Prevalence of self-reported food allergy in U.S. adults: 2001, 2006, and 2010

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ABSTRACT

Background: Epidemiologic evidence indicates that food allergies are increasing in the population. Information on a change in self-reported food allergy (srFA) in adults over time is lacking.

Objective: To report the prevalence of srFA and compare differences at three time points over a decade.

Methods: We analyzed srFA and reported physician-diagnosed food allergy in >4000 U.S. adults who participated in the 2010 U.S. Food and Drug Administration Food Safety Survey. Information on causative food(s), reaction severity characteristics, and various diagnostic factors was also analyzed. We compared 2010 Food Safety Survey data with 2006 and 2001 data, and highlighted relevant differences.

Results: SrFA prevalence increased significantly, to 13% in 2010 and 14.9% in 2006 compared with 9.1% in 2001 (p < 0.001). Physician diagnosed food allergy was 6.5% in 2010, which was not significantly different compared with 7.6% in 2006 and 5.3% in 2001. SrFA increased in both men and women, non-Hispanic white and black adults, 50–59 year olds, and in adults with a high school or lower education. In 2010, milk, shellfish, and fruits were the most commonly reported food allergens, similar to 2001. Also, in 2010, 15% of reactions reportedly required a hospital visit and 8.4% were treated with epinephrine. Minor differences in reaction severity characteristics were noted among the surveys.

Conclusions: Analysis of survey results indicates that the prevalence of srFA increased among U.S. adults from 2001 to 2010 and that adults are increasingly self-reporting FAs without obtaining medical diagnosis. Improved education about food allergies is needed for this risk group.

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RESULTS

In 2010, 574 adults (13%) self-reported having an srFA (Table 2) and 323 (6.5%) in 2010 self-reported a ddFA (Table 3). This was compared with 737 (14.9%) and 385 (7.6%) in 2006, and 471 (9.1%) and 279 (5.3%) in 2001 reporting srFA and ddFA, respectively. Based on these values, the prevalence of srFA was significantly increased ($p < 0.001$) in both 2006 and 2010 compared with 2001. The significant increase in srFA ($p < 0.001$) for both 2006 and 2010 survey years was consistently noted in both men and women, individuals ages 50–59 years, non-Hispanic whites and blacks, and individuals with a high school or less education. For ddFA, prevalence in 2006 was significantly increased from 2001 ($p < 0.001$) but was not significantly different from 2010. No significant difference in ddFA prevalence was noted between 2001 and 2010 surveys ($p = 0.092$). Although some significant subcategory increases in ddFA prevalence from 2001 to 2006 were noted for men, non-Hispanic blacks, and individuals with a high school or less education, there were no significant subcategory increases in ddFA prevalence between the 2001 and 2010 surveys. Thus, by using 2001 and 2010 time end points, analysis of our results indicates no significant change in ddFA prevalence over this decade.

Although not shown in Tables 2 or 3, some differences were noted within demographic groups for both srFA and ddFA in 2010. Female adults were significantly more likely than male adults to report a ddFA ($p < 0.001$). Hispanic adults were approximately half as likely as non-Hispanic white and non-Hispanic black individuals to report either ddFA or srFA ($p < 0.001$). There were no differences in the level of education for those with ddFA or srFA.

The prevalences of allergy to specific foods within srFA and ddFA groups of the most recent 2010 survey are shown in Table 4. Seventy-five percent of adults with srFA and 76% of those with ddFA reported reactions to at least one of the major food allergens (i.e., milk and/or dairy, eggs, fish, shellfish, tree nuts, peanuts, wheat and/or gluten, soy) defined by Food Allergen Labeling and Consumer Protection Act. In addition, the most frequently implicated foods as causes of allergic reactions within both the srFA and ddFA groups were similar. Foods associated with the highest prevalence of srFA were milk and/or dairy (4.1%), shellfish (3.6%), fruits (2.7%), fish (1.7%), and tree nuts and wheat and/or gluten (1.3% each), whereas foods associated with the highest prevalence of ddFA were milk and/or dairy (2.0%), shellfish (1.6%), fruits (1.6%), wheat and/or gluten (0.9%), fish (0.8%), tree nuts (0.7%), and peanut (0.6%). Although questions were asked differently in 2010 compared with 2001, the most frequently reported foods (milk,
Table 1  Verbatim FA questions from the 2001, 2006, and 2010 U.S. Food and Drug Administration FSS

| Survey Year Reported | 2001 | 2006 | 2010 |
|----------------------|------|------|------|
| **Verbatim FA questions from the 2001, 2006, and 2010 U.S. Food and Drug Administration FSS** | | | |
| **Allergy and diagnoses (Tables 2 and 3)** | | | |
| Do you or does anyone who lives in your home with you currently have any food allergies, or does anyone suspect that he or she has a food allergy? | X | | |
| Now, I’d like to ask if you have any current food allergies or do you suspect that you have a food allergy? | | X | X |
| Has a medical doctor diagnosed your condition as a food allergy? | | X | X |
| How did the doctor make the diagnosis? (open ended) | | X | |
| How did the doctor make the diagnosis of a food allergy? (open ended) | | X | X |
| **Foods (Table 4)** | | | |
| What foods or food ingredients are you allergic to? I am going to read you a list. Please answer yes or no for each food category. | X | | |
| Are you allergic to any milk or dairy? | | X | |
| What about eggs? | | X | |
| Any type of fish or shellfish? (What type?) | | X | |
| What type of shellfish are you allergic to? | | X | |
| Are you allergic to any type of nuts or seeds? (What type?) | | X | |
| Are you allergic to wheat, gluten, corn, or other grains? | | X | |
| Are you allergic to any fruits or vegetables? (What type?) | | X | |
| Are you allergic to any kind of beans or legumes? (What type?) | | X | |
| Are you allergic to any other foods? (What type?) | | X | |
| **Reactions (Table 5)** | | | |
| If you eat any of this food, which of these reactions do you have? Do you have . . . ? | X | | |
| What kinds of reactions have you had to the food(s) you are allergic to? | | X | |
| Please respond with yes or no to each item I read. | | | |
| Skin reaction, such as hives, itching, or redness | X | X | |
| Swelling of face | X | X | |
| Itchy lips or mouth | X | X | |
| Throat tightness or itchy throat | X | X | |
| Wheezing | X | X | |
| Trouble breathing, shortness of breath, or coughing | X | X | |
| Nasal congestion | X | X | |
| Stomach pain | X | X | |
| Vomiting or nausea | X | X | |
| Diarrhea | X | X | |
| **Reaction severity (Table 6)** | | | |
| When was the last time you had an allergic reaction to food or had symptoms you thought were caused by an allergic reaction to food? | X | X | |
| How many total food allergic reactions have you had in the past 5 years? | Not asked | X | |
| Was epinephrine used to treat this most recent reaction? | X | X | |
| Were you treated in a hospital or doctor’s office for this reaction? | X | X | |
| Thinking about the food that caused the reaction we were just talking about, was it: (1) A packaged food eaten without further preparation, such as milk or cookies; (2) a prepared food cooked or made at a home, a restaurant, or other such place; or (3) a food that did not come in a package and was not prepared, such as a piece of fruit? | X | X | |

*FA = food allergy; FSS = U.S. Food and Drug Administration Food Safety Surveys.

*Results for 2001 were previously reported by Vierk et al. 19

#Comparisons were made only between 2001 and 2010.
fruits, and shellfish) as causes of allergic reactions in 2010 were unchanged from 2001.19

In 2010, the majority of adults in the srFA and ddFA groups reported experiencing skin symptoms (66.0% and 71.8%, respectively), followed closely by gastrointestinal symptoms in 64.2% and 65.7%, respectively; and respiratory symptoms were reported in 39.6% and 50.8% of respondents in both groups, respectively.

Compared with 2001, there was a significant 18% increase (p < 0.001) in total gastrointestinal symptoms and a significant 20% decrease (p < 0.001) in reporting of total respiratory symptoms in individuals with srFA only. Specific only to the 2010 questionnaire, ~1 in 10 of those with ddFA (9.7%) reported having ever experienced anaphylactic shock in the past (Table 5).

For 2010 respondents with srFA and ddFA, 45% and 41.6%, respectively, reported experiencing an allergic reaction within the past 12 months; 26% and 24%, respectively, reported experiencing their last allergic reaction in the past 1 to 5 years, and 29% and 34%, respectively, reported having gone 5 years or more without an allergic reaction (Table 6). Compared with 2001, a statistically significant increase (p < 0.001) was noted in adults of either group reporting 5 years or more since their last allergic reaction. For 2010 respondents with ddFA, 8.4% had their most recent reaction treated with epinephrine. Also, 19.6% of these individuals reported going to see a physician for a reaction that occurred within the preceding 5 years and 15% reported having their allergic reaction treated in a hospital. Specific only to the 2010 questionnaire, 42% and 50% of srFA and ddFA, respectively, reported more than four allergic reactions to a food in the past 5 years.

With regard to food types and products that caused the allergic reaction in the past 5 years, the majority of reported reactions in 2010 were to prepared foods (44.6% srFA, 45.8% ddFA). If the reaction was from a prepared food, almost 60% of respondents in both FA groups indicated the food that caused their last allergic reaction was prepared in a retail environment (restau-

| Demographic Variables | 2001 (N = 4482) | 2006 (N = 4539) | 2010 (N = 4568) |
|-----------------------|----------------|----------------|----------------|
|                       | srFA, no. (%)* | 95% CI         | srFA, no. (%)* | 95% CI         | p Value#        | srFA, no. (%)* | 95% CI         | p Value§        |
| All                   | 471 (9.0)      | 8.2–9.9        | 737 (14.9)      | 13.8–15.9      | <0.001          | 574 (13)       | 12.1–14.0      | <0.001          |
| Sex                   |                |                |                |                |                |                |                |                |
| Women                 | 340 (11.4)     | 10.1–12.7      | 529 (18)       | 16.4–19.5      | <0.001          | 422 (14.7)     | 10.0–12.6      | 0.001          |
| Men                   | 131 (6.5)      | 5.5–7.6        | 208 (11.4)     | 10.3–13.0      | <0.001          | 152 (11.2)     | 10.0–12.6      | <0.001          |
| Age                   |                |                |                |                |                |                |                |                |
| 18–29 y               | 75 (8.1)       | 6.5–9.9        | 61 (12.6)      | 10.2–16.1      | 0.003           | 21 (17.3)      | 14.6–20.3      | <0.001          |
| 30–39 y               | 81 (8.4)       | 6.7–10.4       | 113 (14.3)     | 11.3–16.4      | 0.001           | 59 (11.4)      | 9.5–13.6       | 0.034           |
| 40–49 y               | 118 (9.6)      | 7.8–11.7       | 141 (13.9)     | 11.6–16.2      | 0.007           | 87 (11.1)      | 9.0–13.5       | 0.344           |
| 50–59 y               | 82 (10)        | 7.9–12.2       | 193 (20.2)     | 17.5–22.6      | <0.001          | 141 (15.7)     | 13.4–18.2      | 0.001           |
| 60–69 y               | 53 (7.7)       | 5.6–10.3       | 103 (13.6)     | 11.0–16.1      | 0.002           | 122 (11.7)     | 9.3–14.5       | 0.027           |
| ≥70 y                 | 42 (8.7)       | 6.2–11.7       | 88 (12)        | 9.8–14.8       | 0.077           | 117 (10.6)     | 8.2–13.4       | 0.337           |
| Race and/or ethnicity |                |                |                |                |                |                |                |                |
| White                 | 361 (8.9)      | 7.9–9.9        | 482 (13.1)     | 12.1–14.5      | <0.001          | 429 (11.7)     | 10.6–12.8      | <0.001          |
| Black                 | 40 (8.8)       | 6.9–11.9       | 70 (19.2)      | 16.0–22.8      | <0.001          | 48 (23)        | 19.5–26.7      | <0.001          |
| Hispanic              | 35 (8.7)       | 6.4–11.5       | 105 (14)       | 10.4–16.0      | 0.026           | 55 (9.1)       | 7.1–11.6       | 0.788           |
| Other                 | 35 (11.6)      | 7.8–15.1       | 65 (28)        | 22.0–32.3      | <0.001          | 56 (20.8)      | 16.2–26.1      | 0.002           |
| Education             |                |                |                |                |                |                |                |                |
| High school or less   | 137 (6.6)      | 5.6–7.7        | 219 (12.5)     | 11.1–14.0      | <0.001          | 166 (12.3)     | 10.9–13.8      | <0.001          |
| At least some college | 329 (11.3)     | 10.0–12.6      | 505 (16.9)     | 15.4–18.4      | <0.001          | 404 (13.8)     | 12.5–15.2      | 0.007           |

srFA = self reported food allergy; FSS = U.S. Food and Drug Administration Food Safety Surveys.
*Weighted percentages.
#p value, comparing 2001 and 2006.
§p value, comparing 2001 and 2010.
The only significant change compared with 2001 was a 30% increase (\(p < 0.001\)) in reports of food types that were neither packaged nor prepared (e.g., fruits) in the srFA group.

In 2010, the most common reported modality used for diagnosis was a skin and/or in vitro IgE test (53.7%) (Table 7). History or physical examination alone was reported in 20.9%, and “other” allergy test was reported in 19.2%. Oral food challenges were reportedly used in only 2.3% of the cases. Only 5.6% of adults reported a combination of history or physical examination and IgE-specific tests, criteria consistent with FA diagnosis in current clinical guidelines.24 In regard to epinephrine prescriptions, we found that 15.3% of adults with ddFA reported being prescribed an epinephrine kit.

**DISCUSSION**

Because living with FA has nutritional, psychosocial, and other consequences that can negatively impact health and quality of life,24–27 a proper diagnosis is essential. Analysis of sequential FSS found an increase in srFA without an associated increase in reported physician diagnosis in U.S. adults over a recent 10-year period. Analysis of our results indicates that a persistent and potentially increasing number of adults may be needlessly avoiding nutritious foods without seeking medical advice, which highlights a public health need for better education and communication to the public about seeking proper diagnosis as per established guidelines.24

Reasons for why adults are self-reporting an FA without obtaining a proper diagnosis are not completely understood and need to be examined further. Reporting of ddFA has been associated with higher, rather than lower, education as well as income level.10,13,28 Thus, it is possible that education, with or without socioeconomic factors that may impact health care access, is likely contributing to this problem. Also, the 2010 survey finding that women significantly report more ddFA than men indicates a possible sex difference in reporting as well. Another observation

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**Table 3 Preregation of self-reported ddFA by demographic group: comparison among 2001, 2006, and 2010 FSS**

| Demographic Variables | 2001 (N = 4482) | 2006 (N = 4539) | 2010 (N = 4568) |
|-----------------------|----------------|----------------|-----------------|
|                       | ddFA, no. (%)* | 95% CI         | ddFA, no. (%)*  | 95% CI          | ddFA, no. (%)* | 95% CI          |
|                       |               | p Value#       |                 | p Value§        |                 |                 |
| All                   | 279 (5.3)     | 4.6–5.9        | 385 (7.6)       | 7.1–8.7         | <0.001¶         | 323 (6.5)       | 5.4–6.8         | 0.092           |
| Sex                   |               |                |                 |                 |                 |                 |
| Women                 | 224 (7.6)     | 6.6–8.7        | 293 (10)        | 9.0–11.5        | 0.002           | 255 (8.9)       | 7.3–9.5         | 0.354           |
| Men                   | 55 (2.7)      | 2.1–3.4        | 92 (4.9)        | 4.5–6.4         | <0.001¶         | 68 (4)          | 3.0–4.6         | 0.059           |
| Age                   |               |                |                 |                 |                 |                 |
| 18–29 y               | 37 (4.1)      | 3.1–5.6        | 26 (5.5)        | 3.9–8.1         | 0.189           | 10 (4.8)        | 3.4–6.7         | 0.532           |
| 30–39 y               | 52 (5.5)      | 4.1–7.1        | 54 (6.7)        | 4.9–8.6         | 0.323           | 29 (4.1)        | 3.0–5.5         | 0.194           |
| 40–49 y               | 70 (5.5)      | 4.1–7.1        | 78 (8.2)        | 6.3–10.0        | 0.037           | 49 (6.4)        | 4.8–8.3         | 0.441           |
| 50–59 y               | 50 (5.7)      | 4.2–7.5        | 103 (9.7)       | 8.3–12.2        | 0.001           | 78 (7.9)        | 6.3–9.8         | 0.076           |
| 60–69 y               | 35 (5.1)      | 3.5–7.3        | 56 (8.1)        | 6.0–10.0        | 0.062           | 74 (7.3)        | 5.4–9.6         | 0.144           |
| ≥70 y                 | 27 (5.7)      | 3.8–8.3        | 54 (7.1)        | 5.9–10.0        | 0.201           | 72 (6.9)        | 5.0–9.3         | 0.444           |
| Race and/or ethnicity |               |                |                 |                 |                 |                 |
| White                 | 212 (5.1)     | 4.4–5.9        | 257 (6.8)       | 6.2–8.0         | 0.002           | 238 (6.1)       | 5.3–9.4         | 0.1             |
| Black                 | 30 (6.5)      | 4.8–9.1        | 49 (13.2)       | 11.2–17.2       | <0.001¶         | 32 (6.9)        | 5.0–9.4         | 0.876           |
| Hispanic              | 18 (4.3)      | 2.7–6.3        | 49 (5.8)        | 4.3–8.3         | 0.187           | 28 (3.5)        | 2.3–5.2         | 0.548           |
| Other                 | 19 (6.3)      | 3.6–9.0        | 23 (9)          | 6.8–13.6        | 0.085           | 21 (11.5)       | 8.1–15.9        | 0.019           |
| Education             |               |                |                 |                 |                 |                 |
| High school or less   | 86 (3.8)      | 3.1–4.7        | 118 (6.8)       | 6.0–8.2         | <0.001¶         | 96 (5.0)        | 4.1–6.0         | 0.072           |
| At least some college | 192 (6.6)     | 5.7–7.7        | 262 (8.3)       | 7.6–9.9         | 0.009           | 224 (7.0)       | 6.1–8.1         | 0.622           |

*ddFA = physician-diagnosed food allergy; FSS = U.S. Food and Drug Administration Food Safety Surveys.

*Weighted percentages.

#p value, comparing 2001 and 2006.

§p value, comparing 2001 and 2010.

¶Differences were significant at \(p < 0.001\); Bonferroni adjustment was applied.
from the 2010 survey results is the finding, only in the srFA group, of an increase in reporting of total gastrointestinal symptoms and a decrease in reporting of total respiratory symptoms in 2010 compared with 2001, which indicates that srFA may be increasingly represented by individuals with gastrointestinal predominant food concerns in whom diagnosis of FA is more difficult to ascertain.24,29–31

As per the 2010 survey, three of four adults with an srFA report reactions to at least one U.S. major food allergen. Fruits represent the largest reported food group outside of these major allergens to cause problems; consistent with high prevalences of fruit allergies seen in other adult populations, mostly in Europe.32,33 There was no specific food found to be specifically overrepresented in adults who reported srFA compared with ddFA. The two most common individual major food allergens in 2010, milk and shellfish, are those consistently found to be the most common allergens in adults from other recent national surveys.14,18

Table 4 Number, weighted percentage, and population prevalence of persons with srFAs and ddFAs reporting allergy to a specific food by food category, 2010 Food Safety Survey

| FA                        | srFA |          | Prevalence (%) in the Total Sample (N = 4568)* |          | Prevalence (%) in total sample (N = 4568)* |
|---------------------------|------|----------|-----------------------------------------------|----------|------------------------------------------|
| Any major food allergens# | 436  | 75       | 9.8                                           | 255      | 76                                       | 4.6                                      |
| Milk and/or dairy         | 177  | 31       | 4.1                                           | 96       | 32                                       | 2                                        |
| Eggs                      | 54   | 8        | 1                                             | 36       | 9                                        | 0.5                                      |
| Fish                      | 50   | 13       | 1.7                                           | 41       | 13                                       | 0.8                                      |
| Shellfish                 | 161  | 28       | 3.6                                           | 109      | 26                                       | 1.6                                      |
| Tree nuts                 | 52   | 10       | 1.3                                           | 33       | 12                                       | 0.7                                      |
| Peanuts                   | 46   | 6        | 0.9                                           | 28       | 10                                       | 0.6                                      |
| Wheat and/or gluten       | 95   | 10       | 1.3                                           | 60       | 14                                       | 0.9                                      |
| Soy                       | 10   | 1        | 0.1                                           | 8        | 2                                        | 0.1                                      |

Other foods§

| Fruit and/or vegetable    | 148  | 21       | 2.7                                           | 88       | 27                                       | 1.6                                      |
| Chocolate                 | 11   | 1        | 0.1                                           | 7        | 1                                        | 0.1                                      |
| Food additive             | 11   | 2        | 0.2                                           | 7        | 2                                        | 0.2                                      |

srFA = self reported food allergy; ddFA = physician-diagnosed food allergy; FSS = U.S. Food and Drug Administration Food Safety Surveys.

*Weighted percentages.

Major food allergen as defined by the Food Allergen Labeling and Consumer Protection Act23; persons might be allergic to more than one food.

§Percentage of persons with probable ddFA with allergic reactions to other foods: beans and/or legumes, 3.8%; spices, other seeds, 2% each; chocolate, 1%; other nuts, 1%; sesame, mustard seeds, <1%; other foods not specified, 11.2%.
from 2001 to 2009. However, because the number of reactions in the past 5 years was not assessed in the survey, it is impossible for us to assess the magnitude of this potential preventative effect in regard to reduction of overall reactions. Moreover, our findings of the timing of reactions may be skewed by recruitment of comparatively older adults in the 2010 compared with younger adults.

A limitation of our study and most other North American FA prevalence studies to date was that criteria for defining FA groups were not based on clinical-guideline validated diagnostic methods but primarily from self-reported cases. Self-reported data have traditionally been subject to reporter bias and overestimation of the true prevalence of clinical FA. These data also do not discern whether the reported FAs were IgE mediated or due to other FA disorders, such as celiac disease or eosinophilic gastrointestinal diseases. Although our study uses physician diagnosis report to identify more probable FA cases within the srFA group, the accuracy of self-report of physician-diagnosis data in estimating the true prevalence of clinical FA is unknown and may also be biased to overestimation. Indeed, our estimated prevalence of ddFA (6.5%) is substantially higher compared with prevalences in adults of ~2–3% determined based on clinically validated methods. It is also noteworthy that food challenge, the criterion standard diagnostic method, was reportedly used in only 2.3% of ddFA cases in adults, which was unchanged since 2001. This is a considerably low use percentage and, when compared with 20% of children reported to have food challenge in a recent national survey in children, indicates a possible age-related discrepancy in use of this diagnostic method that needs to be investigated further.

Attention also is needed when comparing our study prevalence estimates with those from other national surveys due to differences in survey methodologies and criteria used for determining FA. Although our 2010 srFA prevalence estimate for adults is consistent with the 13% rate reported by national guidelines and by systematic reviews of FA prevalence studies, this estimate is higher than estimates of 8.6 to 10% from Canada and the U.S.-based National Health and Nutrition Examination Survey data taken over a similar time period. A likely explanation for this difference is that the FSS asked: “do you currently have any food allergy or suspect that you have a food al-

Table 5  Weighted percentage of reported reactions to foods for persons with srFAs and probable ddFAs, 2001 and 2010 FSS

| Symptom*   | srFA (n = 574) | % Increase from 2001 Study | Self-reported ddFA (n = 323) | % Increase from 2001 Study |
|------------|----------------|---------------------------|----------------------------|---------------------------|
| No. (weighted %) |  | | No. (weighted %) |  |
| Skin       | 361 (66) | 3 | 234 (71.8) | -4 |
| Hives, itching, redness | 281 (53.1) | 9 | 194 (61.2) | 1 |
| Itchy throat, lips, or mouth | 239 (43.1) | 13 | 163 (48.3) | 11 |
| Swelling of face | 169 (36.5) | 3 | 127 (38.2) | -16 |
| Respiratory | 260 (39.6) | -20¶ | 179 (30.8) | -15 |
| Throat tightness | 190 (35.3) | -12 | 133 (39.9) | -17 |
| Wheezing | 153 (26.5) | -6 | 114 (34.1) | -3 |
| Trouble breathing, shortness of breath, coughing | 183 (29.2) | -14 | -14 (36) | -15 |
| Nasal congestion | 164 (27.6) | -13 | 112 (35) | -14 |
| Gastrointestinal | 360 (64.2) | 18¶ | 209 (65.7) | 17 |
| Stomach pain | 313 (47.1) | 10 | 185 (58.9) | 34 |
| Vomiting or nausea | 190 (39.3) | 42 | 121 (41) | 45 |
| Diarrhea | 234 (35.4) | 2 | 140 (43.9) | 19 |
| Other§ | | | | |
| Headache | 161 (24.2) | | 106 (40) | |
| Dizzy | 98 (15.3) | | 73 (23) | |
| Anaphylactic shock | 37 (5.5) | | 31 (9.7) | |

srFA = self reported food allergy; ddFA = physician-diagnosed food allergy; FSS = U.S. Food and Drug Administration Food Safety Surveys.

*Respondents could select more than one symptom.
§Respondents were not asked about headache, dizziness, or anaphylactic shock in 2001.
¶Differences between 2001 and 2010 were significant at p <0.001; Bonferroni adjustment was applied.
“Do you have any food allergies?” whereas the Canadian survey and U.S. National Health and Nutrition Examination Survey asked: “Do you have any food allergies?” This subtle difference of asking about suspected cases likely contributed to higher estimates of srFA, and these higher estimates may also have contributed to reported differences observed between srFA and ddFA in our study compared with other studies.18,39 Differences in

| Variables                                      | srFA (total n = 574)* | Probable ddFA (n = 323)* |
|-----------------------------------------------|------------------------|--------------------------|
|                                               | No. (weighted %) | % Increase from 2001 | No. (weighted %) | % Increase from 2001 |
| Experienced last allergic reaction            |                        |                        |
| In the past 12 mo                             | 246 (44.8)            | -14                     | 133 (41.6)        | -13                     |
| In the past 1–5 y                             | 116 (25.7)            | -14                     | 68 (24)           | -27                     |
| >5 y                                          | 171 (28.6)            | 75%                     | 103 (33.4)        | 80%                     |
| Never                                         | 9 (0.8)               | 56                      | 4 (1)             | 100                     |
| No. reactions in the past 5 y§                |                        |                        |
| 1                                             | 48 (24.5)             | 26 (13.9)               |
| 2–4                                           | 87 (33)               | 50 (36)                 |
| >4                                            | 157 (42.4)            | 87 (50.1)               |
| Treatment (reaction in the past 5 y)#         |                        |                        |
| Treated with epinephrine?                     |                        |                        |
| Yes                                           | 24 (5.9)              | -5                      | 18 (8.4)          | -17                     |
| No                                            | 332 (94.1)            | 0                       | 177 (91.6)        | 2                       |
| Do not know/refused                           | 6                     |                         |                   |                         |
| Where treated?                                |                        |                        |
| Physician’s office only                       | 36 (9.5)              | -44                     | 31 (19.6)         | -21                     |
| Hospital (including physician visit)          | 36 (7.2)              | -4                      | 33 (15)           | 25                      |
| Neither                                       | 290 (83.4)            | 10                      | 137 (65.4)        | 3                       |
| Food type (reaction in past 5 y)              |                        |                        |
| Packaged food, no preparation                 | 88 (33.5)             | 34                      | 44 (30.9)         | 31                      |
| Prepared-packaged food from mix||| | | |
| Prepared food||| | | | |
| Neither packaged nor prepared food (e.g., fruit)| 49 (13.9)            | 30%                     | 27 (15.6)         | 30%                     |
| If packaged food                              |                        |                        |
| Simple: one or few ingredients (e.g., milk, peanut butter) | 50 (50.8)            | -6                      | 12 (43.7)         | 16                      |
| Complex: a lot of ingredients (e.g., cookies) | 55 (49.2)             | 7                       | 37 (56.3)         | 10                      |
| If prepared food, where prepared              |                        |                        |
| Home                                          | 46 (22)               | 22                      | 27 (24.7)         | 73                      |
| Others’ home                                  | 20 (21)               | 163                     | 11 (16.2)         | 71                      |
| Restaurant, store, bakery                     | 106 (57)              | -23                     | 65 (59.2)         | -22                     |

srFA = self reported food allergy; ddFA = physician-diagnosed food allergy; FSS = U.S. Food and Drug Administration Food Safety Surveys.

*“Do not know” and “refused” are not included in the table; valid percentages are shown.

**P for statistical significance was <0.001; Bonferroni adjustment was applied.

|Number of reactions in the past 5 y was not asked in 2001.

§These survey questions in 2010 were limited to those who experienced allergic reactions in the past 5 y; comparisons with 2001 data were made only for those with reactions in the past 5 y.

||The 2001 question about food type did not include an option for “packaged food, needs preparation,” nor did it specify “nonpackaged prepared foods”; therefore, no between-year comparisons could be made.
how the survey questions are asked can lead to wide discrepancies in srFA rates. Indeed, a meta-analysis of published FA prevalence studies found the overall prevalence of FAs in the population to vary greatly, from 1–2% to 10%, differences largely due to varying study designs and diagnostic criteria used (e.g., self-report, food challenge confirmation).40

In regard to comparisons between survey years, this study had an important limitation to highlight. A notable difference in survey response rates was observed between the 2001 (36%) and 2010 (14%) surveys. Response rates are often considered an indicator of data quality, and low response rates are seen as a potential, but not necessarily definite, source of nonresponse bias.41 To assess whether the 2010 FSS has nonresponse bias, we conducted a nonresponse bias analysis and found that respondents were not different from nonrespondents on demographics and other key survey variables. Also, because the main and stated purpose of the survey was to assess food safety knowledge, attitude, and behavior, we would not expect a selection bias toward individuals with FAs compared with those without allergies, which is a problem that requires adjustment with some FA prevalence surveys (see, e.g., Soller18).

The decline in response rates between survey years has been observed with other digit-dial survey studies7 and is likely due to the overall decline in telephone survey response rates and the increase in cell phone–only households.42 Overall, there were far fewer respondents in the 18–29-year-old and 30–39-year-old age groups in 2010 compared with 2001. There was also an increase in the number of individuals ages ≥70 years in 2010. The differences can mainly be explained by the increase in the proportion of older adults in the U.S. population in 2010 compared with 2001, the rise in the use of cell phones over the same time period, and the high percentage of young adult cell phone usage.43

Despite the above limitation, our finding that srFA prevalences significantly increased in both 2006 and 2010 surveys and were consistently found in certain demographic groups strongly supported a conclusion that srFA (without concomitant ddFA) has increased in the U.S. adult population.

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