CONCLUSIONS. The majority of US youth perceive e-cigarettes as less harmful and addictive than cigarettes. Perceived safety parallels the rise in the use of e-cigarettes.

REVIEWER COMMENTS. There are a number of original research articles in *Pediatrics* this year dealing with the meteoric rise in the use of e-cigarettes by children. The authors of this study are limited in their conclusions by the study's cross-sectional nature, reliance on self-reported data, and the lack of individual-level investigation of alterations in the perception and use of e-cigarettes over time. Nonetheless, the conclusion still stands that children in grades 6 to 12 perceive e-cigarettes as safer than their counterpart tobacco products, which is likely contributing to the rapid rise in e-cigarette use. Additional contributors include the low cost of these products and the ability to use them anywhere, as is demonstrated in another study (Bold KW et al. *Pediatrics*. 2016;138[3]:e20160895); these factors may also influence use in adolescents who would not have used tobacco products otherwise (Barrington-Trimis JL et al. *Pediatrics*. 2016;138[2]:e20153983).

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ANAPHYLAXIS

Increasing Emergency Department Visits for Anaphylaxis, 2005-2014

Motosue MS, Bellolio G, Van Houten HK, Shah ND, Campbell RL. *J Allergy Clin Immunol Pract*. 2017;5(1): 171–175

PURPOSE OF THE STUDY. To identify trends regarding anaphylaxis-related emergency department (ED) visits from 2005 to 2014.

STUDY POPULATION. Population data were drawn from OptumLabs Data Warehouse, a national administrative claims database of >100 000 000 pediatric and adult patients in the United States (including those with Medicare Advantage and private insurance) and with a higher representation from the Midwest and the South.

METHODS. ED visits between 2005 and 2014 were included if patients had medical insurance for at least 30 days before the visit. *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis codes for anaphylactic shock, as well as for symptom combinations consistent with anaphylaxis, were used as inclusion criteria, taking care to avoid duplication. Annual rates were expressed as the number of ED visits per 100 000 enrollees. Linear regressions analysis was used to assess for trends by year.

RESULTS. A total of 56 212 ED visits for anaphylaxis were identified. Most visits were for women (57.5%) between 35 and 64 years of age (42.8%) and were caused by unidentified triggers (56.9%). Overall, 27.1% of visits were associated with food, 12% with medications, and 4% with insect venom reactions. Over the 10-year period, the rate of anaphylaxis-related ED visits increased from 14.2 to 28.6 per 100 000 enrollees (101%). This rate increase was seen across all age groups, with the highest increase in children aged 5 to 17 years (196%). Food-related anaphylaxis increased by 124% overall and by 285% in children aged 5 to 17 years. Medication-related anaphylaxis increased by 212%, with the highest rate of increase in children aged 0 to 4 (479%).

CONCLUSIONS. From 2005 to 2014, there was a 101% increase in ED visits for anaphylaxis, with the greatest increase in children <17 and in adults >65 years old. The highest rate increase for both food-related anaphylaxis and anaphylaxis overall was in children aged 5 to 17; for medication-related anaphylaxis, it was in children aged 0 to 4.

REVIEWER COMMENTS. This is an eye-opening study whose authors demonstrate the striking and disproportionate increase in the risk (196%) of anaphylaxis in the pediatric population. Although the authors of this retrospective study only used *International Classification of Diseases, Ninth Revision, Clinical Modification* codes to identify anaphylaxis cases, they highlight the need for continued advances in recognition and treatment of pediatric anaphylaxis. Of concern is the dramatically increasing rates of anaphylaxis triggered by foods (5–17 years) and medications (0–4 years), a trend that mirrors the increasing prevalence of food allergy in children and the challenges of diagnosing anaphylaxis in the preschool-aged group.

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The Risk of Recurrent Anaphylaxis

O'Keefe A, Clarke A, St. Pierre Y, et al. *J Pediatr*. 2017; 180:217–221

PURPOSE OF THE STUDY. To prospectively evaluate the risk and management of recurrent anaphylaxis in children and assess factors associated with recurrences.

STUDY POPULATION. The study included 292 children who were treated for anaphylaxis at participating Canadian emergency departments.

METHODS. Patients were prospectively recruited at presentation for an index anaphylactic reaction. Anaphylaxis was defined as a reaction involving at least 2 organ systems and/or hypotension in response to a potential allergen and was diagnosed by the treating physician. A 12-item survey was given to the care provider in which baseline characteristics of demographics, medical history,

clinical characteristics of the reaction, and management of the index case were evaluated. Parents were then contacted via telephone at approximately yearly intervals for 2 years and given a questionnaire in which the potential for allergic reactions and their triggers, symptoms, and management were evaluated.

RESULTS. Of the 292 patients, 69% completed at least 1 annual follow-up questionnaire, providing 369 patient-years of follow-up. The characteristics of those who responded and those who did not were overall similar, with the exception that those who responded were more likely to have a history of eczema. There were 65 recurrent episodes of anaphylaxis among 47 patients in the follow-up period, with an annual recurrence rate of 17.6%. Foods were the most common trigger, leading to 85% of recurrent reactions. Of these reactions, milk and tree nuts were the most common (15% each), followed by peanuts (6%). Factors associated with increased odds of recurrence included history of asthma, use of epinephrine during the index episode, and food-triggered anaphylaxis at index reaction. Consistent with many other studies, there was an underuse of epinephrine in treating both the index and recurrent episodes of anaphylaxis.

CONCLUSIONS. The authors of this study found the recurrence rate of anaphylaxis in children to be 17.6%, and the odds of recurrence increased with a history of asthma and food-induced anaphylaxis. Furthermore, there was a significant underuse of epinephrine in managing anaphylaxis.

REVIEWER COMMENTS. This study is the largest prospective study thus far in which rates of recurrent anaphylaxis and associated factors in children were evaluated. The recurrence rate observed underscores the importance of long-term, effective patient education in identifying signs, symptoms, and management of anaphylaxis. Furthermore, the authors of this study highlight the well-established underuse of epinephrine in managing anaphylaxis and continue the call for improving epinephrine education.

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Reducing Hospitalization Rates for Children With Anaphylaxis

Farbman KS, Michelson KA, Neuman MI, et al. *Pediatrics*. 2017;139(6):e20164114

PURPOSE OF THE STUDY. To assess whether a quality improvement (QI) intervention can safely reduce the hospitalization rate for children presenting with anaphylaxis.

STUDY POPULATION. Children diagnosed with anaphylaxis from 2008 to 2014 at an urban, tertiary care pediatric emergency department (ED).

METHODS. A multidisciplinary team consisting of pediatric emergency medicine physicians, a pediatric ED nurse, a pharmacist, and a pediatric allergist developed an evidence-based guideline (EBG) reflecting the recommendations from the National Institute of Allergy and Infectious Diseases anaphylaxis guidelines. This EBG recommended that children meeting criteria for anaphylaxis receive prompt intramuscular epinephrine and also receive diphenhydramine and a glucocorticoid. Those with persistent symptoms were hospitalized; those with resolution of symptoms were monitored for 4 hours. The EBG recommended hospitalization for children requiring >1 dose of epinephrine as well as those with any wheezing or hypotension. The hospitalization rates before and after implementation of the EBG were compared. To control for secular trends, hospitalization rates for anaphylaxis at 34 US children's hospitals were analyzed over the study period.

RESULTS. A total of 1169 children diagnosed with anaphylaxis were included in this study, 438 pre-QI intervention and 731 post-QI intervention. By using the EBG intervention, the proportion of children hospitalized decreased from 54% to 36%, with no increase in the rate of ED revisit within 72 hours of discharge. The hospitalization rate across 34 other US pediatric hospitals was static at 52% over the study period.

CONCLUSIONS. Using an EBG for anaphylaxis safely reduced unnecessary hospitalization for children with anaphylaxis. This process was enhanced with periodic reminders about the EBG to providers as well as structured feedback if the EBG was not followed.

REVIEWER COMMENTS. The authors of this study show the value of employing a consensus recommendation (in this case, from the National Institute of Allergy and Infectious Diseases on recognition of anaphylaxis and appropriate pharmacologic intervention) as part of an EBG. Too often early signs of anaphylaxis are not recognized or are inadequately treated, ultimately leading to a more protracted course, more intense treatment, and/or the need for hospitalization for longer-term monitoring. By using clinical criteria that objectively help the clinician discern if a child is likely having anaphylaxis, early intervention with epinephrine, diphenhydramine, and glucocorticoids increases the likelihood of prompt resolution as well as prevention of late-phase reactions.

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The Risk of Recurrent Anaphylaxis

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The Risk of Recurrent Anaphylaxis

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