Supplementary Tables

**Supplementary Table 1.** *ICD* codes for food allergies

| ***ICD* code** | **Version type** | **Short description** | **Allergy type** | **Broader allergy category** |
| --- | --- | --- | --- | --- |
| 99561 | *ICD-9* | ANPHYLCT REACT PEANUTS | Peanut | Peanut |
| 99562 | *ICD-9* | ANPHYLCT REACT CRSTACNS | Shellfish | Shellfish/fish |
| 99564 | *ICD-9* | ANPHYL REACT TR NTS SEED | Tree nut | Tree nut |
| 99567 | *ICD-9* | ANPHYLCT REACT MILK PROD | Milk | Milk |
| 99568 | *ICD-9* | ANPHYLCT REACTION EGGS | Egg | Egg |
| T780 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO FOOD | Unspecified | Unspecified |
| T7800 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO UNSPECIFIED FOOD | Unspecified | Unspecified |
| T7800XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO UNSPECIFIED FOOD, INIT ENCNTR | Unspecified | Unspecified |
| T7800XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO UNSPECIFIED FOOD, SUBS ENCNTR | Unspecified | Unspecified |
| T7800XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO UNSPECIFIED FOOD, SEQUELA | Unspecified | Unspecified |
| T7801 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO PEANUTS | Peanut | Peanut |
| T7801XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO PEANUTS, INITIAL ENCOUNTER | Peanut | Peanut |
| T7801XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO PEANUTS, SUBSEQUENT ENCOUNTER | Peanut | Peanut |
| T7801XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO PEANUTS, SEQUELA | Peanut | Peanut |
| T7802 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO SHELLFISH (CRUSTACEANS) | Shellfish | Shellfish/fish |
| T7802XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO SHELLFISH (CRUSTACEANS), INIT | Shellfish | Shellfish/fish |
| T7802XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO SHELLFISH (CRUSTACEANS), SUBS | Shellfish | Shellfish/fish |
| T7802XS | *ICD-10* | ANAPHYL REACTION DUE TO SHELLFISH (CRUSTACEANS), SEQUELA | Shellfish | Shellfish/fish |
| T7803XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTHER FISH, INITIAL ENCOUNTER | Fish | Shellfish/fish |
| T7803XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTHER FISH, SUBS ENCNTR | Fish | Shellfish/fish |
| T7803XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTHER FISH, SEQUELA | Fish | Shellfish/fish |
| T7804XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO FRUITS AND VEGETABLES, INIT | Fruits and vegetables | Fruits and vegetables |
| T7804XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO FRUITS AND VEGETABLES, SUBS | Fruits and vegetables | Fruits and vegetables |
| T7804XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO FRUITS AND VEGETABLES, SEQUELA | Fruits and vegetables | Fruits and vegetables |
| T7805 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO TREE NUTS AND SEEDS | Tree nut | Tree nut |
| T7805XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO TREE NUTS AND SEEDS, INIT | Tree nut | Tree nut |
| T7805XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO TREE NUTS AND SEEDS, SUBS | Tree nut | Tree nut |
| T7805XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO TREE NUTS AND SEEDS, SEQUELA | Tree nut | Tree nut |
| T7807 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO MILK AND DAIRY PRODUCTS | Milk | Milk |
| T7807XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO MILK AND DAIRY PRODUCTS, INIT | Milk | Milk |
| T7807XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO MILK AND DAIRY PRODUCTS, SUBS | Milk | Milk |
| T7807XS | *ICD-10* | ANAPHYL REACTION DUE TO MILK AND DAIRY PRODUCTS, SEQUELA | Milk | Milk |
| T7808 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO EGGS | Egg | Egg |
| T7808XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO EGGS, INITIAL ENCOUNTER | Egg | Egg |
| T7808XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO EGGS, SUBSEQUENT ENCOUNTER | Egg | Egg |
| T7808XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO EGGS, SEQUELA | Egg | Egg |
| T7809 | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTHER FOOD PRODUCTS | Unspecified | Unspecified |
| T7809XA | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTH FOOD PRODUCTS, INIT ENCNTR | Unspecified | Unspecified |
| T7809XD | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTH FOOD PRODUCTS, SUBS ENCNTR | Unspecified | Unspecified |
| T7809XS | *ICD-10* | ANAPHYLACTIC REACTION DUE TO OTHER FOOD PRODUCTS, SEQUELA | Unspecified | Unspecified |
| V1501 | *ICD-9* | HX-PEANUT ALLERGY | Peanut | Peanut |
| V1502 | *ICD-9* | HX-MILK PROD ALLERGY | Milk | Milk |
| V1503 | *ICD-9* | HX-EGGS ALLERGY | Egg | Egg |
| V1504 | *ICD-9* | HX-SEAFOOD ALLERGY | Fish | Shellfish/fish |
| V1505 | *ICD-9* | HX-OTHER FOOD ALLERGY | Unspecified | Unspecified |
| Z9101 | *ICD-10* | FOOD ALLERGY STATUS | Unspecified | Unspecified |
| Z91010 | *ICD-10* | ALLERGY TO PEANUTS | Peanut | Peanut |
| Z91011 | *ICD-10* | ALLERGY TO MILK PRODUCTS | Milk | Milk |
| Z91012 | *ICD-10* | ALLERGY TO EGGS | Egg | Egg |
| Z91013 | *ICD-10* | ALLERGY TO SEAFOOD | Fish | Shellfish/fish |
| Z91018 | *ICD-10* | ALLERGY TO OTHER FOODS | Unspecified | Unspecified |

**Abbreviation:** *ICD*, *International Classification of Diseases.*

**Supplementary Table 2.** *ICD* codes for exclusion

| ***ICD* code** | **Version type** | **Description** |
| --- | --- | --- |
| K90.4X | *ICD-10* | Malabsorption due to intolerance, not elsewhere classified/non-celiac gluten sensitivity |
| 579.80 | *ICD-9* | Other specified intestinal malabsorption |
| E73.9 | *ICD-10* | Lactose intolerance, unspecified |
| 271.30 | *ICD-9* | Intestinal disaccharidase deficiencies and disaccharide malabsorption |
| K90.0 | *ICD-10* | Celiac disease |
| 579.0 | *ICD-9* | Celiac disease |
| E74.12 | *ICD-10* | Hereditary fructose intolerance |
| 271.2 | *ICD-9* | Hereditary fructose intolerance |
| K52.21 | *ICD-10* | Food protein-induced enterocolitis syndrome |
| 558.3 | *ICD-9* | Allergic gastroenteritis and colitis |
| K52.22 | *ICD-10* | Food protein-induced enteropathy |
| K90.X | *ICD-10* | Intestinal malabsorption |
| K20.0 | *ICD-10* | Eosinophilic esophagitis |
| 530.13 | *ICD-9* | Eosinophilic esophagitis |
| K52.81 | *ICD-10* | Eosinophilic gastritis or gastroenteritis |
| 535.7x | *ICD-9* | Eosinophilic gastritis |
| 535.70 | *ICD-9* | Eosinophilic gastritis, without mention of hemorrhage |
| 535.71 | *ICD-9* | Eosinophilic gastritis, with hemorrhage |
| 558.41 | *ICD-9* | Eosinophilic gastroenteritis |

**Abbreviation:** *ICD, International Classification of Diseases.*

**Supplementary Table 3.** Characteristics of pediatric and adult patients with food allergies

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **Age 0–17 years**  **(*n* = 220,356)** | **Age ≥18 years**  **(*n* = 135,164)** |
| Age, y, mean (SD) | 8.2 (4.8) | 38 (15) |
| Age group, *n* (%) |  |  |
| 0–1 y | 16,390 (7.4) | - |
| 2–5 y | 60,984 (28) | - |
| 6–10 y | 66,764 (30) | - |
| 11–17 y | 76,218 (35) | - |
| 18–25 y | - | 36,977 (27) |
| 26–30 y | - | 11,365 (8.4) |
| 31–64 y | - | 82,730 (61) |
| ≥65 y | - | 4092 (3.0) |
| Sex, female, *n* (%) | 100,403 (46) | 93,125 (69) |
| Insured, *n* (%) |  |  |
| Commercial | 122,500 (56) | 108,003 (80) |
| Medicaid | 97,856 (44) | 23,242 (17) |
| Medicare | 0 | 3919 (2.9) |
| CCI score, mean (SD) | 0.26 (0.48) | 0.51 (1.02) |
| CCI score, *n* (%) |  |  |
| 0 | 166,663 (76) | 91,990 (68) |
| 1 | 51,974 (24) | 30,063 (22) |
| 2 | 1277 (0.6) | 7536 (5.6) |
| ≥3 | 622 (0.3) | 5575 (4.1) |
| Comorbidities, *n* (%) |  |  |
| Allergic rhinitis | 49,665 (23) | 27,802 (21) |
| Asthma | 49,304 (22) | 24,045 (18) |
| Atopic dermatitis/eczema | 29,646 (13) | 4675 (3.5) |
| Anxiety | 8658 (3.9) | 22,505 (17) |
| GERD | 9672 (4.4) | 17,418 (13) |
| Hives (urticaria, CSU) | 13,757 (6.2) | 8763 (6.5) |
| Depression | 4734 (2.1) | 15,579 (12) |
| Conjunctivitis | 4102 (1.9) | 3040 (2.2) |
| Food allergy types, *n* (%) |  |  |
| Single food allergy | 84,190 (38) | 48,769 (36) |
| Multiple food allergiesa | 49,251 (22) | 13,635 (10) |
| Unspecified only | 86,915 (39) | 72,760 (54) |
| Food allergen type, *n* (%) |  |  |
| Peanut | 70,955 (32.2) | 17,248 (12.8) |
| Shellfish | 26,758 (12.1) | 33,188 (24.6) |
| Milk | 23,117 (10.5) | 5740 (4.2) |
| Egg | 22,969 (10.4) | 3923 (2.9) |
| Tree nut | 17,186 (7.8) | 6013 (4.4) |
| Unspecified | 121,257 (55.0) | 83,213 (61.6) |

**Abbreviations:** CCI, Charlson Comorbidity Index; CSU, chronic spontaneous urticaria; GERD, gastroesophageal reflux disease; y, years.

aUnspecified allergy types included.

**Notes:** CCI and comorbidities were assessed during the 12-month baseline period. Race is not uniformly captured in the MarketScan databases and therefore is not included.

**Supplementary Table 4.** Significant (*p* < 0.05) factors associated with all-cause and food allergy-related HRU

| **Outpatient visits** | | | | **Emergency department visits** | | | **Hospitalizations** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Factor** | **Incident rate ratio (95% CI)** |  | **Factor** | | **Odds ratioa  (95% CI)** |  | **Factor** | **Odds ratioa  (95% CI)** |
| **All-cause** | | | | | | | | |
| CCI score: ≥2 | 2.6 (2.5–2.6) |  | Payer: Medicaid | | 4.8 (4.0–5.9) |  | CCI score: ≥2 | 4.1 (3.9–4.3) |
| Anxiety | 1.6 (1.5–1.6) |  | Age ≥18 years | | 1.6 (1.6–1.6) |  | Age ≥18 years | 2.4 (2.3–2.5) |
| Depression | 1.5 (1.5–1.6) |  | CCI score: ≥2 | | 1.6 (1.5–1.6) |  | Depression | 2.0 (1.9–2.1) |
| CCI score: 1 | 1.5 (1.5–1.5) |  | Depression | | 1.5 (1.4–1.5) |  | Payer: Medicaid | 2.0 (1.3–3.1) |
| Allergic rhinitis | 1.4 (1.3–1.4) |  | CCI score: 1 | | 1.3 (1.3–1.4) |  | CCI score: 1 | 1.9 (1.8–2.0) |
| Payer: Medicaid | 1.4 (1.3–1.5) |  | Anxiety | | 1.3 (1.2–1.3) |  | Anxiety | 1.4 (1.3–1.5) |
| Age ≥18 years | 1.3 (1.3–1.3) |  | MFA | | 1.1 (1.1–1.1) |  | Female sex | 1.2 (1.1–1.2) |
| Allergic conjunctivitis | 1.2 (1.2–1.3) |  | Asthma | | 1.1 (1.1–1.1) |  | Region: West | 0.9 (0.9–1.0) |
| MFA | 1.1 (1.1–1.2) |  | Atopic dermatitis | | 1.0 (1.0–1.1) |  | Hives | 0.9 (0.9–1.0) |
| Unspecified FA | 1.1 (1.1–1.1) |  | Female sex | | 1.0 (1.0–1.0) |  | Asthma | 0.9 (0.8–0.9) |
| Hives | 1.0 (1.0–1.1) |  | Region: North Central | | 1.0 (0.9–1.0) |  | Allergic rhinitis | 0.8 (0.8–0.8) |
| Atopic dermatitis | 1.0 (1.0–1.1) |  | Hives | | 1.0 (0.9–1.0) |  | Allergic conjunctivitis | 0.8 (0.7–0.9) |
| Region: Northeast | 1.0 (1.0–1.1) |  | Region: Northeast | | 0.9 (0.9–0.9) |  | Unspecified FA | 0.8 (0.8–0.8) |
| Region: North Central | 1.0 (1.0–1.0) |  | Allergic conjunctivitis | | 0.8 (0.8–0.9) |  |  |  |
| Region: West | 1.0 (1.0–1.0) |  | Allergic rhinitis | | 0.8 (0.8–0.8) |  |  |  |
| Asthma | 0.8 (0.8–0.8) |  | Region: West | | 0.8 (0.7–0.8) |  |  |  |
|  |  |  | Region: unknown | | 0.8 (0.7–1.0) |  |  |  |
|  |  |  | Unspecified FA | | 0.7 (0.7–0.7) |  |  |  |
| **Food allergy-related** | | | | | | | | |
| MFA | 1.8 (1.8–1.8) |  | Payer: Medicaid | | 3.8 (2.9–5.0) |  | CCI score: ≥2 | 2.9 (2.5–3.3) |
| Hives | 1.1 (1.1–1.2) |  | Age ≥18 years | | 2.4 (2.3–2.4) |  | Depression | 2.1 (1.9–2.4) |
| CCI score: ≥2 | 1.1 (1.1–1.1) |  | Depression | | 1.3 (1.2–1.3) |  | CCI score: 1 | 2.0 (1.7–2.2) |
| Region: West | 1.1 (1.1–1.1) |  | MFA | | 1.1 (1.1–1.1) |  | MFA | 1.4 (1.3–1.5) |
| Allergic rhinitis | 1.1 (1.1–1.1) |  | Asthma | | 1.1 (1.0–1.1) |  | Anxiety | 1.2 (1.1–1.3) |
| Allergic conjunctivitis | 1.1 (1.1–1.1) |  | Anxiety | | 1.0 (0.9–1.0) |  | Atopic dermatitis | 1.2 (1.1–1.3) |
| Atopic dermatitis | 1.1 (1.1–1.1) |  | Region: Northeast | | 0.9 (0.8–0.9) |  | Age ≥18 years | 1.1 (1.0–1.2) |
| Unspecified FA | 1.1 (1.1–1.1) |  | CCI score: ≥2 | | 0.9 (0.8–0.9) |  | Female sex | 0.9 (0.8–1.0) |
| Region: North Central | 1.0 (1.0–1.1) |  | Atopic dermatitis | | 0.8 (0.8–0.8) |  | Allergic rhinitis | 0.7 (0.6–0.8) |
| Asthma | 1.0 (1.0–1.0) |  | Allergic conjunctivitis | | 0.7 (0.6–0.7) |  | Unspecified FA | 0.6 (0.5–0.6) |
| Anxiety | 1.0 (1.0–1.0) |  | Region: North Central | | 0.7 (0.7–0.8) |  |  |  |
| CCI score: 1 | 1.0 (1.0–1.0) |  | Region: West | | 0.7 (0.7–0.7) |  |  |  |
| Region: Northeast | 1.0 (1.0–1.0) |  | Allergic rhinitis | | 0.6 (0.6–0.6) |  |  |  |
| Female sex | 1.0 (1.0–1.0) |  | Hives | | 0.5 (0.5–0.5) |  |  |  |
| Depression | 1.0 (0.9–1.0) |  | Unspecified FA | | 0.4 (0.4–0.4) |  |  |  |
| Payer: Medicaid | 0.8 (0.8–0.9) |  |  | |  |  |  |  |
| Age ≥18 years | 0.8 (0.8–0.8) |  |  | |  |  |  |  |

**Abbreviations:** CCI, Charlson Comorbidity Index; CI, confidence interval; FA, food allergies; MFA, multiple food allergies (unspecified allergy types included).

**a**Odds of having the event compared with a reference group: age 0–17 years; sex: male; region: south; CCI score: 0; comorbid condition: absence; allergy type: single; payer: Commercial/Medicare.

**Supplementary Table 5.** Significant (*p* < 0.05) factors associated with all-cause and food allergy-related health care costs

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Outpatient visits** | | | **Emergency department visits** | | | **Hospitalizations** | |
| **Factor** | **Incident rate ratio (95% CI)** |  | **Factor** | **Odds ratioa  (95% CI)** |  | **Factor** | **Odds ratioa  (95% CI)** |
| **All-cause** | | | | | | | |
| CCI score: ≥2 | 4.8 (4.6–5.2) |  | CCI score: ≥2 | 1.7 (1.6–1.8) |  | CCI score: ≥2 | 1.9 (1.6–2.3) |
| CCI score: 1 | 1.8 (1.7–1.9) |  | Age ≥18 years | 1.4 (1.4–1.5) |  | Atopic dermatitis | 1.5 (1.2–2.0) |
| Age ≥18 years | 1.8 (1.7–1.8) |  | Depression | 1.2 (1.2–1.3) |  | Region: Northeast | 1.3 (1.1–1.5) |
| Anxiety | 1.5 (1.5–1.6) |  | CCI score: 1 | 1.2 (1.2–1.3) |  | Region: West | 1.2 (1.0–1.5) |
| Depression | 1.3 (1.3–1.4) |  | Anxiety | 1.2 (1.2–1.3) |  | Female sex | 0.9 (0.8–1.0) |
| Region: Northeast | 1.2 (1.2–1.2) |  | Region: West | 1.2 (1.2–1.2) |  | Asthma | 0.8 (0.6–0.9) |
| Allergic rhinitis | 1.1 (1.1–1.2) |  | Female sex | 1.1 (1.1–1.1) |  |  |  |
| Region: West | 1.1 (1.1–1.2) |  | MFA | 1.1 (1.0–1.1) |  |  |  |
| MFA | 1.1 (1.1–1.1) |  | Hives | 1.1 (1.0–1.1) |  |  |  |
| Unspecified FA | 1.1 (1.0–1.1) |  | Region: North Central | 0.9 (0.9–0.9) |  |  |  |
| Atopic dermatitis | 1.1 (1.0–1.1) |  |  |  |  |  |  |
| Region: North Central | 1.1 (1.0–1.1) |  |  |  |  |  |  |
| Female sex | 1.0 (1.0–1.1) |  |  |  |  |  |  |
| Asthma | 0.7 (0.7–0.7) |  |  |  |  |  |  |
| **Food allergy-related** | | | | | | | |
| CCI score: ≥2 | 1.9 (1.8–2.0) |  | Region: West | 1.4 (1.3–1.4) |  | Region: Northeast | 1.3 (1.1–1.7) |
| MFA | 1.5 (1.4–1.5) |  | Region: Northeast | 1.2 (1.1–1.2) |  |  |  |
| CCI score: 1 | 1.3 (1.2–1.4) |  | Age ≥18 years | 1.1 (1.1–1.2) |  |  |  |
| Age ≥18 years | 1.2 (1.1–1.2) |  | MFA | 1.1 (1.0–1.1) |  |  |  |
| Region: Northeast | 1.1 (1.1–1.2) |  | Female sex | 1.0 (1.0–1.1) |  |  |  |
| Region: West | 1.1 (1.1–1.1) |  | Hives | 0.9 (0.8–1.0) |  |  |  |
| Female sex | 1.0 (0.9–1.0) |  |  |  |  |  |  |
| Allergic rhinitis | 0.9 (0.8–0.9) |  |  |  |  |  |  |
| Allergic conjunctivitis | 0.9 (0.8–1.0) |  |  |  |  |  |  |
| Hives | 0.9 (0.8–0.9) |  |  |  |  |  |  |
| Unspecified FA | 0.9 (0.9–1.0) |  |  |  |  |  |  |
| Asthma | 0.8 (0.7–0.8) |  |  |  |  |  |  |

**Abbreviations:** CCI, Charlson Comorbidity Index; CI, confidence interval; FA, food allergies; MFA, multiple food allergies (unspecified allergy types included).

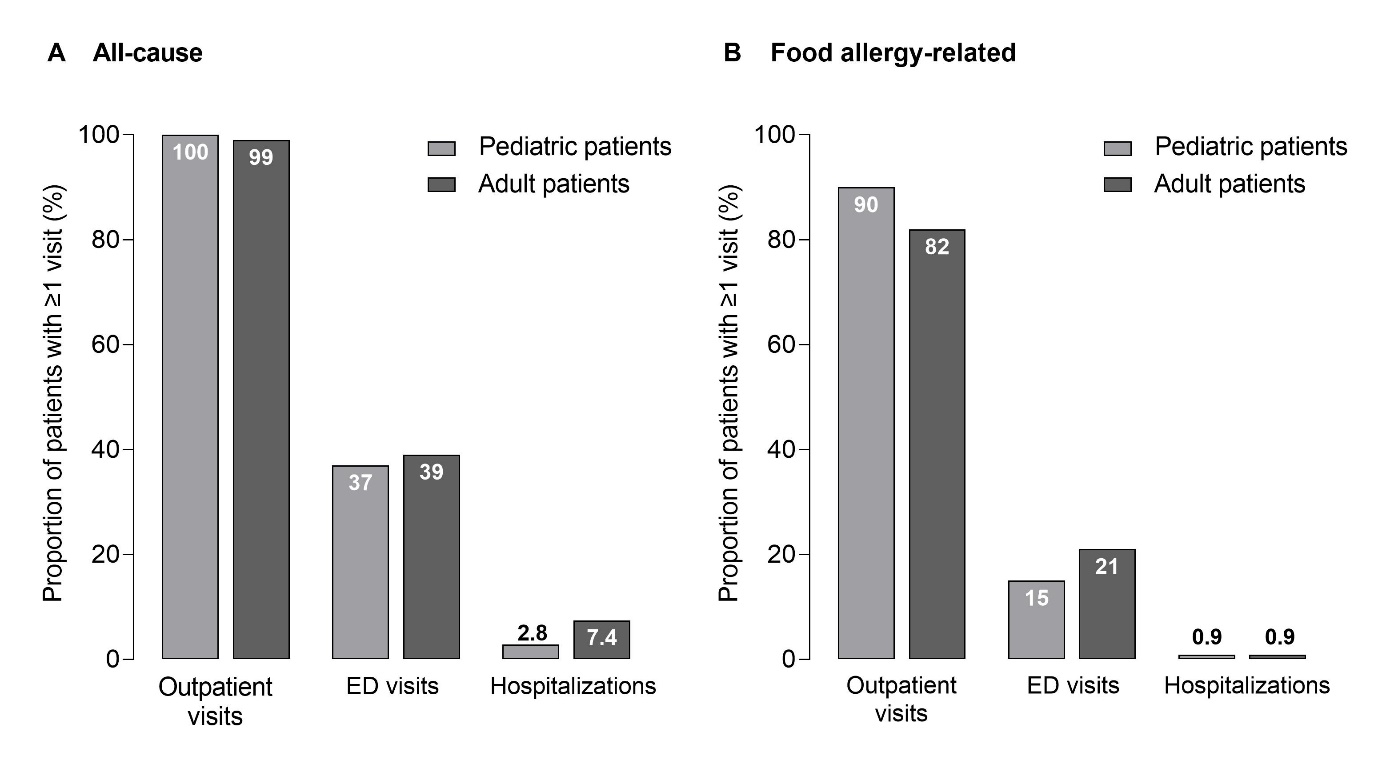
aOdds of having the event compared to a reference group: age 0-17 y; sex: male; region: south; CCI score: 0; comorbid condition: absence; allergy type: single; payer: Commercial/Medicare.

Supplementary Figures

**Supplementary Figure 1.** Health care resource use among pediatric and adult patients with food allergies.

Proportion of patients with one or more (**A**) all-cause visit and (**B**) food allergy-related visit.

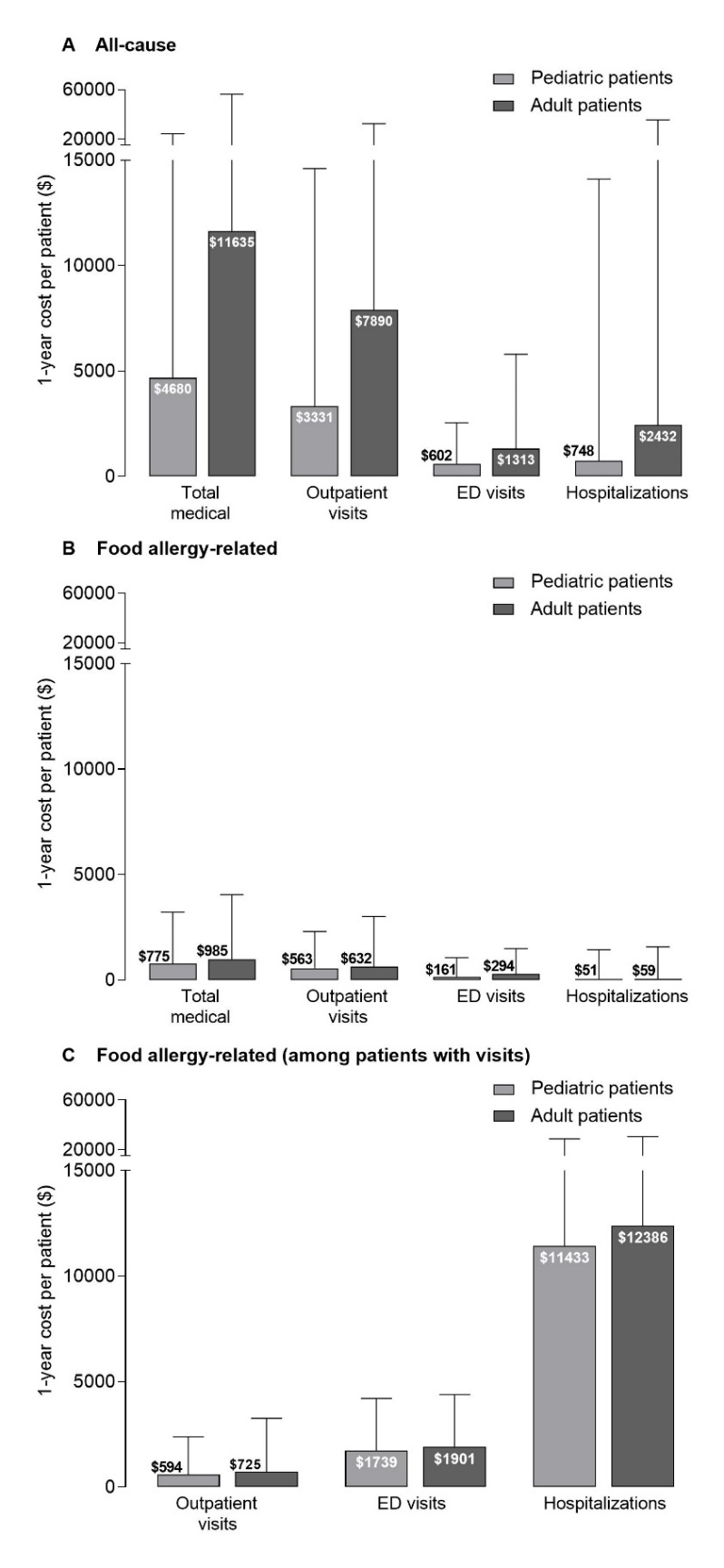
**Abbreviation:** ED, emergency department.



**Supplementary Figure 2.** Estimated mean (SD) 1-year direct medical cost per pediatric and adult patient with food allergies (2022 USD).

(**A**) All-cause cost, (**B**) food allergy-related cost, and (**C**) food allergy-related cost among patients with visits (outpatient visits, ED visits, and hospitalizations).

**Abbreviations:** ED, emergency department; USD, United States dollars.



**Supplementary Figure 3.** Estimated mean (SD) 1-year out-of-pocket cost per pediatric and adult patient with food allergies (2022 USD).

(**A**) All-cause cost, (**B**) food allergy-related cost, and (**C**) food allergy-related cost among patients with visits (outpatient visits, ED visits, and hospitalizations).   
**Abbreviations:** ED, emergency department; USD, United States dollars.

