Anaphylaxis in America: The prevalence and characteristics of anaphylaxis in the United States

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Background: Although anaphylaxis is recognized as an important life-threatening condition, data are limited regarding its prevalence and characteristics in the general population.
Objective: We sought to estimate the lifetime prevalence and overall characteristics of anaphylaxis.
Methods: Two nationwide, cross-sectional random-digit-dial surveys were conducted. The public survey included unselected adults, whereas the patient survey captured information from household members reporting a prior reaction to medications, foods, insect stings, or latex and idiopathic reactions in the previous 10 years. In both surveys standardized questionnaires queried anaphylaxis symptoms, treatments, knowledge, and behaviors.
Results: The public survey included 1,000 adults, of whom 7.7% (95% CI, 5.7% to 9.7%) reported a prior anaphylactic reaction. Using increasingly stringent criteria, we estimate that 5.1% (95% CI, 3.4% to 6.8%) and 1.6% (95% CI, 0.8% to 2.4%) had probable and very likely anaphylaxis, respectively. The patient survey included 1,059 respondents, of whom 344 reported a history of anaphylaxis. The most common triggers reported were medications (34%), foods (31%), and insect stings (20%). Forty-two percent sought treatment within 15 minutes of onset, 34% went to the hospital, 27% self-treated with antihistamines, 10% called 911, 11% self-administered epinephrine, and 6.4% received no treatment. Although most respondents with anaphylaxis reported 2 or more prior episodes (19% reporting ≥5 episodes), 52% had never received a self-injectable epinephrine prescription, and 60% did not currently have epinephrine available.
Conclusions: The prevalence of anaphylaxis in the general population is at least 1.6% and probably higher. Patients do not appear adequately equipped to deal with future episodes, indicating the need for public health initiatives to improve anaphylaxis recognition and treatment. (J Allergy Clin Immunol 2014;133:461-7.)

Key words: *Anaphylaxis, prevalence, epinephrine*

Anaphylaxis is an acute, life-threatening systemic allergic reaction associated with different mechanisms, triggers, clinical presentations, and severity.[1-4] Estimates of anaphylaxis prevalence vary widely, and many studies suggest that the prevalence is increasing, particularly in developed countries.[5-21] The different estimates might be due to differences in the populations studied,

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Abbreviation used
RDD: Random-digit-dial

as well as the many different study designs used, including retrospective reviews of medical records of allergy clinic visits, emergency department visits, hospital admissions, critical care unit admissions, and deaths in addition to reviews of medication-dispensing databases to ascertain dispensing rates for epinephrine autoinjectors. Studies that have focused on anaphylaxis related to specific triggers, such as foods, insect stings, and medications, have also yielded highly variable results. For example, in studies of food-induced anaphylaxis, rates ranging from as low as 1 per 100,000 to as high as 70 per 100,000 have been reported by using data from hospitalizations, emergency department visits, and medical records reviews, whereas the proportion of anaphylaxis cases determined to be due to foods also varied between 13% and 65%.[11-17]

In this study we sought to assess the lifetime prevalence of anaphylaxis in the United States from the general adult population, as well as to gather data on the characteristics of anaphylactic reactions from the general adult population and a more focused population that included patients of all ages.

METHODS

Two independent, nationwide, cross-sectional random-digit-dial (RDD) landline telephone surveys were conducted between July and November 2011 by using screening questions and standardized questionnaires, including demographic data and detailed information regarding anaphylaxis symptoms, treatments, knowledge, awareness, perceptions, behaviors, and quality of life (see Supplemental documents 1 and 2 in this article's Online Repository at www.jacionline.org). The study and survey instruments were approved by the Institutional Review Board of Abt SRBI (New York, NY).

The first survey, which was referred to as the public survey, was primarily intended to capture the lifetime prevalence of anaphylaxis. Eight thousand five hundred fifteen telephone contacts were made from a total sample of 11,153 RDD numbers found to be associated with a household (Table I). A total of 1,200 eligible respondents age 18 years and older were identified, among whom 1,000 interviews were completed (83% of screened eligible respondents). The survey included more than 75 questions, and the average interview duration was 14 minutes, with a range of 7 to 34 minutes. For analysis, these data were weighted by age and sex to be representative of the adult population of the United States.

The second survey, which was referred to as the patient survey, focused specifically on subjects who reported experiencing some type of generalized allergic reaction to a food, insect sting, medication, and/or latex and/or an exercise-induced or idiopathic reaction within the past 10 years. Household screening was conducted to identify all persons with an eligible history of an allergic reaction, and if more than 1 person was eligible, the respondent with a history of anaphylaxis or any reaction requiring immediate medical attention was chosen; otherwise, he or she was chosen at random. If the person with a history of an allergic reaction was less than 18 years old, the parent or most knowledgeable adult completed the proxy interview. Screening interviews were completed in 7,512 households from a total sample of 29,595 household contact numbers; 1,651 respondents were identified as eligible, among whom 1,059 interviews were completed (97% of screened eligible respondents, Table I). The median respondent age was 52 years of age, 93% were high school graduates, and 44% had a 4-year college degree or greater. The average interview length for this more extensive interview, which included more than 100 questions, was 33 minutes, with a range of 14 to 107 minutes.

To define allergic reactions that might represent anaphylaxis, symptom reports from the questionnaires were categorized into 5 organ systems: (1) respiratory, defined as positive responses to questions about increased breathing rate, cough, wheeze, chest tightness, throat itching, and/or hoarse voice; (2) skin and subcutaneous tissue, including itching, rash, hives, eye swelling, lip swelling, or tongue swelling; (3) gastrointestinal, including cramps, abdominal pain, vomiting, and/or diarrhea; (4) neurologic, including feelings of uneasiness and/or sudden behavioral change (in young children); and (5) cardiovascular, including dizziness, loss of consciousness, low blood pressure, and/or loss of bladder or bowel control. Reported reactions were then categorized as those involving 1, 2, 3, or more than 3 systems, and for the purposes of analysis, "confirmed" anaphylaxis in the patient survey was defined as those reactions that involved 2 or more systems with respiratory and/or cardiovascular symptoms or those leading to loss of consciousness, even if only that single system was involved.[1]

Data were processed by using SPSS software (SPSS, Chicago, Ill), and descriptive statistics were generated. The weights for the public survey were calculated by using 2010 Census numbers with adjustments of the sample by sex and age by using poststratification. CIs were calculated with the SAS system (SAS Institute, Cary, NC) and the Surveyfreq procedure because of the use of weighted percentages in the public data file.

RESULTS

Public survey

Overall characteristics of the 1,000 respondents are presented in Tables I and II. The median respondent age was 45 years, 93% were high school graduates, and 38% had a 4-year college degree or greater. Of note, 8.6% of respondents who had visited the emergency department in the past 12 months (1.9% of the total surveyed population) did so for allergy-related reasons (which could include environmental allergens), and 5.6% of those hospitalized in the past 12 months (0.7% of the total population) were hospitalized for allergy-related reasons. A history of asthma was reported by 17% of respondents. There were reports of a history of allergies to medications by 33%, to foods by 15%, to insect stings by 19%, and to latex by 6.2%. Nearly 3 in 5 American adults (59%) reported that they had heard the term anaphylaxis, with 41% reporting that they were somewhat or very familiar with the term.

Before asking specific questions about anaphylaxis, a definition and a general question were presented to the respondents as follows: "Anaphylaxis is a severe, sudden allergic reaction that typically involves two or more organs, such as the skin, airways, lungs, stomach, heart or blood pressure. Have you ever had an anaphylactic or a severe, sudden, multi-system allergic reaction within minutes to a few hours after being exposed to something?" Of the 1,000 respondents, the answer was yes in 7.7% (weighted percentile, actual n = 87; 95% CI, 5.7% to 9.7%), no in 91%, and do not know in 0.9%. For the 87 answering yes, the most recent reaction occurred within the past year in 17%, 1 to 2 years ago in 10%, and 3 or more years ago in 72%; 1.5% did not know or refused to answer. The symptoms reported in their most recent reaction are summarized in Fig 1, *A*, whereas Fig 2, *A*, categorizes these symptoms into the 5 predefined organ systems. Respiratory symptoms were most common (73%), followed by skin (61%), cardiovascular (24%), neurologic (15%), and gastrointestinal (7%) symptoms. Although 30% of reactions involved only a single organ system, most respondents reported multisystem reactions, including 2 or more systems in 67% and 3 or more systems in 16%.

Several definitions with increasingly stringent criteria were used to define anaphylaxis prevalence (Fig 3). Although any history of anaphylaxis was reported in 7.7%, probable anaphylaxis, which was defined as 2 or more systems with respiratory and/or cardiovascular symptoms, was reported in 5.1% (95% CI, 3.4%