [PubMed: 17538053]
6. Eldeirawi KM, Persky VW. Associations of physician-diagnosed asthma with country of residence in the first year of life and other immigration-related factors: Chicago asthma school study. *Ann Allergy Asthma Immunol Off Publ Am Coll Allergy Asthma Immunol.* 2007 Sep; 99(3):236–43.
7. Koinis-Mitchell D, Sato AF, Kopel SJ, McQuaid EL, Seifer R, Klein R, et al. Immigration and Acculturation-Related Factors and Asthma Morbidity in Latino Children. *J Pediatr Psychol.* 2011 Jul 10; 36(10):1130–43. [PubMed: 21745811]
8. Holguin F, Mannino DM, Antó 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 Jan 15; 171(2):103–8. [PubMed: 15516539]
9. Lara M, Akinbami L, Flores G, Morgenstern H. Heterogeneity of childhood asthma among Hispanic children: Puerto Rican children bear a disproportionate burden. *Pediatrics.* 2006 Jan; 117(1):43–53. [PubMed: 16396859]
10. Singh GK, Hiatt RA. Trends and disparities in socioeconomic and behavioural characteristics, life expectancy, and cause-specific mortality of native-born and foreign-born populations in the United States, 1979–2003. *Int J Epidemiol.* 2006 Aug; 35(4):903–19. [PubMed: 16709619]
11. Gorman BK, Landale NS. Premature Birth and Asthma Among Young Puerto Rican Children. *Popul Res Policy Rev.* 2005 Aug 1; 24(4):335–58.
12. Mayo Clinic Staff. [cited 2013 Jul 23] Asthma: Risk Factors. 2011. Internet Available from: <http://www.mayoclinic.com/health/asthma/DS00021/DSECTION=risk-factors>

13. Murray CS, Poletti G, Keadze T, Morris J, Woodcock A, Johnston SL, et al. Study of modifiable risk factors for asthma exacerbations: virus infection and allergen exposure increase the risk of asthma hospital admissions in children. *Thorax*. 2006 May; 61(5):376–82. [PubMed: 16384881]
14. Hafkamp-de Groen E, van Rossem L, de Jongste JC, Mohangoo AD, Moll HA, Jaddoe VWV, et al. The role of prenatal, perinatal and postnatal factors in the explanation of socioeconomic inequalities in preschool asthma symptoms: the Generation R Study. *J Epidemiol Community Health*. 2012 Nov; 66(11):1017–24. [PubMed: 22268130]
15. Black MH, Smith N, Porter AH, Jacobsen SJ, Koebnick C. Higher prevalence of obesity among children with asthma. *Obes Silver Spring Md*. 2012 May; 20(5):1041–7.
16. National Asthma Education and Prevention Program. Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007. *J Allergy Clin Immunol*. 2007 Nov; 120(5 Suppl):S94–138. [PubMed: 17983880]
17. Hagan, JF.; Shaw, JS.; Duncan, PM. Bright futures: guidelines for health supervision of infants, children, and adolescents. Elk Grove Village, IL: American Academy of Pediatrics; 2008.
18. Akinbami LJ, Lynch CD, Parker JD, Woodruff TJ. The association between childhood asthma prevalence and monitored air pollutants in metropolitan areas, United States, 2001–2004. *Environ Res*. 2010 Apr; 110(3):294–301. [PubMed: 20117766]
19. McConnell R, Islam T, Shankardass K, Jerrett M, Lurmann F, Gilliland F, et al. Childhood incident asthma and traffic-related air pollution at home and school. *Environ Health Perspect*. 2010 Jul; 118(7):1021–6. [PubMed: 20371422]
20. Raghunathan, TE.; Solenberger, P.; Van Hoewyk, J. IVEware: Imputation and variance estimated software, user guide. Ann Arbor, MI: Survey Research Center, Institute for Social Research; 2002.
21. DeNavas-Walt, C.; Proctor, B.; Smith, J. Income, Poverty, and Health Insurance Coverage in the United States: 2011. Washington, DC: US Government Printing Office; 2012.
22. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among us children and adolescents, 1999–2010. *JAMA*. 2012 Feb 1; 307(5):483–90. [PubMed: 22253364]
23. Wang J, Liu AH. Food allergies and asthma. *Curr Opin Allergy Clin Immunol*. 2011 Jun; 11(3): 249–54. [PubMed: 21467928]
24. Sigurs N, Bjarnason R, Sigurbergsson F, Kjellman B. Respiratory syncytial virus bronchiolitis in infancy is an important risk factor for asthma and allergy at age 7. *Am J Respir Crit Care Med*. 2000 May; 161(5):1501–7. [PubMed: 10806145]
25. Ball TM, Castro-Rodriguez JA, Griffith KA, Holberg CJ, Martinez FD, Wright AL. Siblings, Day-Care Attendance, and the Risk of Asthma and Wheezing during Childhood. *N Engl J Med*. 2000; 343(8):538–43. [PubMed: 10954761]
26. Kamper-Jørgensen M, Wohlfahrt J, Simonsen J, Grønbaek M, Benn CS. Population-based study of the impact of childcare attendance on hospitalizations for acute respiratory infections. *Pediatrics*. 2006 Oct; 118(4):1439–46. [PubMed: 17015534]
27. Hamilton E, Cardoso JB, Hummer RA, Padilla YC. Assimilation and emerging health disparities among new generations of U.S. children. *Demogr Res*. 2011 Dec 8; 25:783–818.
28. Hackbarth AD, Romley JA, Goldman DP. Racial and ethnic disparities in hospital care resulting from air pollution in excess of federal standards. *Soc Sci Med*. 2011 Oct; 73(8):1163–8. [PubMed: 21893376]
29. Wright RJ, Subramanian SV. Advancing a multilevel framework for epidemiologic research on asthma disparities. *Chest*. 2007 Nov; 132(5 Suppl):757S–769S. [PubMed: 17998340]
30. Soobader M, Cubbin C, Gee GC, Rosenbaum A, Laurenson J. Levels of analysis for the study of environmental health disparities. *Environ Res*. 2006 Oct; 102(2):172–80. [PubMed: 16781704]
31. Landrigan PJ, Goldman LR. Children's vulnerability to toxic chemicals: a challenge and opportunity to strengthen health and environmental policy. *Heal Aff Proj Hope*. 2011 May; 30(5): 842–50.
32. Vivier PM, Hauptman M, Weitzen SH, Bell S, Quilliam DN, Logan JR. The important health impact of where a child lives: neighborhood characteristics and the burden of lead poisoning. *Matern Child Health J*. 2011 Nov; 15(8):1195–202. [PubMed: 20972613]

33. Mohai P, Kweon BS, Lee S, Ard K. Air pollution around schools is linked to poorer student health and academic performance. *Heal Aff Proj Hope*. 2011 May; 30(5):852–62.
34. Canino G, Koinis-Mitchell D, Ortega AN, McQuaid EL, Fritz GK, Alegría M. Asthma disparities in the prevalence, morbidity, and treatment of Latino children. *Soc Sci Med* 1982. 2006 Dec; 63(11):2926–37.
35. Spira-Cohen A, Chen LC, Kendall M, Lall R, Thurston GD. Personal exposures to traffic-related air pollution and acute respiratory health among Bronx schoolchildren with asthma. *Environ Health Perspect*. 2011 Apr; 119(4):559–65. [PubMed: 21216722]
36. Joseph CLM, Foxman B, Leickly FE, Peterson E, Ownby D. Prevalence of possible undiagnosed asthma and associated morbidity among urban schoolchildren. *J Pediatr*. 1996 Nov; 129(5):735–42. [PubMed: 8917242]
37. Nicholas SW, Jean-Louis B, Ortiz B, Northridge M, Shoemaker K, Vaughan R, et al. Addressing the Childhood Asthma Crisis in Harlem: The Harlem Children's Zone Asthma Initiative. *Am J Public Health*. 2005 Feb; 95(2):245–9. [PubMed: 15671459]
38. Quinn K, Shalowitz MU, Berry CA, Mijanovich T, Wolf RL. Racial and Ethnic Disparities in Diagnosed and Possible Undiagnosed Asthma Among Public-School Children in Chicago. *Am J Public Health*. 2006 Sep; 96(9):1599–603. [PubMed: 16507720]
39. Freeman NCG, Schneider D, McGarvey P. School-Based Screening for Asthma in Third-Grade Urban Children: The Passaic Asthma Reduction Effort Survey. *Am J Public Health*. 2002 Jan; 92(1):45–6. [PubMed: 11772757]
40. Stein RE, Bauman LJ, Epstein SG, Gardner JD, Walker DK. How well does the questionnaire for identifying children with chronic conditions identify individual children who have chronic conditions? *Arch Pediatr Adolesc Med*. 2000 May; 154(5):447–52. [PubMed: 10807293]

What's New

Mexican-origin children with U.S.-born parents have elevated asthma risks in early childhood compared to otherwise similar children with foreign-born parents. These results indicate that asthma incidence and burden will likely rise with increasing assimilation and acculturation.

Figure 1. Health and Behavioral Risk and Protective Factors Among Mexican-Origin Children by Parental Nativity

Figure 2. Annual Number of Elevated Ozone Days by Race/Ethnicity and Nativity (n=4,600)

Table 1
Descriptive Characteristics by Asthma Status, ECLS-B Kindergarten Assessment

	(1) Children Without Asthma n = 5,500	(2) Children With Asthma n = 1,350	(3) Significant Differences by Asthma Status
<u>Race/Ethnicity/Mexican Parental Nativity (%)</u>			
Mexican, at Least 1 Foreign-Born Parent	12.1	9.3	<i>c</i>
Mexican, 2 U.S.-Born Parents	7.0	7.1	Not significant
Non-Hispanic White	55.3	43.1	<i>c</i>
Other Hispanic	6.9	8.8	<i>c</i>
African-American	11.5	24.7	<i>c</i>
Asian-American	2.7	2.0	<i>c</i>
Other Race	4.4	4.8	Not significant
<u>Gender (%)</u>			
Male	49.7	58.9	<i>c</i>
<u>Health-Related Characteristics (%)</u>			
Low Birthweight	6.5	11.6	<i>c</i>
History of Respiratory Illness	18.2	52.7	<i>c</i>
Breastfed	71.0	62.8	<i>c</i>
Family History of Asthma	33.6	55.7	<i>c</i>
Non-Food Allergy	10.1	26.8	<i>c</i>
Food Allergy	2.9	8.0	<i>c</i>
High BMI	34.4	41.6	<i>c</i>
Smoker in Household	25.0	29.7	<i>c</i>
<u>Child Care (%)</u>			
Ever in Center-Based Child Care	64.8	69.6	<i>c</i>
<u>Socioeconomic Status (%)</u>			
Mother's Education < High School	18.1	23.7	<i>c</i>
Mother's Education High School Grad	27.8	32.3	<i>c</i>
Mother's Education Some College	28.4	26.9	<i>b</i>
Mother's Education College Grad	25.9	17.1	<i>c</i>
In Poverty	21.8	35.4	<i>c</i>
<u>Health Care Access/Utilization (%)</u>			
Uninsured at Some Point	13.2	10.3	<i>c</i>
Well-Child Care Utilization	80.4	82.9	<i>c</i>

^a All analyses are weighted; sample sizes are rounded to nearest 50 per ECLS-B confidentiality requirements

^b $p < 0.01$

^c $p < 0.001$

Risk and Protective Factors for Asthma by Child Race/Ethnicity and Mexican Parental Nativity (n = 6,900^a)

Table 2

	Mexican, 1 Foreign Born Parent (n=600)	Mexican, 2 U.S. Born Parents (n=450)	Non-Hispanic White (n=2,800)	Other Hispanic (n=400)	African-American (n=1,050)	Asian-American (n=750)	Other Race (n=800)
Gender (%)							
Male	54.8 ^{b, c}	51.8	51.2	49.7	50.7	52.6	47.2 ^b
Health-Related Characteristics (%)							
Low Birthweight	6.1	7.1	6.3	8.2 ^b	12.5 ^b	7.0	7.4 ^b
History of Respiratory Illness	12.2 ^{b, c}	20.5 ^b	27.8	22.3 ^b	24.7 ^b	13.2 ^b	28.6
Breastfed	80.7 ^{b, c}	66.4 ^b	71.3	75.2 ^b	48.6 ^b	79.8 ^b	73.8 ^b
Family History of Asthma	16.1 ^{b, c}	43.7 ^b	38.0	42.2 ^b	48.4 ^b	17.8 ^b	47.0 ^b
Non-Food Allergy	7.9 ^{b, c}	10.4 ^b	15.1	12.1 ^b	11.1 ^b	7.4 ^b	17.2 ^b
Food Allergy	1.3 ^{b, c}	2.9 ^b	4.4	3.7	3.6 ^b	6.9 ^b	4.6
High BMI	42.8 ^{b, c}	37.7 ^b	31.8	45.4 ^b	37.6 ^b	29.0 ^b	41.9 ^b
Smoker in Household	21.5 ^{b, c}	35.1 ^b	25.4	22.9 ^b	26.7	15.6 ^b	35.5 ^b
Child Care							
Ever in Center-Based Care	52.2 ^{b, c}	57.4 ^b	67.9	67.7	73.5 ^b	61.8 ^b	61.1 ^b
Socioeconomic Status							
Mother's Education < High School	51.1 ^{b, c}	27.5 ^b	9.4	24.2 ^b	25.7 ^b	13.4 ^b	13.6 ^b
Mother's Education HS Grad	28.1 ^{b, c}	32.1 ^b	25.3	34.9 ^b	36.5 ^b	15.3 ^b	31.2 ^b
Mother's Education Some College	15.8 ^{b, c}	32.8 ^b	30.5	24.4 ^b	29.2 ^b	19.9 ^b	32.5 ^b
Mother's Education College Grad	5.0 ^{b, c}	7.6 ^b	34.8	16.5 ^b	8.6 ^b	51.4 ^b	22.6 ^b
In Poverty	45.6 ^{b, c}	27.4 ^b	12.4	28.8 ^b	48.2 ^b	14.6 ^b	27.4 ^b
Health Care Access/Utilization							
Uninsured at Some Point	25.2 ^{b, c}	15.8 ^b	10.5	18.2 ^b	9.1 ^b	8.6 ^b	6.6 ^b
Well-Child Care Utilization	79.1 ^{b, c}	80.1	80.1	86.0 ^b	82.9 ^b	81.4 ^b	80.3

^a All analyses are weighted; sample sizes are rounded to nearest 50 per ECLS-B confidentiality requirements

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Significant difference ($p < .05$), comparisons between each race/ethnicity/parental nativity group and non-Hispanic whites
Significant difference ($p < .05$), comparisons between Mexican-origin children with 1 foreign born parent and those with 2 U.S. born parents

Table 3
Odds Ratios from Multiple Logistic Regression Analyses Modeling Ever Having Asthma
by Kindergarten (n=6,900^a)

	Model 1	Model 2
<u>Race/Ethnicity/Mexican Parental Nativity</u>		
Mexican, 1 Foreign-Born Parent	0.99 (0.76-1.29)	1.50 (1.05-2.14)^c
Mexican, 2 U.S.-Born Parents	1.31 (0.93-1.85)	1.45 (1.00-2.09)^b
Other Hispanic	1.64 (1.13-2.38)^d	1.77 (1.17-2.67)^d
African-American	2.76 (2.15-3.53)^e	2.55 (1.89-3.44)^e
Asian-American	0.93 (0.67-1.30)	1.73 (1.20-2.50)^d
Other Race	1.39 (1.01-1.92)^c	1.16 (0.79-1.70)
Non-Hispanic White (reference)	—	—
<u>Gender</u>		
Male		1.47 (1.22-1.76)^e
Female (reference)		—
<u>Health-Related Characteristics</u>		
Low Birthweight		1.54 (1.27-1.87)^e
History of Respiratory Illness		4.83 (4.05-5.76)^e
Breast feed		0.87 (0.70-1.07)
Family History of Asthma		1.94 (1.57-2.39)^e
Non-Food Allergy		2.61 (2.08-3.29)^e
Food Allergy		2.23 (1.45-3.44)^e
High BMI		1.21 (1.01-1.46)^c
Smoker in Household		1.01 (0.79-1.28)
<u>Child Care</u>		
Ever in Center-Based Care		1.16 (0.93-1.46)
<u>Socioeconomic Status</u>		
Mother's Education High School Graduate		0.98 (0.72-1.32)
Mother's Education Some College		0.88 (0.62-1.26)
Mother's Education College Graduate		0.68 (0.43-1.09)
Mother's Education < High School (reference)		—
In Poverty		1.53 (1.18-2.00)^d
<u>Health Care Access/Utilization</u>		
Uninsured at Some Point		0.73 (0.55-0.97)^c
Well-Child Care Utilization		1.91 (0.94-3.90)

^a All analyses are weighted; sample sizes rounded to nearest 50 per ECLS-B confidentiality requirements; Model 1 includes only race/ethnicity and Mexican parental nativity, and Model 2 includes additional controls for risk and protective factors.

^b p<0.10

^c p< 0.05

^d
p< 0.01

^e
p< 0.001

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Table 4
Multiple Regression Results, Number of Asthma Attacks, Odds of Taking Asthma Medication and Odds of Hospitalization in Children With Asthma

	(1) Number of Asthma Attacks (Regression Coefficients) (n = 1,350 ^a)	(2) Taking Asthma Medication (Odds Ratios) (n = 1,350)	(3) Asthma Hospitalization/ER (Odds Ratios) (n = 1,350)	(4) Asthma Hospitalization/ER (Odds Ratios) Ozone Subsample (n = 500)
<u>Race/Ethnicity/Mexican Parental Nativity</u>				
Mexican, 1 Foreign-Born Parent	-0.90 ^b	0.96	1.94	0.88
Mexican, 2 U.S.-Born Parents	-0.04	1.58	2.03	1.46
Other Hispanic	-1.31 ^e	1.66 ^b	1.62	1.44
African-American	-0.16	1.32	2.40 ^d	1.94
Asian-American	0.07	0.50 ^b	0.24 ^c	0.11 ^c
Other Race	-0.19	1.09	1.48	2.01
Non-Hispanic white (reference)	—	—	—	—
<u>Gender</u>				
Male	0.16	1.02	1.24	1.06
Female (reference)	—	—	—	—
<u>Health-Related Characteristics</u>				
Low Birthweight	0.02	1.46 ^c	1.00	1.03
History of Respiratory Illness	0.12	1.67 ^e	1.26	0.97
Breastfed	-0.20	0.90	0.62 ^b	0.65
Family History of Asthma	0.22	1.19	0.77	0.67
Non-Food Allergy	0.13	2.22 ^e	1.30	1.24
Food Allergy	0.37	2.22 ^e	1.43	1.52
High BMI	-0.05	1.35 ^c	1.05	1.30
Smoker in Household	-0.28	1.06	0.95	1.00
<u>Child Care</u>				
Ever in Center-Based Care	0.06	1.04	1.06	1.16
<u>Socioeconomic Status</u>				
Mother's Education HS Graduate	-0.29	0.85	0.91	0.88
Mother's Education Some College	-0.10	0.96	0.79	0.58
Mother's Education College Graduate	-0.59 ^b	1.43	1.45	1.03
Mother's Education <HS (reference)	—	—	—	—
In Poverty	-0.37	1.06	0.97	0.85
<u>Health Care Access/Utilization</u>				
Uninsured at Some Point	0.26	0.75	0.85	0.78
Well-Child Care Utilization	0.98 ^d	0.69	2.09	2.12
<u>Asthma Medication</u>				
Taking Asthma Medication	1.50 ^e		2.42 ^e	2.33 ^d

	(1) Number of Asthma Attacks (Regression Coefficients) (n = 1,350 ^a)	(2) Taking Asthma Medication (Odds Ratios) (n = 1,350)	(3) Asthma Hospitalization/ER (Odds Ratios) (n = 1,350)	(4) Asthma Hospitalization/ER (Odds Ratios) Ozone Subsample (n = 500)
<u>Environmental Ozone</u>				
Elevated Ozone				1.02 ^c

^a All analyses are weighted; sample sizes rounded to nearest 50 per ECLS-B confidentiality requirements; model 1 results were produced using negative binomial regression; results for models 2-4 were produced using logistic regression.

^b p<0.10

^c p< 0.05

^d p<.01

^e p< 0.001