

# Occurrence of Anaphylaxis by School Grade Level and Staff Training: Findings From the EPIPEN4SCHOOLS® Survey

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## ABSTRACT

**Rationale:** To conduct an exploratory study of anaphylaxis and epinephrine auto-injector (EAI) use in US schools during the 2013-2014 school year.

**Methods:** This exploratory, cross-sectional, web-based survey of schools participating in the EPIPEN4SCHOOLS® program (Mylan Specialty L.P., Canonsburg, PA) captured characteristics of anaphylactic events and EAI use in children and adults enrolled or working in schools.

**Results:** Thirty-six percent of responding schools (2146/6019) were grade schools (pre-K to grade 5), 12% (703/6019) were middle schools (grades 6-8), and 18% (1064/6019) were high schools (grades 9-12); the remaining 34% (2088/6019) were other grade combinations. Nearly 50% of students (355/724) who experienced anaphylaxis were in high school, 32% (234/724) were in grade school, and 19% (135/724) were in middle school. Although frequency of food-related triggers was consistent across grade levels, 22% of high school students (79/234) experienced an event with an unknown trigger, compared with 14% (33/234) and 15% (20/133) of grade school and middle school students, respectively. Approximately 36% of schools (2022/5613) trained only the school nurse and select staff to recognize anaphylaxis, whereas 29% (1621/5613) and 31% (1730/5613) trained most staff or all staff, respectively. A majority of schools, 54% (3024/5578), permitted only the school nurse and select staff to administer epinephrine; 16% (879/5578) and 22% (1218/5578) permitted most staff or all staff, respectively, to administer epinephrine.

**Conclusions:** Adolescents may be at a higher-risk developmental stage for anaphylaxis, and some students encounter staff members who are untrained in anaphylaxis recognition or treatment. These findings suggest a need for continued anaphylaxis training for protection of all students, staff, and visitors.

## INTRODUCTION

- Anaphylaxis is a serious, acute, and potentially life-threatening allergic reaction.<sup>1</sup>
- Risk of anaphylaxis can be affected by age, as there are higher incidences of anaphylaxis, hospital admissions for anaphylaxis, and epinephrine auto-injectors (EAI) dispensed for females beginning at age 15.<sup>2,4</sup>
  - Incidence rates of anaphylaxis and number of EAIs dispensed are also elevated among young males (from infancy through early adolescence).<sup>2,4</sup>
- Appropriate training of school personnel to recognize severe allergic events is critical, as many anaphylactic reactions (especially those triggered by food allergy) occur outside the home.<sup>5</sup>
  - Many states require schools to stock EAIs and to properly train staff to use them in emergency situations.<sup>5</sup>
- In one study, school staff were unaware of life-threatening allergies in nearly 25% of observed cases of anaphylaxis, resulting in a failure to have individualized action plans and physician orders for epinephrine for the affected students.<sup>6</sup>
- A survey of school nurses revealed that they scored lower on objective knowledge tests concerning anaphylaxis compared with tests concerning diabetes and asthma, 2 other disease states commonly associated with emergencies in the school setting.<sup>7</sup>
- Together, these data suggest that school staff may vary considerably in their preparedness and training to recognize and treat anaphylaxis with EAIs.

## OBJECTIVE

- This analysis describes the preparedness of staff to recognize the signs and symptoms of anaphylaxis in US schools enrolled in the EPIPEN4SCHOOLS® program (Mylan Specialty L.P.).

## METHODS

- This exploratory cross-sectional survey of schools participating in the EPIPEN4SCHOOLS program assessed anaphylactic events and treatment(s) administered at each responding school during the 2013-2014 school year.

## Data source

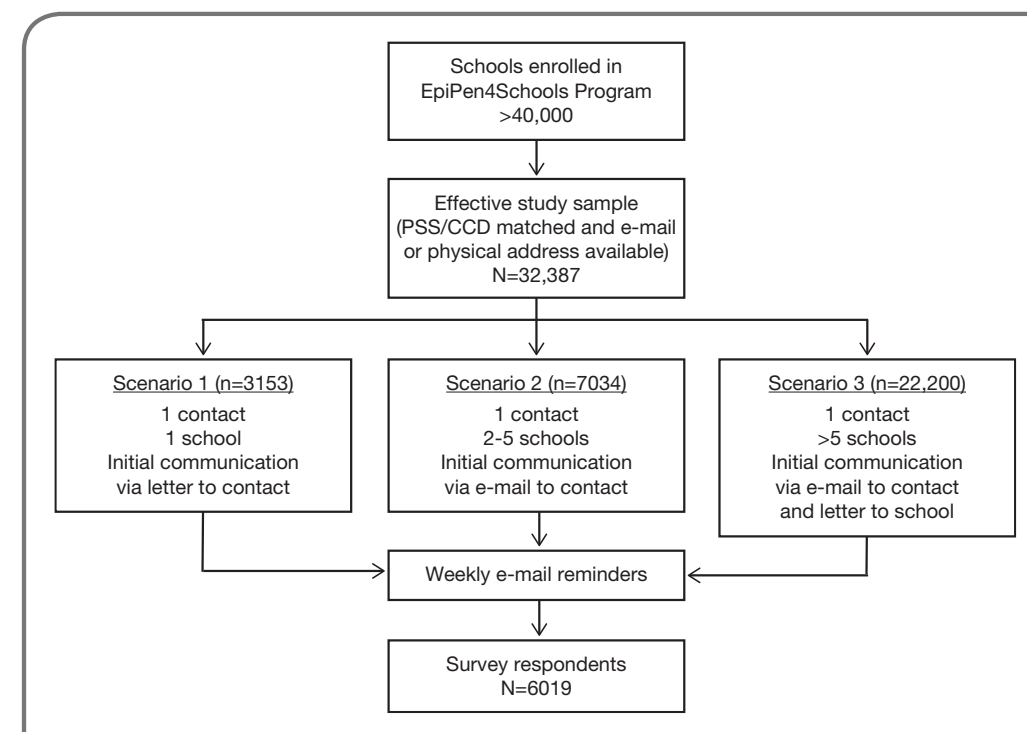
- Survey of schools participating in the EPIPEN4SCHOOLS program, which was launched in 2012 to provide EPIPEN® Auto-Injectors\* (Mylan Specialty L.P.) to qualifying public and private kindergarten, elementary, middle, and high schools in the United States
  - Composed of 15 web-based questions, 8 of which were repeated for each anaphylactic event reported per school
  - Answered by an individual at each school with knowledge of occurrences of anaphylactic reactions and treatment(s) administered during the 2013-2014 school year (eg, school nurse)
  - Study duration: May 21, 2014, to July 9, 2014

\*The EPIPEN4SCHOOLS program provided 2 EPIPEN Auto-Injector 2-packs, 2 EPIPEN Jr® Auto-Injector 2-packs, or 1 of each 2-pack free of charge.

## Sample contact and notification

- US schools registered with the EPIPEN4SCHOOLS program (>40,000) were matched to Common Core of Data (CCD; US Department of Education, Washington, DC) or to the Private School Universe Survey (PSS; US Department of Education, Washington, DC) databases to obtain demographic and school contact information to request participation in the survey (Figure 1).
  - A total of 32,387 schools had available contact information (Figure 1).
  - 3 possible scenarios occurred for contacting and notifying the respondents, based on the number of schools per contact (Figure 1).
  - A total of 6019 surveys were completed; most questions included a count of missing data, as respondents were not required to answer every question.

Figure 1. Preparation of samples and notification procedures.



CCD, Common Core of Data; PSS, Private School Universe Survey.

## Data analysis

- Characteristics of participating schools (eg, census region, grade levels of responding schools, type and source of EAIs stocked) and of anaphylactic events (eg, individual who experienced the anaphylactic event, previously known allergies, the trigger that initiated the anaphylactic event, treatment administered) were reported using descriptive statistics.
  - Relative frequency of each characteristic was calculated by dividing the total number for each response category of the relevant variable across all schools by the combined number of responses across all schools.
  - Missing responses were excluded.

## RESULTS

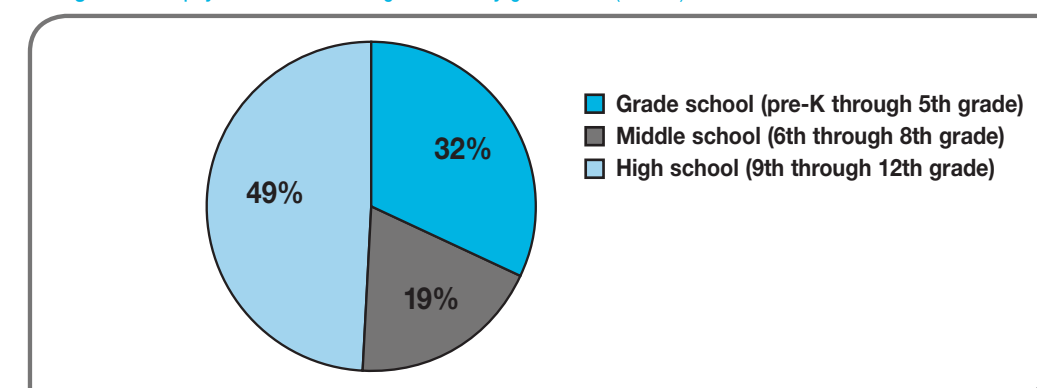
### Respondents

- Of the 6001 responding schools with available grade level information (matched from CCD and PSS databases), 36% (n=2146) were grade schools (pre-K through 5th grade), 24% (n=1443) were grade/middle schools (pre-K through 8th grade), 12% (n=703) were middle schools (6th through 8th grade), 18% (n=1064) were high schools (9th through 12th grade), and the remaining 11% (n=645) had other grade level combinations.

### Anaphylactic events experienced by students

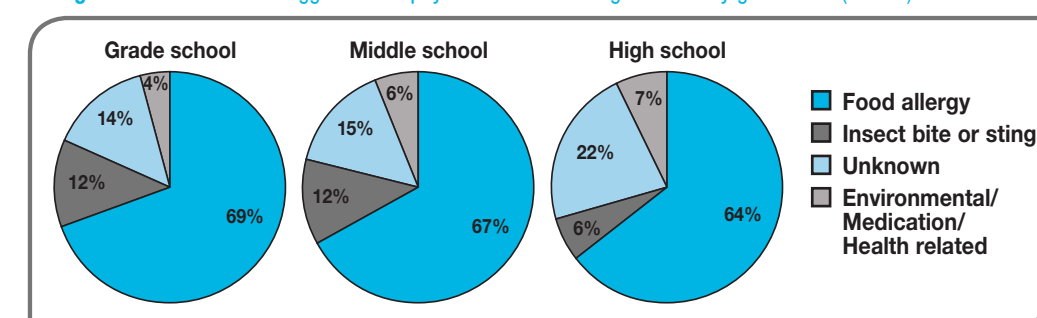
- Of the 724 students who experienced an anaphylactic event, 49% (n=355) were in high school, 32% (n=234) were in grade school, and 19% (n=135) were in middle school (Figure 2).

Figure 2. Anaphylactic events among students by grade level (n=724).



- Anaphylactic events among students were most often triggered by food (66%, 478/721), followed by unknown triggers (18%, 132/721).
- A similar profile of triggers was reported across grade levels, with food allergies initiating >60% of the anaphylactic events (Figure 3).
  - 22% of high school students who experienced anaphylaxis (79/354) had an event with an unknown trigger compared with 14% (33/234) and 15% (20/133) of grade school and middle school students, respectively.
  - Percentages of anaphylactic events triggered by food and insect bites or stings were somewhat lower among students in high school compared with those in grade/middle school.

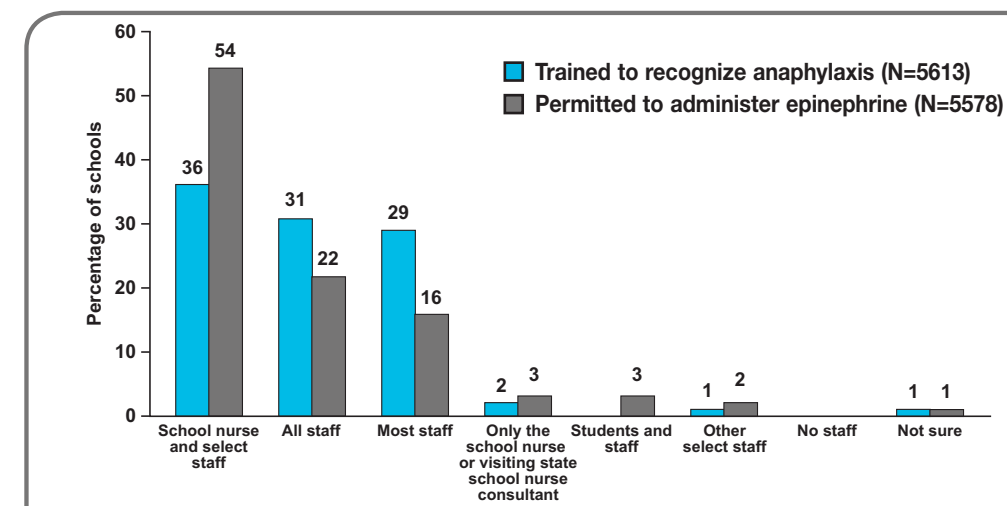
Figure 3. Distribution of triggers of anaphylactic events among students by grade level (n=721).



### Training and administration of medication by school staff

- A total of 5613 schools provided information regarding staff members who were trained to recognize anaphylaxis.
  - Among these schools, 36% (2022/5613) trained only the school nurse and select staff to recognize anaphylaxis, whereas 29% (1621/5613) and 31% (1730/5613) trained most staff or all staff, respectively (Figure 4).
  - Few schools (1%, 59/5613) trained select staff other than the school nurse (eg, coaches, athletic trainers, first responders, and office staff) (Figure 4).

Figure 4. School staff trained to recognize the signs and symptoms of anaphylaxis and staff permitted to administer epinephrine.



- Among 5578 schools providing information regarding administration of epinephrine by staff members, a majority (54%, n=3024) permitted only the school nurse and select staff to administer epinephrine; 16% (n=879) and 22% (n=1218) permitted most staff or all staff, respectively, to administer epinephrine (Figure 4).

## STRENGTHS AND LIMITATIONS

- This is the first comprehensive analysis of anaphylactic events and use of EAIs in US schools, providing details of >900 events.
- This exploratory survey was subject to limitations such as response bias and potential measurement errors, including systematic and random variance resulting from the respondents (eg, failing to carefully read a question or misreporting an event).
- Responses were limited by the level of detailed information retained at the schools related to anaphylaxis and were subject to respondent recollection of the events.
- Survey response rate was 19%, likely due to factors such as the timing of the survey at the end of the school year, and the lack of direct and verifiable contact information for some respondents.

## SUMMARY AND CONCLUSIONS

- Nearly half of the anaphylactic events were experienced by students enrolled in high school.
- Food allergies triggered >60% of the anaphylactic events among students across grade levels, though triggers for 18% of events were unknown.
- Some schools trained most or all staff to recognize anaphylaxis, though <50% of responding schools allowed personnel other than the school nurse or select staff to administer epinephrine.
- Adolescence may be a particularly high-risk period for anaphylaxis, and some students could encounter staff members who are untrained in recognition or treatment of anaphylaxis.

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**References:** 1. Simons FE, Sheikh A. Anaphylaxis: the acute episode and beyond. *BMJ*. 2013;346:f602. 2. Decker WW, Campbell RL, Manivannan V, et al. The etiology and incidence of anaphylaxis in Rochester, Minnesota: a report from the Rochester Epidemiology Project. *J Allergy Clin Immunol*. 2006;118(6):1161-1165. 3. Harduar-Morano L, Simon MR, Watkins S, Blackmore C. A population-based epidemiologic study of emergency department visits for anaphylaxis in Florida. *J Allergy Clin Immunol*. 2011;128(3):594-600. 4. Simons FE, Peterson S, Black CD. Epinephrine dispensing patterns for an out-of-hospital population: a novel approach to studying the epidemiology of anaphylaxis. *J Allergy Clin Immunol*. 2002;110(4):647-651. 5. Gupta RS. Anaphylaxis in the young adult population. *Ann J Med*. 2014;127(1 suppl):S17-S24. 6. McIntyre CL, Sheetz AH, Carroll CR, Young MC. Administration of epinephrine for life-threatening allergic reactions in school settings. *Pediatrics*. 2005;116(5):1134-1140. 7. Allen K, Henselman K, Laird B, Quiñones A, Reutzel T. Potential life-threatening events in schools involving rescue inhalers, epinephrine autoinjectors, and glucagon delivery devices: reports from school nurses. *J Sch Nurs*. 2012;28(1):47-55.