

## Original Article

# Food Allergy Trends and Epinephrine Autoinjector Presence in Summer Camps

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**What is already known on this topic?** Epidemiologic data from summer camps are largely limited to injuries. An assessment of food allergies, asthma, and epinephrine autoinjector availability, to estimate risk, has not been performed in the summer camp environment.

**What does this article add to our knowledge?** It offers large population data on the incidence of food allergies and asthma in summer camp attendees across the United States and Canada. It also estimates the availability of prescribed epinephrine autoinjectors for food-allergic campers.

**How does this study impact current management guidelines?** This study establishes estimates of disease burden in camp settings and potential gaps in the availability of epinephrine for emergency use. These data could be used as a reference to strengthen camp policies and educational materials.

**BACKGROUND:** Pediatric campers with food allergies are at greater risk for exposure and anaphylaxis. A diagnosis of asthma increases risk for anaphylaxis. Epidemiological investigations of food-allergic children at high risk for allergic reactions requiring intervention in camp settings are lacking.

**OBJECTIVE:** The objectives of this study were to estimate the prevalence of food allergies among otherwise healthy campers in summer camps throughout the United States and Canada, and to assess asthma comorbidity and determine rates of epinephrine autoinjector prescriptions present in this population.

**METHODS:** We partnered with [CampDoc.com](http://CampDoc.com), a web-based camp electronic health record system. Deidentified data were abstracted from 170 camps representing 122,424 campers. Only food allergies with a parental report of symptoms requiring intervention or with a camp prescription for an epinephrine autoinjector were included, whereas gluten, lactose intolerance, and food dyes were excluded. Asthma status and epinephrine presence on the camp medication list were assessed.

**RESULTS:** Overall, 2.5% of campers (n = 3055) had documented food allergies. Of these campers, 22% had multiple food allergies. Median age was 11 years; 52% were female. Nuts (81%), seafood (17.4%), egg (8.5%), fruit (8.1%), and seeds (7.2%) were the top 5 food allergies reported. Of food-allergic campers, 44.3% had concurrent asthma and 34.7% of those campers were taking multiple asthma medications. Less than half (39.7%) of food-allergic children brought an epinephrine autoinjector to the camp.

**CONCLUSIONS:** Life-saving epinephrine is not necessarily available for food-allergic children in camp settings. A substantial proportion of food-allergic campers are at higher risk for anaphylaxis based on concurrent asthma status. © 2016 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2016;■:■-■)

**Key words:** Pediatric; Summer camp; Allergy; Anaphylaxis; Asthma; Epinephrine autoinjector; Urgent care; Emergency care

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Childhood summer camp is a formative experience for the 11 million children who are estimated by the American Camp Association to attend summer camps yearly.<sup>1,2</sup> Summer camps provide children and adolescents an environment to learn independence away from home that will be necessary as they transition to high school and college. Summer camps do have a different supervisory environment compared with both home and school environments that may lead to an element of increased risk for illness or injury. Food allergies remain a life-threatening illness for children and adolescents in the form of anaphylaxis.<sup>3-15</sup> Food allergy rates in pediatric patients have increased significantly over the past 1 to 2 decades,<sup>16-18</sup> with current estimates of prevalence of food allergy ranging between 4% and 8% of children and adolescents.<sup>16,18-20</sup> Highly publicized pediatric cases of anaphylaxis-related death at summer camps have been reported in the past several years.<sup>21-23</sup> A previous study found that on college campuses, which share similar

*Abbreviations used**EHR- Electronic health record**ICS- Inhaled corticosteroid**LABA- Long-acting  $\beta$ -agonist**NHANES- National Health and Nutrition Examination Survey**SABA- Short-acting  $\beta$ -agonist*

systemic and supervisory issues with summer camps, many young college students with food allergies were ill-prepared to deal with their food allergies and were at increased risk for anaphylaxis while on college campuses.<sup>24</sup>

Summer camps also give increased opportunities for food sharing and potential decreased supervision of meal times in comparison with home environments. Menus may vary substantially from home or school for each child and the risk of cross-contamination may be higher. In children studied in school environments who were administered epinephrine for symptoms of anaphylaxis, 24% had no prior history of food allergy.<sup>11</sup> Children with uncontrolled asthma and a diagnosis of food allergy are also at risk for more severe anaphylactic reactions.<sup>4,6,7,13,25,26</sup> In one study from 2010, a 5.2 times increased hazard ratio was reported for anaphylaxis in those patients with a diagnosis of asthma.<sup>7</sup>

Summer camps, unlike schools, are often located in remote locations without close proximity to emergency medical services. Children who experience an allergic reaction requiring intervention while attending camps in remote areas are at higher risk for delayed treatment or definitive care due to the lack of a nearby pediatric capable medical center. Also, unlike school settings, summer camps are not necessarily included in current legislation to have stock unassigned prescriptions of injectable epinephrine available for treatment of anaphylaxis.<sup>27,28</sup> As of September 2016, 38 states have legislation allowing schools to stock unassigned epinephrine autoinjectors, whereas 11 states have laws requiring schools to stock epinephrine devices.<sup>29</sup> One state has pending legislation.<sup>29</sup> This advance is likely in response to the financial incentive provided by the School Access to Emergency Epinephrine Act that was signed into law by President Obama in November 2013.<sup>30</sup> No large-scale studies have assessed the true presence of epinephrine in schools since the passage of this legislation. Prior data have shown widely variable rates of epinephrine availability.<sup>31-35</sup>

School-based laws are not globally applicable to summer camps as many summer camps are either private or nonprofit in nature and receive little funding to cover health- and safety-related expenditures. However, given recent acknowledgment that camps and other recreational entities should be treated similarly to schools, there are now 23 states that have passed legislation to allow camps to have unassigned epinephrine autoinjectors.<sup>27,28</sup> A recent study of camps' compliance with health and safety recommendations reported epinephrine availability in 64% of its surveyed population; however, it was unclear whether these autoinjectors were prescribed or unassigned in nature.<sup>36</sup>

The epidemiology of food allergies among children attending summer camps, along with concurrent asthma status, is entirely unclear. On review of the current literature, summer camps are an entity that is unstudied on a large scale. The most significant research barrier appears to be the lack of available electronic data from a large number of summer camps. Our study, which is the

first to attempt to study food allergies and anaphylaxis on a large scale among camps nationally, sought to overcome this barrier by partnering with a camp-specific electronic health record (EHR) system to directly extract deidentified data from a large pediatric population of campers without having to rely on data indirectly obtained from camp administration on the health trends of their campers.

Our primary objective was to estimate the prevalence of food allergies among otherwise healthy campers in a large number of summer camps throughout the United States and Canada. The secondary objectives were to assess the extent of asthma comorbidity to identify campers at higher risk for life-threatening allergic reactions, and to determine rates of epinephrine autoinjector prescriptions present in this population.

## METHODS

We partnered with [CampDoc.com](http://CampDoc.com), the largest web-based camp-specific EHR system that manages health forms, medications, allergies, illness, and injury tracking for more than 500 summer camps (as of 2016) in the United States and Canada. At the time of this study during the 2014 summer camp season, the [CampDoc.com](http://CampDoc.com) census was only 184 camps. Of those 184 camps, only 170 camps were collecting allergy data. These 170 camps were used in this study, representing 122,424 individual campers. Camps self-identified as resident (overnight) camps, day camps, or both. All available deidentified allergy and asthma data from 2014 camp attendees were retrospectively abstracted in October 2014 onto Microsoft Excel (2011) after parental input into the EHR system. Notably, when parents filled out this EHR form, free text boxes for both medications and food allergies were used exclusively. In addition to the option of complete free text entering of answers, these boxes also employed an autosuggest option, which had both a list of possible options that could be scrolled through and selected, and a filter function to limit the available list options for selection once typing was initiated.

Food allergies listed as gluten intolerance, lactose intolerance, and food dyes were excluded from our analysis. Only food allergies with either a parental report of a previous history of an allergic reaction requiring intervention or a camp prescription for an epinephrine autoinjector for food allergies were included. Camper food allergies were categorized and coded into 11 different categories based on parental data input: nuts (peanuts and tree nuts), meat, wheat, legumes, soy, dairy, seeds, fruits/vegetables, egg, seafood, and other. Despite the fact that they comprise 2 distinct categories of allergens, peanuts and tree nuts were categorized together due to many parents reporting the food allergen as simply "nuts." Similarly, "seafood" comprised both fish and shellfish and "seeds" encompassed both sesame and sunflower due to parental report. Campers' asthma status was also obtained using either parent report on the medical form and/or by camp documentation of asthma medications. Asthma medications were defined as inhaled corticosteroid (ICS), inhaled short-acting  $\beta$ -agonist (SABA), combination ICS/long-acting  $\beta$ -agonist (ICS/LABA), and leukotriene inhibitors. SAS 9.3 (SAS Institute Inc., Cary, NC) was used for statistical analysis. Data were summarized using descriptive statistics.

## RESULTS

Overall, 2.5% of campers ( $n = 3055$ ) from 167 US and 3 Canadian summer camps had documented food allergies. Of the US camps, 21.6% ( $n = 36$ ) were located in the Midwest, 41.3%

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