



## Letter

## Likelihood of being prescribed an epinephrine autoinjector in allergic Canadians with lower educational levels

Failure to administer epinephrine promptly after suspected ingestion of a food allergen can have severe and even fatal consequences.<sup>1</sup> Our previous population-based telephone survey found that only 55% of Canadians diagnosed as having peanut, tree nut, fish, shellfish, and/or sesame allergy self-reported having an epinephrine autoinjector (EAI), and adults, males, and those residing in households where the respondent was single were less likely to have one.<sup>2</sup> However, this study was limited because it underrepresented some of the most vulnerable populations. Furthermore, we did not query patients on actual availability of the EAI or on other common allergies, such as milk, egg, wheat, or soy.

The current study (Surveying Prevalence of Food Allergy in All Canadian Environments) bridges these gaps by targeting vulnerable populations: those with low educational levels, those with low income (low income refers to household income below the Low Income Cut-off, defined as the 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), new Canadians (immigrated to Canada <10 years ago), and individuals of aboriginal identity (First Nations, Métis, or Inuit). It also provides data on prescription and availability of the EAI for 9 priority food allergens (peanut, tree nut, fish, shellfish, sesame, milk, egg, wheat, and soy).

We performed a random cross-Canada telephone survey in 2010–2011 that targeted regions with a high proportion of low-income households, new Canadians, and individuals of aboriginal identity.<sup>3</sup> Using 2006 Canadian Census data, we targeted postal codes from the Canadian Census tracts with the highest proportion of our groups of interest, then randomly selected households from within these postal codes. If respondents reported that any household member had an allergy to any of the 9 foods, they were queried on whether an EAI had ever been prescribed for this individual and whether the device was always carried outside the home.

Multivariate logistic regression was performed to identify predictors of being prescribed or always carrying the EAI among individuals with a diagnosed food allergy (self-report of a physician diagnosis of allergy to at least 1 of the 9 food allergens<sup>2</sup>). The following variables were included as covariates: age (<18 years), sex, postsecondary education (college or university degree for adults or highest educational attainment in the household for children), low income, immigrant status (new Canadian, immigrated ≥10 years ago, born in Canada), aboriginal status, marital status, urban location of household (residing in a Canadian metropolitan area with a population ≥ 100,000), presence of peanut or tree nut allergy, allergy to more than one priority allergen, age at

most severe reaction, treatment with epinephrine during most severe reaction, multiple allergic reactions, and self-report of diagnostic allergy testing. Because 24% of the sample did not report household income, a sensitivity analysis for missing income was performed where a multivariate model, which included individuals reporting income, was compared with a model that included those not reporting income.

Of the 12,762 households reached, 5,734 households, representing 15,022 individuals, completed the survey (45% response rate). Of 348 participants with self-reported diagnosed food allergy, 44.0% (95% confidence interval [CI], 38.7%–49.4%) were prescribed an EAI, and 56.9% of these (95% CI, 48.6%–64.8%) reported always carrying it (Table 1).

In the multivariate model, adults with higher educational level and children residing in a household with an adult having a post-secondary degree (OR, 3.30; 95% CI, 1.69–6.44), individuals reporting aboriginal identity (OR, 2.50; 95% CI, 1.09–5.75), those with peanut or tree nut allergy (OR, 3.01; 95% CI, 1.75–5.17), those who experienced their most severe reaction at a younger age (OR, 0.98; 95% CI, 0.96–0.99), and those reporting confirmatory testing (OR, 3.44; 95% CI, 1.58–7.48) were more likely to be prescribed an EAI. Prescription did not differ according to income or immigrant status. The predictors of being prescribed the EAI were the same in the multivariate models that were restricted to individuals who did and did not report their income. There were no factors associated with carrying the EAI.

This is the first study, to our knowledge, to examine prescription and availability of the EAI using a population-based survey that targeted vulnerable populations. We found that many Canadians with food allergy are not prescribed an EAI, particularly adults with lower educational level and children residing in households with low educational attainment; furthermore, almost half of those prescribed the device do not carry it. As has been previously reported, self-report of EAI availability is likely to be overestimated, perhaps because of social desirability bias,<sup>4</sup> whereby patients tend to report carrying the device because they know they are supposed to and this response is thus “socially desirable.”

All participants reported having been diagnosed by a physician as having food allergy, and 74.4% of those not prescribed an EAI reported having positive diagnostic test results for food allergy. Hence, in most cases, the physician appears to have confirmed the allergy but did not prescribe the EAI. Twenty-two percent of those not prescribed reported not having any diagnostic testing. It is possible that their physician advised them that they had a food allergy, but in reality the physician believed it was a non-IgE-mediated adverse reaction to food and hence did not necessitate testing or an EAI. Alternatively, the physician may have believed it was a true allergy but did not believe testing or a prescription for an EAI was warranted.

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**Table 1**  
Prescription and availability of the EAI among individuals with diagnosed food allergy

| Variable                                                | Total No. of patients with diagnosed food allergy | Patients prescribed the EAI, % (95% CI) | Total No. of patients prescribed the EAI | Patients carrying the EAI (among those prescribed), % (95% CI) |
|---------------------------------------------------------|---------------------------------------------------|-----------------------------------------|------------------------------------------|----------------------------------------------------------------|
| Allergic to any of the nine priority food allergens     | 348                                               | 44.0 (38.7–49.4)                        | 153                                      | 56.9 (48.6–64.8)                                               |
| Children (<18 years)                                    | 96 <sup>a</sup>                                   | 68.8 (58.5–77.8)                        | 66 <sup>a</sup>                          | 57.6 (44.8–69.7)                                               |
| Adults                                                  | 244 <sup>a</sup>                                  | 34.8 (28.9–41.2)                        | 85 <sup>a</sup>                          | 56.5 (45.3–67.2)                                               |
| Male                                                    | 143                                               | 47.6 (39.1–56.1)                        | 68                                       | 51.5 (39.0–63.8)                                               |
| Female                                                  | 205                                               | 41.5 (34.6–48.5)                        | 85                                       | 61.2 (50.0–71.6)                                               |
| High educational level                                  | 259 <sup>b</sup>                                  | 49.0 (42.8–55.3)                        | 127 <sup>b</sup>                         | 59.8 (50.8–68.4)                                               |
| Low educational level                                   | 87 <sup>b</sup>                                   | 28.7 (19.5–39.4)                        | 25 <sup>b</sup>                          | 44.0 (24.4–65.1)                                               |
| High income                                             | 216 <sup>c</sup>                                  | 48.6 (41.8–55.5)                        | 138                                      | 56.2 (46.2–65.9)                                               |
| Low income                                              | 49 <sup>c</sup>                                   | 30.6 (18.3–45.4)                        | 15                                       | 53.3 (26.6–78.7)                                               |
| New Canadian                                            | 24                                                | 33.3 (15.6–55.3)                        | 8                                        | 75.0 (34.9–96.8)                                               |
| Immigrated ≥10 years ago                                | 57                                                | 29.6 (18.0–43.6)                        | 16                                       | 56.3 (29.9–80.2)                                               |
| Born in Canada                                          | 267                                               | 48.3 (42.2–54.5)                        | 129                                      | 55.8 (46.8–64.5)                                               |
| Aboriginal identity                                     | 41                                                | 56.1 (39.7–71.5)                        | 23                                       | 43.5 (23.2–65.5)                                               |
| Nonaboriginal identity                                  | 307                                               | 42.3 (36.8–48.1)                        | 130                                      | 59.2 (50.3–67.8)                                               |
| Married or living with partner                          | 236 <sup>d</sup>                                  | 46.6 (40.1–53.2)                        | 110 <sup>d</sup>                         | 55.5 (45.7–64.9)                                               |
| Single                                                  | 104 <sup>d</sup>                                  | 38.5 (29.1–48.5)                        | 40 <sup>d</sup>                          | 65.0 (48.3–79.4)                                               |
| Urban household                                         | 214                                               | 39.7 (33.1–46.6)                        | 85                                       | 62.4 (51.2–72.6)                                               |
| Rural household                                         | 134                                               | 50.7 (42.0–59.5)                        | 68                                       | 50.0 (37.6–62.4)                                               |
| Peanut and/or tree nut allergy                          | 164                                               | 61.6 (53.7–69.1)                        | 101                                      | 59.4 (49.2–69.1)                                               |
| Did not have peanut and/or tree nut allergy             | 184                                               | 28.3 (21.9–35.4)                        | 52                                       | 51.9 (37.6–66.0)                                               |
| Multiple allergies                                      | 100                                               | 61.0 (50.7–70.6)                        | 61                                       | 65.6 (52.3–77.3)                                               |
| Single allergy                                          | 248                                               | 37.1 (31.1–43.4)                        | 92                                       | 51.1 (40.4–61.7)                                               |
| <18 years old at most severe reaction                   | 145                                               | 57.2 (48.8–65.4)                        | 83                                       | 51.8 (40.6–62.9)                                               |
| ≥18 years old at most severe reaction                   | 203                                               | 34.5 (28.0–41.5)                        | 70                                       | 62.9 (50.5–74.1)                                               |
| Treated with epinephrine during most severe reaction    | 67                                                | 43.3 (31.2–56.0)                        | 29                                       | 62.1 (42.3–79.3)                                               |
| Did not receive epinephrine during most severe reaction | 281                                               | 44.1 (38.2–50.1)                        | 124                                      | 55.6 (46.5–64.6)                                               |
| Multiple allergic reactions                             | 280                                               | 44.3 (38.4–50.3)                        | 124                                      | 58.1 (48.9–66.9)                                               |
| Single allergic reaction                                | 68                                                | 42.6 (30.7–55.2)                        | 29                                       | 51.7 (32.5–70.6)                                               |
| Report diagnostic testing                               | 293                                               | 48.1 (42.3–54.0)                        | 141                                      | 58.2 (49.6–66.4)                                               |
| Did not report diagnostic testing                       | 55                                                | 21.8 (11.8–35.0)                        | 12                                       | 41.7 (15.2–72.3)                                               |

Abbreviations: CI, confidence interval; EAI, epinephrine autoinjector.

<sup>a</sup>Data on age were missing for 8 individuals for prescription of the EAI and 2 for availability.<sup>b</sup>For adults, educational level refers to their personal educational attainment. For children, educational level refers to the highest educational attainment in the household. Data on educational level were missing for 2 individuals for prescription of the EAI and 1 for availability.<sup>c</sup>Data on income were missing for 83 individuals for prescription of the EAI.<sup>d</sup>Data on marital status were missing for 8 individuals for prescription of the EAI and 3 for availability.

Those of higher educational level were more likely to be prescribed the EAI, which could partly be attributed to greater access to long-term follow-up with a specialist or higher health literacy, making them more likely to request an EAI prescription from their physician.<sup>5</sup> We hypothesized that those of low income, new Canadians, and those of aboriginal identity would have fewer prescriptions because of poorer access to regular health care<sup>6,7</sup> and/or use of alternative health care, such as healers.<sup>8</sup> Furthermore, we anticipated that these populations, potentially because of nonconventional health care beliefs and lower employment rates<sup>9</sup> and therefore limited access to employee health benefits to cover the cost of purchasing the EAI, may be less likely to carry the EAI. However, we did not observe any differences between new Canadians or those of low income and the rest of the sample, perhaps because of inadequate sample size or because those participating in our study were more likely to have access to health care and follow Western medicine than nonparticipants. Interestingly, individuals of aboriginal identity were more likely to be prescribed an EAI than those not of aboriginal identity. It is possible that limited availability of emergency health care services in remote northern regions,<sup>10</sup> where most of Canada's aboriginal population resides, prompted physicians to prescribe the EAI more readily than in urban centers, where most of the country's nonaboriginal population resides.

It was interesting that no differences were observed in availability of the EAI across all of the characteristics we evaluated. It is possible that variables that predict who carries the device were not captured in our study, and these deserve further attention.

Our study was conducted in Canada, and the findings may not be generalizable to the US context because of differences in the health care systems. Unlike in Canada, where access to health care is universal, in the United States, patients incur costs of physician visits unless they have private insurance or Medicaid or Medicare, which is a major barrier to seeking health care.<sup>11,12</sup> In terms of prescription drug coverage, there is limited public coverage in both countries, and nonadherence to prescription medications because of cost has been identified as a problem in both.<sup>12,13</sup> Therefore, we hypothesize that uninsured or poorly insured Americans with suspected food allergy may be less likely than Canadians to seek a physician diagnosis but that if a diagnosis was made and a prescription for the EAI obtained, the likelihood that the EAI would not be purchased because of cost is probably similar to the Canadian context.

Because epinephrine is the only means of arresting progression of an allergic reaction into anaphylaxis, the importance of immediate accessibility of the EAI needs to be disseminated to the general population, particularly to those of lower socioeconomic status. In addition, clinicians must be reminded of the importance of prescribing the EAI because it will enhance the quality of life of patients and families affected with food allergy.

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