

Childcare and School Management Issues in Food Allergy

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Abstract

Purpose of Review The goal of this review is to characterize food allergy management and anaphylaxis in schools and assess current policies and level of preparedness of schools to recognize and treat anaphylaxis.

Recent Findings An increasing number of school-aged children have food allergies, and studies show that a significant number of school children with no known history of allergies will experience their first anaphylactic reaction at school. Stock-unassigned epinephrine auto-injectors are recommended in schools but not mandatory in most states, and therefore, epinephrine is not always available. Non-nursing staff members are sometimes administering epinephrine due to limitations in nurse staffing.

Summary Wide variations in staff training and lack of stock epinephrine leave many schools inadequately prepared to manage anaphylactic reactions. Emphasis should be placed not only on ensuring all schools have stock epinephrine but also on training a wider range of school staff members to minimize treatment delay with epinephrine and improve clinical outcomes.

Keywords Food allergy · Anaphylaxis · Epinephrine · Allergic reaction · School nurse · School staff training

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Introduction

Anaphylaxis is a severe allergic reaction for which prompt treatment with epinephrine can be lifesaving [1]. Most anaphylactic reactions presenting to the pediatric emergency department are due to food allergies [2–4]. While there is a wide variation of reported prevalence of food allergies in the literature, studies have estimated the prevalence of food allergies to be approximately 8% in children, and this prevalence continues to increase [5, 6].

Current management focuses on food allergen avoidance and recognition and treatment of anaphylaxis when accidental ingestions occur. The most common food allergens include milk, egg, peanut, tree nut, wheat, and soy, which are ever present in schools [6, 7]. Despite efforts to strictly avoid the food and school policies to try to minimize allergen exposures, allergic reactions including anaphylaxis occurring at school are inevitable. Additionally, up to a quarter of children with a food-induced allergic reaction at school had no known history of food allergies [8].

School staff members are increasingly expected to recognize allergic reactions and promptly initiate treatment. The level of preparedness among schools is variable in terms of who can administer epinephrine, availability of individualized emergency action plans, and whether stock epinephrine is kept at school as current national guidelines are voluntary and not mandatory. School staff training on anaphylaxis can also differ significantly from only the school nurse receiving training to all school staff members being trained [9•].

In this review, we will discuss food allergy management, characteristics of allergic reactions occurring at school, treatment response and preparedness, as well as the psychosocial aspects of food allergies on school children.

Characteristics of Food-Related Allergic Reactions in Schools

With an increasing prevalence in food allergies, a significant number of reactions are occurring at school. Detailed telephone surveys of self-reported reactions in patients with known food allergies showed that 16–18% of children had an allergic reaction occurring at school or daycare [7, 10]. Fifteen to 28% of reactions were treated with epinephrine. In a more recent nationwide study during the 2013–2014 school year, an anaphylaxis rate of 16% was reported among 5683 schools [11••]. Twenty-two percent had no known allergy, and for 9%, it was unclear whether they had an allergy before the episode. Other studies have similarly reported that about a quarter of food allergy reactions at school will occur in children who have no known history of food allergies [8, 10].

The majority of the reactions in school-aged children occur in the classroom (79–83%) particularly if there was an eating area in the classroom, followed by the lunchroom (12–15%) [7, 10]. A number of reactions (19%) have also been shown to occur during school field trips, on the playground, while traveling to and from schools [8], as well as at summer camp [12].

According to a survey study of food allergic reactions in schools, milk was the most common identified trigger among preschool children, and peanut was the most common trigger among school-aged children [7]. Class craft activities can also lead to reactions with two reported episodes that occurred when peanut butter bird feeders were being made at the same table [10].

Fatal reactions to food occurring at school or childcare have been reported. In a report of fatal anaphylactic reactions to food from a national registry in 2001, four out of the 32 reported fatalities occurred at school or daycare, six occurred at college, and one occurred at camp [13]. A follow-up to this report of food-induced anaphylaxis fatalities from 2001 to 2006 identified 31 additional fatalities, about half of which occurred in children 18 years or younger. Two of these fatal reactions occurred at school and one at college [14]. A study of fatalities due to food-induced anaphylaxis specifically in the UK found that among school-aged children (4–18 years of age), 17% ($n = 8$) of fatalities occurred in an educational environment [15]. These studies showed that the largest number of fatalities occurred among adolescents and young adults with either peanuts or tree nuts being the most common trigger [14, 15].

Children less than 5 years and college-aged students with food allergies can also present their own unique challenges. Among children with peanut and tree nut allergy, the majority (64%) of allergic reactions occurred in daycare or preschool [10]. A study in Sweden similarly found that food-induced allergic reactions were more common in children ages 0 to 3 years, but these reactions tend to be less severe [16]. Additionally, younger children are less capable of clearly

verbalizing any symptoms of an allergic reaction, and the caregiver may be unaware, which can lead to delayed recognition and treatment [17]. On the other end of the spectrum are college students, who are more likely to take risks with only 40% reporting compliance with strict avoidance of food allergens [18], and they are less likely to carry an epinephrine auto-injector [19].

Minimizing Allergen Exposure in Schools

Schools implement various policies in order to minimize student exposures to allergens. These policies range from peanut or nut-free schools to no-sharing rules, allergen-free tables, or no outside food for celebrations. It remains controversial whether these precautions are necessary or effective. Peanut-free guidelines have been shown to effectively lower peanut levels in school lunches brought from home, but it is unclear whether this translates to fewer allergic reactions [20]. One study reported a lower rate of epinephrine use in schools that had peanut-free tables compared to those without. However, in the same study, peanut-free schools had a higher rate of reported epinephrine use [21].

Some food-allergic patients are very sensitive to the food allergen. Peanut-allergic patients have been shown to react to levels of peanut as low as 100 μg by ingestion during double-blinded placebo-controlled food challenges [22, 23]. Ingestion of the food is of primary concern; however, there remains fear of allergen exposure through skin contact or inhalation. In a study of 30 children with peanut allergy (recent peanut-specific IgE antibody concentration >50 kIU/L or positive peanut-specific IgE antibody and a clinical history of a significant reaction to peanut), exposure to peanut butter by skin contact and inhalation did not cause any systemic or respiratory symptoms [24]. The pea-sized amount on the skin was chosen to replicate contamination from a poorly cleaned table, and 10 minutes of inhalation exposure was used to imitate exposure while sitting next to someone eating a peanut butter sandwich. At most, ten out of the 30 children in the study experienced mild cutaneous symptoms with either erythema, pruritus, or wheal-and-flare reactions at the site of peanut butter contact on the skin. On the other hand, aerosolized food allergens such as boiled milk or cooked fish can trigger allergic reactions, and activities involving cooking or boiling food allergens should be avoided at school [25].

Even with an allergen such as peanut present in schools, there are ways to minimize exposure. A study showed that the major peanut allergen Arah1 was undetectable from school tabletops that contained peanut butter after being cleaned with a common household cleaner with the exception of dishwashing liquid, which left residual amounts of Arah1 [26]. After applying peanut butter directly to study patients' hands, handwashing with water and soap or commercial wipes

removed Arah1 completely; however, water alone or hand sanitizer was an ineffective cleaning method as both left detectable amounts of Arah1.

Despite efforts to avoid food allergens, strict avoidance remains difficult and accidental exposure is inevitable. A survey of parents of children with confirmed peanut allergy in Canada estimated an annual incidence rate of accidental exposure to peanut for children with peanut allergy as approximately 12% [27, 28]. Four percent of these inadvertent exposures occurred in daycare, while 6% occurred in school. Even in peanut-free schools, accidental exposures can occur as 71% of accidental exposures occurred in schools that were peanut free [27]. There was no significant difference in the percentage of accidental exposures that occurred in schools that prohibited peanut (4.9%) versus schools that allowed peanut (3.0%) [28].

Different precautions are needed depending on the age of the child. Young children require more oversight by caregivers as they are unable to identify potential allergens or understand no-sharing rules [29]. They are more likely to have oral exposures by either thumb sucking, eating craft materials, or mouthing toys.

In addition, hidden allergens used in art or science craft projects have been associated with allergic reactions [10]. Paste (wheat), shaving cream (milk), finger paint (egg), play dough (wheat), and macaroni art (wheat and egg) are examples of craft items that may contain potential allergens and could be accidentally ingested by young children. Measures should be taken to avoid crafts that contain food allergens.

Treatment of Allergic Reactions

While management of food allergies is primarily avoidance, the frequency of food allergic reactions at school, including fatal reactions, makes it even more vital for schools to be prepared to recognize and treat food-induced allergic reactions. In 2013, the Centers for Disease Control and Prevention (CDC) released voluntary guidelines for the management of food allergies in schools and childcare settings that emphasized the following: ensure the daily management of food allergies for individual children, prepare for and respond to food allergy emergencies, provide professional development on food allergies for staff, educate children and family members about food allergies, and create and maintain a healthy and safe educational environment [30]. According to the recommendations, students should have individualized food allergy emergency care plans (ECPs) that are prepared by the child's healthcare provider.

Another set of voluntary national guidelines entitled "Caring for Our Children" which was published by the American Academy of Pediatrics (AAP), American Public Health Association (APHA), and the National Resource

Center for Health and Safety in Child Care and Early Education (NRC) discusses general safety in childcare facilities [31]. The guidelines address children with food allergies and also recommend individualized emergency care plans for children with food allergies and training of the caregivers or teachers to prevent exposures, recognize symptoms, and treat allergic reactions appropriately.

Preparedness is a key, and measures should be taken to minimize any delay in administering epinephrine as this could prevent fatal reactions [1]. Epinephrine, the treatment for anaphylaxis, should be readily available with *quick and easy* access [30]. The CDC recommends that epinephrine be stored in a safe and secure location that trained staff members can access easily during school hours. However, staff must also follow any federal, state, and local laws and regulations regarding the storage of medications as some require keeping all medications locked away. As children with no prior history of allergies can have their first anaphylactic reaction at school, the CDC voluntary guidelines also recommend keeping stock epinephrine, if allowed by a state law [30].

While having an individualized emergency care plan is advised for food-allergic patients, one study showed that 14% of children who experienced an allergic reaction at school had no protocol in place [7]. Another study reported that 24% of children who had a reaction at school had no individualized healthcare plan in place and no prescribed epinephrine [8]. Most recently, a report from Massachusetts found that only 57% of students with known allergies had an individualized healthcare plan [32].

In a nationwide study of epinephrine auto-injector use among schools that received free epinephrine auto-injectors through the EpiPen4Schools program, 636 individuals were treated with an epinephrine auto-injector for anaphylaxis during the 2013–2014 school year [11•]. Forty-nine percent were treated with the school's stock epinephrine, and 45% were treated with a personal epinephrine auto-injector. Nine percent required a second epinephrine injection. Twenty-four percent of anaphylactic reactions were not treated with epinephrine, and the majority of these reactions were treated with antihistamines instead. With almost half of patients utilizing the stock epinephrine, this study highlights the importance of having epinephrine readily available in schools. It is also concerning that despite the availability of unassigned epinephrine, almost a quarter of anaphylactic reactions were not treated with epinephrine.

On November 13, 2013, the School Access to Emergency Epinephrine Act was signed into law. This act provides an incentive for states that enforce schools to keep stock epinephrine auto-injectors [33]. However, only 11 states currently require schools to stock epinephrine in kindergarten to 12th grade schools: Arizona, California, Delaware, Maryland, Massachusetts, Michigan, Nebraska, Nevada, New Jersey, North Carolina, and Virginia [34]. All other states have laws

or guidelines that allow but do not require schools to stock epinephrine with the exception of Hawaii where legislation is still pending.

In a study in California from 2011 when epinephrine was allowed but not yet required, only 13% of nurses reported actually having epinephrine in stock, and 10% reported needing to use another student's assigned epinephrine auto-injector to treat an anaphylactic reaction [35]. Barriers to having stock epinephrine were identified by California nurses as lack of support from the local school district as well as funding. Even with allowance of stock epinephrine in most states and voluntary recommendations to have epinephrine on site, this does not guarantee the availability of epinephrine auto-injectors as shown in California. In a survey of schools in Houston, Texas, less than half of schools (43%) reported having student-specific epinephrine auto-injectors [36•]. Additionally, schools of lower socioeconomic status were less likely to have epinephrine auto-injectors available. Guidelines focusing on student-specific epinephrine do not ensure that epinephrine is present in all schools. The evidence shows that there is significant variation among states and schools in terms of stocking epinephrine. While student-specific epinephrine is important, there is support for non-student-specific epinephrine in schools and childcare facilities and a standardized protocol for treatment, particularly for those children who have their first anaphylactic reaction at school [9•, 11•, 29, 37•].

School Staff Training and Preparedness

Even with epinephrine auto-injectors available in schools, school staff members must be trained in the recognition and initial management of anaphylaxis. One study reported that the first adult to become aware of a reaction was the teacher in most cases (59%) [10]. Several sources of treatment delay for anaphylactic reactions at school were identified in this same study, which included failure to recognize reactions, failure to follow an emergency plan, calling parents instead of administering emergency medication, and inability to administer epinephrine. It is important to minimize delay of epinephrine to treat anaphylaxis as delays have been associated with poor outcomes [38].

There is variability in terms of who is trained to recognize anaphylaxis and administer epinephrine. Some schools restrict epinephrine administration to the school nurse, particularly in a student with no prior history of anaphylaxis [39]. Training may or may not include non-nursing staff members at school. In a nationwide survey, most schools reported that only the school nurse and select staff were trained to recognize anaphylaxis (36%) as well as administer epinephrine (54%) [9•]. Fewer schools trained all staff and allowed them to administer epinephrine (31 and 22%, respectively). Three percent of schools allowed students and staff to give epinephrine.

Nurses are not always available or on location at the time of the reaction [10], and sometimes unlicensed staff members are administering epinephrine. An assessment of Wisconsin schools found that an alarming number of schools (92%) had no nurse [40]. Among the Wisconsin schools that had a school nurse, 80% reported the nurse was present for less than 10 hours per week. Additionally, even when nurses are present, they are often covering multiple school buildings or a high volume of students. A recent study of surveyed school nurses in Colorado found that in schools where nurses were covering four or more school buildings, significantly more epinephrine was given by an unlicensed staff member compared to schools where nurses covered fewer school buildings [41]. A report from the Massachusetts Department of Public Health from the 2011 to 2012 school year reported that 81% of epinephrine administrations were given by school nurses [32]. Five percent were given by non-nursing staff members, and more than half of these non-nursing staff members had not been trained in epinephrine administration.

As many nurses are expected to cover a large volume of students and multiple sites, unlicensed staff members are sometimes giving epinephrine. Therefore, the presence of increased nursing should be considered to improve student's safety [37•]. It would also be beneficial to train all school staff members in the recognition and management of anaphylaxis to minimize any treatment delay. Basic training of school staff members has been shown to significantly improve the ability of nurses and staff members to recognize and treat anaphylaxis [42].

Effect of Food Allergies on Schoolchildren

In a study of health-related quality of life in food-allergic patients, children and adolescents with food allergies reported significantly greater limitations in social activities and the perception of lower overall health compared to the general population [43]. Almost half of these families of food-allergic children (49%) reported that food allergy affected the social activities of the family, and 41% of parents felt that food allergies contributed to stress. Thirty-four percent noted that food allergy affected school attendance.

In another study, almost a quarter of food-allergic patients (24%) reported being the target of bullying [44]. An overwhelming majority (86%) said that they were bullied, teased, or harassed repetitively due to food allergies. While most of the perpetrators were classmates, 21% were identified to be school staff members, including teachers. Over half of bullied patients (57%) noted that the bullying involved the food allergen, either by touching their skin, thrown or waved at them, or contamination of their food. Bullying has also been associated with lower quality of life and increased anxiety among the children and parents [45]. Awareness and education of food

allergy-related bullying, which can potentially endanger the target student if it involves the food allergen, should be provided in schools.

Conclusion

Food allergy management in childcare facilities and schools is a growing challenge. Management of food allergies should focus not only on allergen avoidance but also on readiness to address allergic reactions as accidental ingestions happen and severe reactions will inevitably occur at schools. In addition to training staff to recognize and treat anaphylaxis, schools must take responsibility to ensure that epinephrine is readily available as prompt administration of epinephrine in anaphylaxis can be lifesaving. While individualized emergency care plans and student-assigned epinephrine are essential, there remains a gap in care for the significant number of students who may have their first allergic reaction at school. There is a considerable variation among schools regarding whether stock epinephrine is available and which staff members are trained to recognize and treat anaphylaxis, and current voluntary recommendations and incentives to keep stock epinephrine seem insufficient. Additionally, nursing staff are expected to cover a high volume of students and are not always available on site; thus, emphasis should be placed on increasing the number of school nurses and training non-nursing staff members as well. Ensuring the availability of unassigned stock epinephrine and broadening anaphylaxis training to non-nursing staff members are important measures that can be taken to minimize any treatment delay and potentially save lives.

Compliance with Ethical Standards

Conflict of Interest Drs. Tsuang and Wang declare no conflicts of interest relevant to this manuscript.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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