Methods:

Study design and Subjects

Participants were from Project Viva, a prospective pre-birth cohort study that recruited women during early pregnancy from Atrius Harvard Vanguard Medical Associates, a multi-specialty group practice in Eastern Massachusetts. Mothers were enrolled between April 1999 and July 2002. Detailed enrollment criteria have been described previously (E1). In-person interviews and questionnaires were conducted in early pregnancy after the initial prenatal visit (average of 9.9 weeks of gestation), and mid-pregnancy at 26-28 weeks of gestation. Interviews and questionnaires on child health were administered at 6 months, 1 year, and annually thereafter. Of the 2,128 live births, we included 1,148 participants with outcome data at the early teen visit (mean age 13.3 years). Compared with the included participants, those excluded were less likely to have mothers with a graduate degree (23.5% versus 34.2%) and were more likely to have mothers who smoked during pregnancy (16.9% versus 9.0%). However, prevalence of parental atopy was similar (56.7% versus 59.2%) as was adolescent race/ethnicity (18.3% versus 15.6 non-Hispanic black; 10.9% versus 9.5% Hispanic) (**Table E3).** The institutional review boards of Brigham and Women's Hospital and Harvard Pilgrim Health Care approved this study.

Assessment of Child Race/Ethnicity and Maternal SES during Pregnancy

We determined the race/ethnicity of the adolescent by asking the mother to choose one or more racial/ethnic groups for her child. We created four racial/ethnic groups based on the mother's response including non-Hispanic white (reference category), non-Hispanic black, Hispanic (regardless of race if also checked), and other (mixed race, Asian or Pacific Islander, American Indian or Alaskan Native, and other).

We examined the following measures of home environment and indicators of SES: maternal education, smoking by the mother during pregnancy and by anyone in the home during the child's first year of life, household income, and median household income from the neighborhood census tract. Mothers reported their highest level of educational attainment, personal smoking, and household income on questionnaires during pregnancy. Mothers also reported household smoking on the 6 month and year one postpartum questionnaires. Median annual income for census tract of residence at the time of study enrollment was determined using data from the 2000 United States Census. We defined low neighborhood income as a census tract in the lowest quartile of the distribution of our study population (<$41,771 per year), all of whom lived in the greater Boston area at study enrollment.

Adolescent Allergy Outcomes

Of the 1,148 children who presented for the in-person visit (age 11.2 to 16.6 years), 701 had blood drawn and 647 had samples sufficient to measure allergen-specific IgE levels by Phadia ImmunoCap (age 11.9 to 16.4 years). Food sensitivity to each food allergen (milk, egg, peanut, soy, or wheat) was defined as positive if the respective food specific IgE level was >0.35 kU/L.

We inquired about allergic-type symptoms following allergen intake with the question: "Which of the following food(s) is your child allergic to? Specify the reaction(s) that your child had within one hour of eating them. Please check as many reactions for each food as needed." The listed reactions were: hives on one body part, hives on more than one body part, nausea/vomiting, diarrhea, wheezing, trouble breathing, itchy throat or mouth, coughing, sneezing, runny or stuffy nose, loss of consciousness, eczema or worsening eczema. The foods

listed included milk, egg, peanut, soy, wheat and also other allergens (e.g. other nuts and shell-fish which we did not investigate because there was no corresponding IgE measure). We considered an adolescent to have had food allergy symptoms to one of the 5 common food allergens if their mother reported that the child had one or more of these symptoms to that food. We also classified each adolescent based on whether the mother reported allergic-type reaction to any food. We did not collect data on physician-diagnosed food allergy.

Statistical Analysis

We assessed associations of adolescent race/ethnicity and measures of SES with odds of allergic sensitization and symptoms to each of the 5 common food allergens using logistic regression models. We used prevalence ratios rather than odds ratios for sensitization to peanut and wheat because the outcome was common (the prevalence was >27% among black and "other" race/ethnicity participants). To estimated prevalence ratios, we used PROC GENMOD's log-binomial regression (SAS Institute, Cary, NC) as described by Spiegelman and colleagues (E2). All models adjusted for adolescent age, sex, and race/ethnicity and parental history of atopy. Parental history of atopy was defined as positive if either parent was reported to have asthma, allergic rhinitis, or atopic dermatitis.

References

E1. Oken E, Baccarelli AA, Gold DR, Kleinman KP, Litonjua AA, De Meo D, et al. Cohort profile: project viva. Int J Epidemiol. 2015 Feb;44(1):37–48.

E2. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and

differences. Vol. 162, American journal of epidemiology. United States; 2005. p. 199–200.

Table E1: Participant Characteristics of 1,148 adolescents in Project Viva, overall and according to race/ethnicity

		Adolescent race/ethnicity			
	Overall	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other
	n=1148	n=749	n=179	n=109	n=110
	Mean (SD) or %				
Adolescent					
Female	48.4%	49.7%	45.3%	45.0%	48.2%
Age at early teen visit, years	13.3 (1.0)	13.3 (1.0)	13.3 (1.0)	13.3 (1.0)	13.2 (0.9)
Mother					
Education					
. <College graduate	28.0%	17.0%	57.0%	60.2%	24.8%
. College grad	37.7%	43.5%	31.3%	18.5%	27.5%
. Graduate degree	34.2%	39.5%	11.7%	21.3%	47.7%
Smoked during pregnancy	9.0%	8.0%	10.7%	13.0%	9.1%
Family/household					
Parental history of atopy	59.2%	59.9%	54.2%	59.3%	62.4%
Annual household income					
. ≤$40,000	14.2%	5.0%	44.8%	39.3%	17.8%
. $40,001-70,000	21.2%	21.5%	24.6%	18.0%	17.8%
. >$70,000	64.6%	73.6%	30.6%	42.7%	64.4%
Any smokers in the household (in first year)	13.0%	9.7%	24.3%	22.1%	11.3%
Neighborhood at enrollment					
Census tract median household income (lowest quartile, <$41,771/year)	23.2%	9.0%	66.7%	45.0%	28.2%

Table E2: Adolescent Outcomes

Data from 647 adolescents participating in Project Viva who had IgE samples (upper portion) and from 1,145 adolescents whose's mothers completed the symptom questionnaire (lower portion)

		Adolescent race/ethnicity			
	Overall	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other
IgE >0.35 kU/L	n=647	n=400	n=113	n=71	n=63
			N (%)		
Milk	71 (11.0)	40 (10.0)	15 (13.3)	10 (14.1)	6 (9.5)
Egg	50 (7.7)	25 (6.3)	11 (9.7)	7 (9.9)	7 (11.1)
Peanut	110 (17.0)	50 (12.5)	31 (27.4)	11 (15.5)	18 (28.6)
Soy	62 (9.6)	32 (8.0)	14 (12.4)	7 (9.9)	9 (14.3)
Wheat	128 (19.8)	71 (17.8)	32 (28.3)	8 (11.3)	17 (27.0)
	Overall	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other
Allergic symptoms	n=1145	n=747	n=179	n=109	n=109
			N (%)		
Milk	14 (1.2)	9 (1.2)	3 (1.7)	0	2 (1.8)
Egg	9 (0.8)	5 (0.7)	3 (1.7)	0	1 (0.9)
Peanut	46 (4.0)	20 (2.7)	11 (6.1)	4 (3.7)	11 (10.1)
Soy	6 (0.5)	5 (0.7)	1 (0.6)	0	0
Wheat	9 (0.8)	6 (0.8)	1 (0.6)	0	2 (1.8)

Table E3: Characteristics of Included and Excluded Participants

	Included Participants n=1,148	Excluded Participants n=980	p-Value
Adolescent			
Sex			0.95
. Female	48.4%	49.6%	
Race/Ethnicity			0.21
. Non-Hispanic white	65.3%	61.6%	
. Non-Hispanic black	15.6%	18.3%	
. Hispanic	9.5%	10.9%	
. Other	9.6%	9.1%	
Mother			
Education			<.001
. <College graduate	28.0%	44.1%	
. College grad	37.7%	32.4%	
. Graduate degree	34.2%	23.5%	
Smoked during pregnancy	9%	16.9%	<.001
Family/household			
Parental history of atopy	59.2%	56.7%	0.25
Annual household income			0.003
. ≤$40,000	14.2%	17.5%	
. $40,001-70,000	21.2%	25.7%	
. >$70,000	64.6%	56.8%	
Any smokers in the household (in first year)	13.0%	14.9%	0.27
Neighborhood at enrollment			
Census tract median household income (lowest quartile, <$41,771/year)	23.2%	27.1%	0.04