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Peanut allergy prevalence among school-age children in a US cohort not selected for any disease

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To the Editor:

What is the prevalence of peanut allergy among US children? Given that 90% of US households consume peanut butter,¹ this is an important question. The answer is not straightforward, however, as estimates of peanut allergy prevalence among US children differ by allergy definition, study population, and methodology.² Previous estimates for US children have been based on self-report^{3–6} or specific IgE (sIgE) criteria,⁷ which are thought

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Capsule Summary

In a US cohort of school-age children not selected for any disease, the prevalence of peanut allergy ranged from 2.0% to 5.0%, depending on definition. Peanut allergy among US school-age children is increasingly prevalent.

to be inaccurate.² Estimates have varied according to whether they were based on telephone surveys,³ electronic surveys,⁴ or nationally representative surveys such as the National Health and Nutrition Examination Survey (NHANES) (Table 1).^{5–7} One must consider that self-report is hindered by reporting bias, surveys of food allergy are more likely to enlist those with the condition, and nationally representative surveys are limited in the extent of phenotyping possible given their wide scope. It can therefore be difficult to discern how differences in definition, study population, and methodology affect prevalence estimates across studies. Here we report and compare prevalence estimates of childhood peanut allergy according to varying criteria among 7–10 year-old children participating in a US birth cohort not selected for any disease.

We determined prevalence of childhood peanut allergy based on reported symptoms, sIgE levels, clinical information, and combinations of these variables among participants of Project Viva. Project Viva is a large, observational cohort study based in eastern Massachusetts with enrollment from Harvard Vanguard Medical Associates, a multi-site group medical practice. Participants were not selected for any disease. The study was designed to examine maternal dietary and other factors that could influence child health outcomes, with health broadly defined.⁸ Enrollment occurred between 1999 and 2002 in early pregnancy and resulted in delivery of 2128 singleton children. Interviews and questionnaires on child health were administered when the children were age 6 months, 1 year, and annually thereafter. We collected outcome data for this study at the mid-childhood in-person visit (mean age 7.9 years). Among the 1277 children who presented for an in-person interview at mid-childhood, 699 (55%) had blood drawn, and 616 (87.7% of those with blood samples) had sIgE measured by Phadia ImmunoCAP. Compared to those who did not follow up, participants who did follow up showed higher proportions of maternal white race (69% vs. 62%), college or graduate education (69% vs. 58%), and annual household income (63% vs. 58%), but there were no significant differences in parental atopy (P value 0.13). Compared with the general US population, there was a higher proportion of blacks and lower proportion of Hispanics among participants. Further details regarding the comparability of the 616 children to the larger cohort have been previously described.⁸

We considered a child to have self-reported peanut allergy if his/her mother answered yes to, “Has your child ever had an allergic reaction to peanuts,” and yes to at least one of the following categories of allergic reaction symptoms with peanut ingestion: “Skin related (e.g. hives, swelling),” “Respiratory (e.g., shortness of breath, wheezing, cough),” “Cardiovascular (e.g. low blood pressure, dizziness or fainting),” “Gastrointestinal (e.g. vomiting, diarrhea),” or “Anaphylaxis (severe, multi-system allergic reaction).” These questions, which assess convincing symptoms of IgE-mediated reaction, are comparable to those used in previous studies of self-reported peanut allergy by Sicherer et al.³ We assessed prescription of an epinephrine auto-injector with the question, “Has a health care professional, such as a doctor, physician assistant or nurse practitioner, ever prescribed an EpiPen for your child?”

The prevalence of self-reported peanut allergy in this cohort of US children not selected for any disease was 4.6% (Table 2), higher than previously reported estimates of self-reported peanut allergy among US children of comparable age (Table 1). Similarly, we observed a

5.0% prevalence of “clinical peanut allergy” according to sIgE-based criteria that previously resulted in a 2.7% prevalence among comparably aged children in the 2005–2006 NHANES study.⁷ Within Project Viva, the 4.9% prevalence of peanut allergy defined by both sensitization and prescribed epinephrine auto-injector was similar in magnitude to the estimates defined by self-reported allergy and sIgE-based “clinical allergy” criteria.

The relatively high prevalence rates we observed may reflect continued rise of peanut allergy prevalence in the US, consistent with the rising trend in self-reported peanut allergy that Sicherer et al. observed between 1997, 2002, and 2008.³ Additionally, our cohort was based in the Northeast, where rates of peanut sensitization may be higher relative to western US regions.⁹

Application of a more stringent definition for peanut allergy than self-reported allergy or “clinical allergy,” such as the peanut sIgE 14 kU/L decision point for 90% specificity reported by Sampson,¹⁰ yielded a prevalence of 2.9% (Table 2), which is still higher than previously reported estimates by any criteria (Table 1). Our strictest definition of peanut allergy, requiring peanut sIgE greater than the 90% specificity decision point *and* prescribed epinephrine auto-injector, yielded a prevalence of 2.0%. While it could be argued that despite Project Viva’s general health goals, the relatively high prevalence rates we observed could be due to food allergic families preferentially returning for mid-childhood visits, the rates of parental atopy (assessed prenatally) among those who did and did not present at mid-childhood were not significantly different, supporting that selection bias was not at play.

As we assessed peanut allergy using different criteria within this cohort, we also assessed for agreement between the definitions. Agreement was the highest between self-reported peanut allergy and peanut allergy defined by both peanut sensitization and prescribed epinephrine auto-injector ($K = 0.75$, 95%CI 0.62–0.88). There was moderate agreement between self-reported peanut allergy and peanut allergy defined by both the 90% specificity decision point and prescribed epinephrine auto-injector ($K = 0.57$, 95%CI 0.38–0.76), and less agreement between self-reported peanut allergy and peanut allergy defined by the 90% specificity decision point only ($K = 0.49$, 95%CI 0.31–0.68).

Each epidemiologic method for assessing peanut allergy prevalence has strengths and limitations. Double-blind, placebo-controlled food challenges are the gold standard for clinical peanut allergy diagnosis, but these are challenging to implement in large, unselected cohorts and have not been done in unselected US cohorts.² As diagnostic adjuncts, component resolved diagnostics may also be increasingly implemented in epidemiologic cohorts going forward. In this letter, we have provided prevalence estimates according to several criteria that can be compared to one another and to previous estimates. Our results come from a US cohort of children not selected for allergy or any disease, and they support that peanut allergy is an increasingly prevalent condition.

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Abbreviations

NHANES	National Health and Nutrition Examination Survey
sIgE	specific IgE
US	United States

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Key messages

- Estimates of peanut allergy prevalence among children in the US have varied by allergy definition, study population, and methodology
- The prevalence of peanut allergy in a US cohort of school-age children not selected for allergy or any disease ranged from 2.0% to 5.0%, depending on definition. Peanut allergy is an increasingly prevalent condition of concern.

Table 1

Previously reported prevalence estimates of childhood peanut allergy in the US

Study	Criteria for definition	Method	Survey Year	Prevalence Percent (95%CI)
Sicherer et al. ²	Self-reported reaction and symptoms	Telephone survey	1997	0.4 (0.2–0.7) in <18yrs
Sicherer et al. ²	Self-reported reaction and symptoms	Telephone survey	2002	0.8 (0.5–1.2) in <18 yrs 0.8 (0.4–1.8) in 6–10 yrs
NHANES 2005–2006 ⁷	Clinical food allergy based on sIgE criteria [^]	Nationally representative survey	2005–2006	1.8 (1.5–2.1) in 1–5 yrs 2.7 (2.4–3.0) in 6–19 yrs
NHANES 2005–2006 ⁷	Peanut sIgE 14 kU/L [*]	Nationally representative survey	2005–2006	1.0 (0.7–1.3) in 1–5 yrs 0.9 (0.7–1.2) in 6–19 yrs
NHANES 2007–2008 ⁶	Self-reported allergy [†]	Nationally representative survey	2007–2008	1.4 (0.9–1.9) in <18 yrs
Sicherer et al. ²	Self-reported reaction and symptoms	Telephone survey	2008	1.4 (1.0–1.9) in <18 yrs 2.1 (1.3–3.4) in 6–10 yrs
NHANES 2009–2010 ⁶	Self-reported allergy [†]	Nationally representative survey	2009–2010	0.9 (0.4–1.4) in <18 yrs
NHANES 2007–2010 ⁶	Self-reported allergy [†] excluding those with recent consumption	Nationally representative survey	2007–2010	0.9 (0.7–1.1) in children and adults combined
Infant Feeding Practices Study II ⁵	Self-reported allergy	Mail survey	2009–2010	0.6 (0.3–1.0) In <1 yr
Gupta et al. ⁴	Self-reported allergy and reaction history	Electronic survey	2009–2010	2.0 (1.8–2.2) in < 18 yr 1.9 (1.6–2.3) in 6–10 yrs

[^] as defined by Liu et al as 50% of participants with peanut sIgE 2.0–14.0 kU/L and 95% of participants with peanut sIgE 14 ku/L.⁷^{*} 90% specificity decision point reported by Sampson.¹⁰[†] Based on broad questions that did not address symptoms.^{5, 6}

Table 2

Prevalence of peanut allergy among school-age children in a US observational birth cohort not selected for any disease (N = 616)

Criteria for definition	Number	Prevalence Percent (95% CI)
Self-reported reaction and symptoms	27	4.6 (2.9–6.3) [‡]
Clinical food allergy based on sIgE criteria [^]	31	5.0 (3.5–7.1)
Peanut sIgE ≥ 0.35 kU/L and prescribed epinephrine autoinjector	29	4.9 (3.2–6.7) [‡]
Peanut sIgE ≥ 14 kU/L [*]	18	2.9 (1.6–4.3)
Peanut sIgE ≥ 14 kU/L and prescribed epinephrine autoinjector	12	2.0 (0.9–3.2) [‡]

[^] as defined for NHANES by Liu et al as 50% of participants with peanut sIgE 2.0–14.0 kU/L and 95% of participants with peanut sIgE ≥ 14 kU/L.⁷

^{*} 90% specificity decision point reported by Sampson.¹⁰

[‡] Denominator is 589 subjects with complete interview responses.