

## Letter to the Editor

**Overall prevalence of self-reported food allergy in Canada**

To the Editor:

In 2010, our group published the first Canadian estimates of the prevalence of peanut, tree nut, fish, shellfish, and sesame allergy<sup>1</sup> based on a nationwide telephone survey of randomly selected households (the SCAAALAR [Surveying Canadians to Assess the prevalence of food Allergies and Attitudes towards food LABelling and Risk] study). However, this article did not provide an estimate for the overall prevalence of food allergy. In the SCAAALAR study, although we inquired about the presence of other food allergies, we elicited information on reaction characteristics and diagnostic testing only for the 5 allergens above as collecting such detailed data for all food allergens would have considerably lengthened the telephone survey. This letter provides estimates of the overall prevalence of food allergy in Canada based on self-report; sociodemographic predictors of self-reported food allergy are also examined.

As described previously,<sup>1</sup> we performed a cross-sectional telephone interview between May 2008 and March 2009 of randomly selected households in the 10 Canadian provinces. The initial eligible participant who completed the survey on behalf of all household members was asked if anyone in the household had a food allergy, and to which food(s). Demographic information was also collected.

We developed 3 prevalence estimates of perceived allergy by (1) including in the numerator all individuals self-reporting at least 1 food allergy; (2) excluding from the numerator all adults self-reporting an allergy to milk, egg, wheat, and/or soy only; IgE-mediated allergies to these foods usually resolve by adulthood, and adverse reactions to milk in adulthood are more likely to represent lactose intolerance<sup>2</sup> and adverse reactions to wheat are more likely to represent celiac disease<sup>3</sup>; and (3) using estimate number 2 and adjusting for nonresponse via multiple imputation.

Since prevalence varies by area of residence, we used information available on the nonrespondents (province and postal code) to predict the rate of allergy within nonrespondents. This proceeded in 2 stages: First, we imputed the number of persons within each household, assuming that the distribution of household size was similar within responding and nonresponding residences. Then, for each subject with missing data, we used a hierarchical logistic regression model to predict the missing allergy status.

Predictors of self-reported food allergy (as defined in number 2) were identified through multivariate regression analyses. Potential predictors included post-secondary education of household respondent (attained college/university degree), low-income household,\* marital status of household respondent (married/living with partner), urban location of household,† birthplace of household respondent (born in Canada), geographic location of the household (Ontario and Atlantic Canada,

\*Low-income cutoff defined as an income level at which families or unattached individuals spend at least 70% of before-tax income on food, shelter, and clothing and is determined according to family size and geographic location.

†Residing in a Canadian metropolitan area with a population of 100,000 or more.

**TABLE I.** Demographic characteristics

	SCAAALAR population (%)	Canadian population (%)
College/university/professional degree or diploma	60.5	32.9 (as of 2001)
Household income under low-income cutoff*†	8.9	14.5 (as of 2006)
Born in Canada	85.6	80.6 (as of 2006)

\*Among respondents who provided income-related information, representing 61% of our household sample.

†Low income cutoffs, defined as income levels at which families or unattached individuals spend at least 70% of before-tax income on food, shelter, and clothing and is determined according to family size and geographic location. Data from Ben-Shoshan et al.<sup>1</sup>

**TABLE II.** Self-reported prevalence of food allergy in Canada\*

	% (95% CI)		
	Children	Adults	Entire study population
Estimate 1: Including all adults			
Peanut	1.77 (1.21-2.33)	0.78 (0.58-0.97)	1.00 (0.80-1.20)
Tree nut	1.73 (1.16-2.30)	1.07 (0.84-1.30)	1.22 (1.00-1.44)
Fish	0.18 (0.00-0.36)	0.60 (0.43-0.78)	0.51 (0.37-0.65)
Shellfish	0.55 (0.21-0.88)	1.91 (1.60-2.23)	1.60 (1.35-1.86)
Sesame	0.23 (0.03-0.43)	0.07 (0.01-0.13)	0.10 (0.04-0.17)
Milk	2.23 (1.51-2.95)	1.89 (1.56-2.21)	1.97 (1.64-2.29)
Egg	1.23 (0.69-1.77)	0.67 (0.48-0.86)	0.80 (0.61-0.99)
Wheat	0.45 (0.08-0.83)	0.86 (0.63-1.08)	0.77 (0.57-0.96)
Soy	0.32 (0.08-0.55)	0.16 (0.07-0.25)	0.20 (0.10-0.30)
Fruits	1.14 (0.68-1.60)	1.61 (1.32-1.89)	1.50 (1.25-1.75)
Vegetables	0.45 (0.17-0.74)	1.29 (1.02-1.55)	1.10 (0.88-1.31)
Other	1.32 (0.80-1.84)	1.67 (1.37-1.97)	1.59 (1.32-1.86)
All foods	7.14 (5.92-8.36)	8.34 (7.69-8.99)	8.07 (7.47-8.67)
Estimate 2: Excluding some adults			
All foods	7.14 (5.92-8.36)	6.56 (5.99-7.13)	6.69 (6.15-7.24)
Estimate 3: Estimate 2 adjusted for nonresponse			
All foods	7.12 (6.07-8.28)	6.58 (6.22-6.96)	6.67 (6.19-7.17)

\*These are not mutually exclusive groups; that is, individuals can self-report more than 1 allergy.

Western Canada, or Quebec), and age of allergic individual (<18 years).

Of the 10,596 households who were contacted to complete the survey, 3,666 responded (35% response rate) of which 3,613 completed the survey, representing 9,667 individuals (7,469 adults and 2,198 children). Compared with the general Canadian population, less educated and lower-income families and new Canadians were underrepresented in the SCAAALAR study (Table I). Of the 9,667 individuals, 8.07% (95% CI, 7.47%-8.67%) reported at least 1 food allergy. After exclusion of adults reporting only milk, egg, wheat, and/or soy allergy (estimate number 2), the overall prevalence decreased to 6.69%

**TABLE III.** Prevalence estimates for peanut, tree nut, fish, shellfish, and sesame allergy

	% (95% CI)		
	A: Self-report of food allergy*	B: Self-report of convincing history and/or physician diagnosis of food allergy†	Difference: A – B
<b>Peanut</b>			
Children	1.77 (1.21-2.33)	1.68 (1.14-2.23)	0.09 (–0.69 to 0.87)
Adults	0.78 (0.58-0.97)	0.71 (0.52-0.90)	0.07 (–0.21 to 0.34)
Entire study population	1.00 (0.80-1.20)	0.93 (0.74-1.12)	0.07 (–0.21 to 0.35)
<b>Tree nut</b>			
Children	1.73 (1.16-2.30)	1.59 (1.04-2.14)	0.14 (–0.65 to 0.93)
Adults	1.07 (0.84-1.30)	1.00 (0.78-1.23)	0.07 (–0.26 to 0.39)
Entire study population	1.22 (1.00-1.44)	1.14 (0.92-1.35)	0.08 (–0.23 to 0.39)
<b>Fish</b>			
Children	0.18 (0.00-0.36)	0.18 (0.00-0.36)	0.00 (–0.25 to 0.25)
Adults	0.60 (0.43-0.78)	0.56 (0.39-0.73)	0.04 (–0.20 to 0.28)
Entire study population	0.51 (0.37-0.65)	0.48 (0.34-0.61)	0.03 (–0.17 to 0.23)
<b>Shellfish</b>			
Children	0.55 (0.21-0.88)	0.50 (0.18-0.82)	0.05 (–0.42 to 0.51)
Adults	1.91 (1.60-2.23)	1.69 (1.39-1.98)	0.23 (–0.20 to 0.66)
Entire study population	1.60 (1.35-1.86)	1.42 (1.18-1.66)	0.19 (–0.17 to 0.54)
<b>Sesame</b>			
Children	0.23 (0.03-0.43)	0.23 (0.03-0.43)	0.00 (–0.28 to 0.28)
Adults	0.07 (0.01-0.13)	0.05 (0.00-0.11)	0.01 (–0.07 to 0.09)
Entire study population	0.10 (0.04-0.17)	0.09 (0.03-0.15)	0.01 (–0.08 to 0.10)

\*Prevalence of food allergy based on self-report taken from Table I.

†Prevalence of food allergy as reported in Ben-Shoshan et al.<sup>1</sup>

(95% CI, 6.15%-7.24%); the prevalence was 7.14% (95% CI, 5.92%-8.36%) in children and 6.56% (95% CI, 5.99%-7.13%) in adults. Using estimate number 2 and imputing the allergy status of nonresponding households yielded a prevalence of 6.67% (95% CI, 6.19%-7.17%). Milk, peanut, and tree nut were the most common allergies in children, and shellfish, fruits, and vegetables in adults (Table II).

There was a higher rate of self-reported food allergy among individuals who resided in a household where the primary respondent was a postsecondary graduate (odds ratio [OR], 1.24 [95% CI, 1.03-1.51]) or where the primary respondent was born in Canada (OR, 1.47 [95% CI, 1.10-1.92]). Individuals living in Quebec had the lowest rate of self-reported food allergy (OR, 0.73 [95% CI, 0.59-0.90]), followed by Ontario and Atlantic Canada (reference group, OR, 1.00) and Western Canada (OR, 1.30 [95% CI, 1.04-1.63]).

Our estimate of the overall prevalence of food allergy relies on self-report, likely leading to an overestimate of the prevalence of true food allergy. Characterizing adverse reactions to all foods in sufficient detail to determine whether reactions were likely IgE-mediated would have substantially lengthened the questionnaire and adversely affected our response rate. However, our previous publication<sup>1</sup> compared prevalence estimates based on self-report with estimates based on a convincing history of an IgE-mediated reaction to a food‡ or self-report of a physician diagnosis, and found only slight differences (Table III).

A limitation of our imputed prevalence estimate is the assumption of similar distribution of household size between responders

and nonresponders. In addition, our imputation did not consider demographic or other factors that may influence the development and/or reporting of allergy because these data were unavailable for nonresponders. Since awareness of or experience with food allergy may influence a subject's willingness to participate in our survey, it is possible that responders were more likely to have food allergies than nonresponders, possibly creating a selection bias. Further, it is possible that the overrepresentation of higher-income families and nonimmigrants in our study led to an overestimate of prevalence, although it is not clear whether these differences are true differences in allergy prevalence, or arise from different reporting patterns among these groups. Given these caveats, it is likely that our lower bound estimate of 6.67% represents a reasonable approximation for the overall prevalence of self-reported food allergy in Canada.

Our prevalence estimates are consistent with a recent systematic review reporting that food allergy affects between 2% and 10% of the American population.<sup>4</sup> Although a meta-analysis published in 2007 reported a range of prevalence estimates for self-reported food allergy from 3% to 35%, the majority of these studies reported estimates closer to 10%.<sup>5</sup> In addition, a recent survey reported that 8% of American children suffer from food allergy,<sup>6</sup> which is similar to our estimate of 7.14% for Canadian children. Our estimates for the prevalence of milk, egg, wheat, and soy allergy in children are also consistent with published data (published estimates ranged between 2.2% and 2.8% for milk, 1.3% and 1.6% for egg, 0.4% and 1.3% for wheat, and 0% and 1.3% for soy).<sup>5,7</sup> Although our estimates for fruit and vegetable allergy are comparable to those of an American study,<sup>7</sup> research has shown that up to 60% of those reporting allergies to fruits and vegetables may have oral allergy syndrome and are therefore at very low risk of anaphylaxis.<sup>8</sup>

Those residing in households where the respondent had a postsecondary education or was born in Canada were more likely to report a food allergy. This is consistent with previous

‡A convincing history of an allergic reaction was defined as a minimum of 2 mild signs/symptoms or 1 moderate or 1 severe sign/symptom that was likely IgE-mediated and occurred within 2 hours of ingestion or contact (or inhalation for fish and shellfish). Mild symptoms include pruritus, urticaria, flushing, or rhinoconjunctivitis; moderate includes angioedema, throat tightness, gastrointestinal complaints, or breathing difficulties (other than wheeze); and severe includes wheeze, cyanosis, or circulatory collapse.

observations; Pawlinska-Chmara et al<sup>9</sup> reported a higher prevalence of food allergy in families with highly educated parents living in favorable economic conditions, and an Australian study reported a higher prevalence of asthma, allergies, and atopy in Australian-born individuals compared with Asian-born immigrants.<sup>10</sup> Higher prevalence of food allergy in these groups may be attributed to a variety of factors: (1) higher health literacy and a higher likelihood of seeking medical attention for possible food allergy; (2) a lifestyle characterized by fewer children and pets, increased use of antibiotics, and improved sanitation, which may contribute to a T<sub>H</sub>2 predominance in the immune system and increased allergic disease<sup>9</sup>; and (3) delayed introduction of allergenic foods in accordance with a previous recommendation by the American Academy of Pediatrics suggesting that restriction of allergenic foods early in life could reduce the development of food allergy. This recommendation has since been retracted as recent studies suggest that delayed introduction may in fact increase the development of food allergy.<sup>11</sup>

Although 6.67% of Canadians report a food allergy, fewer are likely to have a true food allergy. Despite not being formally diagnosed with food allergy, those who merely believe they are allergic are still adversely affected; they may follow unnecessary dietary restrictions and experience the same anxiety and uncertainty as those who have been diagnosed as allergic. Hence, it is critical to encourage all who suspect they have a food allergy to seek appropriate medical care to ensure correct diagnosis and follow-up.

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