



Current trends in food allergy–induced anaphylaxis management at school



Matthew Greenhawt, MD, MBA, MSc ^{*}; Dana Wallace, MD [†]; J. Wesley Sublett, MD, MPH [‡]; Erin Maughan, PhD, MS, RN, PHNA-BC, FNASN, FAAN [§]; Andrea Tanner, MSN, RN, NCSN [§]; Kevin J. Kelley, MD [¶]; Stanley Fineman, MD ^{||}; Martha White, MD [#]; Gene Cash, PhD, ABPP ^{**}; Charmayne Anderson, MPA, BA ^{††}; Sally Schoessler, MEd, BSN, RN ^{††}; Ruchi Gupta, MD, MS ^{‡‡}; Michael Pistiner, MD, MMSc ^{§§}

^{*} Children's Hospital Colorado, University of Colorado School of Medicine, Section of Allergy and Immunology, Aurora, Colorado

[†] Nova Southeastern University School of Medicine, Fort Lauderdale, Florida

[‡] Family Allergy and Asthma, Louisville, Kentucky

[§] National Association of School Nurses, Silver Spring, Maryland

[¶] Department of Pediatrics, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

^{||} Department of Pediatrics, Emory University School of Medicine, Atlanta, Georgia

[#] Institute for Asthma and Allergy, Wheaton, Maryland

^{**} College of Psychology, Nova Southeastern University, Davie, Florida

^{††} Allergy & Asthma Network, Tysons Corner, Virginia

^{‡‡} Ann & Robert H. Lurie Children's Hospital of Chicago, Institute for Public Health and Medicine, Northwestern Feinberg School of Medicine, Chicago, Illinois

^{§§} Section of Pediatric Allergy and Immunology, MassGeneral Hospital for Children, Harvard University School of Medicine, Boston, Massachusetts

Key Messages

- Anaphylaxis is a life-threatening medical emergency requiring prompt treatment with intramuscular epinephrine. The prevalence of anaphylaxis has increased in recent years, including anaphylaxis occurring in the school setting
- Anaphylaxis can be associated with reduced quality of life
- Forty-nine of 50 states now have stock epinephrine laws, but few have mandated reporting systems regarding use of stock devices
- More data are needed to understand how stock epinephrine programs are being implemented, the success of such implementation, and what barriers exist to supporting school nursing and other personnel in the implementation of such programs.

ARTICLE INFO

Article history:

Received for publication January 9, 2018.

Received in revised form April 11, 2018.

Accepted for publication April 16, 2018.

ABSTRACT

Objective: To review the evidence and current policies regarding the use of epinephrine at schools and child care centers

Data Sources and Study Selections: A narrative review was performed based on the result of conference proceedings of a group of interprofessional stakeholders who attended the USAnaphylaxis Summit 2017 presented by Allergy & Asthma Network.

Results: Anaphylaxis is a well-recognized medical emergency that requires prompt treatment with intramuscular epinephrine. Anaphylaxis can be associated with poor quality of life. There is renewed recent focus on anaphylaxis management in schools. This interest has been spurred by an increase in the number of children with food allergy who are attending school, data that support up to 25% of first-time anaphylactic events occurring on school grounds, and a well-publicized fatality that helped to initiate a movement for stock, undesignated, non–student-specific epinephrine. Stock epinephrine is now available in 49 states, with an

Reprints: Matthew Greenhawt, MD, MBA, MSc, Food Challenge and Research Unit, Section of Allergy and Clinical Immunology, Children's Hospital Colorado, University of Colorado School of Medicine, 13123 E. 16th Ave., Aurora, CO 80045; E-mail: Matthew.Greenhawt@childrenscolorado.org.

Disclosures: All authors received honorarium from the Allergy and Asthma Network for presenting at the 2017 USAnaphylaxis Summit.

Funding Sources: The USAnaphylaxis Summit, during which the material and topics contained within this review were presented, was sponsored by the Allergy and Asthma Network through an educational grant provided by Mylan Pharmaceutical.

<https://doi.org/10.1016/j.anaai.2018.04.015>

1081-1206/© 2018 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

increasing number of states instituting mandatory reporting for use of such devices. Nursing efforts are paramount to support and implement stock epinephrine programs. Many states do not have clarity on delegation of authority for who can administer stock epinephrine, and there is evidence of variability in storage of stock devices. Few states have outcomes data that support successful implementation of stock epinephrine programs.

Conclusion: Additional data are needed to demonstrate successful implementations of stock epinephrine programs and their outcomes. Such programs should include support for school nursing and clearer delineation of authority for medication administration as well as standards for where and how devices are stored.

© 2018 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

Introduction

Anaphylaxis is a life-threatening medical emergency that requires prompt treatment with intramuscular epinephrine.^{1–4} With an increase in the number of children at risk or having experienced anaphylaxis in schools, there is a renewed focus on the preparation of schools to treat such an event, given data that support up to 25% of first-time anaphylactic events occurring on school grounds and a well-publicized fatality that helped to initiate a movement for stock, undesignated, non-student-specific epinephrine.^{5,6} This review details key issues related to anaphylaxis management at school and specifically themes and discussions shared in a recent multidisciplinary summit on this subject.

Developmental and Social Perspectives of Anaphylaxis in the School Setting

A school-aged child with food allergy may refer to someone in kindergarten or in college. Accordingly, needs for these students with respect to anaphylaxis management differ. Anaphylaxis has a negative effect on the psychological well-being and quality of life (QoL) of both children and their families.⁷ As children with anaphylaxis age, they carry an additional, escalating burden of sharing the responsibility of managing their risk of exposure.⁸ Data are mixed about whether epinephrine autoinjector use reduces or worsens anxiety and improves QoL.⁹ Naturally, young children have more limited ability to manage anaphylactic risk and are highly dependent on adults. Consistency in allergy management plans among environments may reduce the child's anxiety.¹⁰

QoL in children with food allergy is comparatively worse than in those with other chronic illnesses and is influenced by a multitude of factors.^{11,12} Food allergic children and adolescents may have anxiety, depression, social isolation, and stress.^{7,13} Food allergy bullying is an increasing concern that clinicians should routinely query because it may influence self-management behaviors and worsen the aforementioned stress, poor QoL, and anxiety.⁸ Although some degree of anxiety associated with having an allergy or prior anaphylactic reaction is potentially adaptive, this can quickly become maladaptive and influence poor QoL.¹⁴ Food allergic adolescents face additional risks compared with younger children; they are at high risk for a severe reaction (with teenagers overrepresented in fatality series) and vulnerable to peer pressure and risk-taking in social situations. Worse, this population often does not carry their epinephrine autoinjectors, a factor associated with food allergy fatality.^{15–17} The 2 studies of food allergic college students have noted that there is poor notification of close campus contacts and food preparers of one's food allergy and poor adherence to carrying self-injectable epinephrine.¹⁸ However, peer involvement with allergy management may foster facilitative support in social situations as well as adherence with optimal self-management strategies.^{8,10}

How are Schools Currently Managing Anaphylaxis?

According to nationally representative survey data, approximately 6 million US children (approximately 8%) have IgE-mediated

food allergy, including 25% with peanut allergy and 30% with multiple food allergies.¹⁹ This amount roughly translates to 2 students per 25-person classroom, with this rate expected to increase. Peanut and tree nuts are frequently reported triggers of severe reactions. Data indicate that potentially 18% of children with food allergies have experienced an allergic reaction at school,¹⁹ although there are not strong data to clarify the number of children that help to comprise the 25% of first-time anaphylactic reactions (which includes not only all causes but also adults) that have been reported to occur at school.²⁰

This increase in food allergy has necessitated implementation of clear management strategies to maintain a safe learning environment. Unlike stock epinephrine, for which there is national policy, less than 25% of states have any guidelines in place to facilitate management at school.²¹ The Centers for Disease Control and Prevention published voluntary guidelines in 2013, but the effect of these guidelines has not been well studied. School food allergy management remains a variable and decentralized process, in stark contrast to epinephrine legislation.²² Existing school policies focus mainly on peanut and tree nut allergy and trend toward restriction or exclusion of these allergens—a strategy focus that stems from the early 2000s as an initial response to the initial realization of an increasing problem but possibly to the exclusion of milk and egg allergy which remain more prevalent than peanut.^{19,20,23,24}

A recognized gap in school food allergy management has been limited systematic research on current food allergy management strategies. Many school-level policies have been implemented without data definitively supporting their necessity, based on parent or caregiver advocacy, and through enactment of protections from federal disability laws being applied to food allergy. Many schools and districts have voluntarily chosen to enact restriction policies at the level of the class, lunchroom, or school.^{20,22,25} Another option has been implementation of plans designated under §504 of the Rehabilitation Act, a federal disability law that has been interpreted to potentially entitle food allergic children to allergen-free or allergen-restricted learning environments (eg, 504 plans).²⁶

Despite enactment of such policies, there remains a paucity of data (experimental or quasi-experimental) on the outcomes of classroom or school-level selective allergy restriction, despite potential increasing requests or demands for such measures.^{20,22,24} Officially, no national or statewide guidelines, allergy professional society, or major advocacy group recommends specific allergen restriction policies.²² The extent to which restrictive measures may work has been poorly studied. Recently, Bartnikas et al²⁴ published a 5-year retrospective study of Massachusetts school nurses (a state with both a mandated stock epinephrine policy and reporting) that explored the association between restrictive policy implementation and the use of epinephrine in the school setting and found that nut-free schools were not associated with any reduction in epinephrine use, but schools that instituted nut-free tables were. Drivers and preferences for such restrictive policies are also poorly understood, and not all families with a food allergic child necessarily support such policies.²⁴

Similar to the case with accommodations, there is also a paucity of published data about the use of anaphylaxis management plans

in schools and their outcomes. Specific areas of concern include the uniformity or variation of instructions in the plans, differences in outcomes based on who assesses the student (nurse vs layperson), ease of adhering with the written plan, and postmanagement disposition strategies.^{27,28} Despite moving to a stock epinephrine model, there is no movement toward stock school-level management plans, instead requiring each student to supply his/her own plan as opposed to having a universal school-level plan.^{29,30} Multiple anaphylaxis management treatment plans exist, including ones written by individual schools or districts, states, a major layperson advocacy group, and the American Academy of Pediatrics and a recently (2017) updated plan from the American Academy of Allergy, Asthma & Immunology, which had otherwise not been updated since 2008.²⁷ No data exist to understand why certain caregivers, practitioners, or schools use or prefer one plan over the other, if there are differences in outcomes based on these plans, or if the plan itself or the staff training and preparation to execute the plan is the more crucial step. The extent to which school personnel are trained and the quality and potential variability of the training require further exploration. There are several online training anaphylaxis management programs aimed at school personnel (nurses and laypersons), and some data that support these programs successfully increase understanding of how to use epinephrine devices as specified in the action plan.^{31,32} Additional study regarding how to cost-effectively and efficiently train laypersons to implement instructions in anaphylaxis management plans would be of benefit in understanding potential variation in how such plans are executed.

The Challenges of Stock Epinephrine

Measuring Stock Epinephrine Outcomes

On November 13, 2013, President Obama signed the School Access to Emergency Epinephrine Act into law. Not even 5 years later, 49 of the 50 states now have either opt-in or mandated stock epinephrine legislation.²¹ Most states have passed laws that are opt-in policies at the school or district level to voluntarily stock epinephrine, without specifying how to prescribe, maintain, or pay for the device (although this may also lack clarity in states with a mandate law).²¹ Few successful program implementations have been reported.³³ No study has assessed the effect of the type of law (mandate vs. option), differences in funding and provision of the devices, and differences in planning or resources to implement these policies on outcomes. Massachusetts is the first state that has mandated reporting of epinephrine use, with few other states doing so. Multiple states are experiencing barriers in the implementation of these laws, which may stem from poorly worded or incompletely conceptualized legislation.³⁴

A major impetus for stock legislation was in part to serve as a safety net for students, initiated after the death of a girl in Virginia who could not afford to maintain a device at both home and school.³⁵ There is, as stated, a paucity of data that have explored implementation of such laws and who may be benefitting. A study of Chicago Public Schools (Illinois is an opt-in state and an early adapter) noted a rather disconcerting pattern associated with race/ethnicity and income levels across the city, where differences were noted in administration rates in northern vs southern Chicago schools, a pattern the authors commented could be associated with access to care issues or other disparities related to the recognition, treatment, and documentation linked to such policies.³³ It would be important for future study of stock epinephrine policy to explore the degree to which such policy may benefit socioeconomically disadvantaged children where there is potential for an effect based on racial/ethnic and sociodemographic disparities or cases in which the practitioner has not prescribed a device to an at-risk child or possibly when such children may elude diagnosis.

The success of stock epinephrine programs will largely rest on the school personnel implementing them. The Framework for 21st Century School Nursing Practice supports these efforts.³⁶ A chief concern is that only 39.3% of schools have full-time registered school nurses and 25% of schools have no nurse at all.³⁷ Availability of school nursing may be a barrier to a coordinated approach to anaphylaxis management and implementation of stock epinephrine programs.³⁴ Given that many state school nurses are also the point persons responsible for mandated or voluntary data reporting for epinephrine (a student's device or stock) administration, nursing leadership could help to reorganize existing programs into a more nationally uniform effort. Another potential need is clarifying if or when a stock or personal epinephrine source is used, which could assist to assess the effect of the legislation (Jolene Bracale, student health services specialist, Indiana Department of Education, personal written communication, August 29, 2017).^{38–40} Other barriers include cost; legal liability or the perception of liability for prescribing and administering the device; lack of prescribing physicians; lack of staff knowledge or training regarding how, when, and in whom to administer epinephrine; and lack of administrative support.⁴¹

The EPIPEN4SCHOOLS program for the 2014–2015 academic year ($n = 12,275$ schools) is an example of stock epinephrine implementation and outcome reporting across multiple states.⁴² In this study, participating school staff were surveyed regarding stock epinephrine use and practices. All units were provided by one device maker, who sponsored this study. There were 2,191 reported anaphylaxis cases ($n = 12,275$ schools reporting): 89.8% occurred in students and 54% from food triggers, with the highest rate in high school-aged students (40.1%). Epinephrine was administered on school property for 63.7% of the reactions, and there was a full-time school nurse available in 53.6% of responding schools. Stock epinephrine was used in 631 of 1,267 cases (49.8%). Emergency medical services were called for 1,203 cases (60.2%) of 1998 events with data.⁴²

Logistical Considerations for Stock Epinephrine: Coordinating a Symphony of Moving Parts

Schools are facing larger issues with how they implement and operationalize stock epinephrine policies. Delegation of authority for medication is inconsistent because some states allow registered school nurses to delegate medication administration and some do not.⁴³ This delegation variability is also inconsistently clarified in guidance documents and reporting requirements.⁴⁰ Several states have initiated systematic data collection efforts on medications administered at school, but there is no national effort for this.⁴⁴ Only 75% of schools have a school nurse, which differs from previous generations of children.^{40,45} Medication administration responsibilities may be diverse—a 2006 national study found 163 distinct medications were administered in a school year, and a more recent study noted 59 distinct medications were administered.^{46,47} Two studies noted that most states allow both unlicensed assistive personnel (UAP) and registered nurses (RNs) to administer stock epinephrine, although selected states only permitted an RN to do so.⁴⁸ Interestingly, although 56.9% of schools allowed UAP to administer student specific epinephrine, only 21.3% allowed UAP to administer stock epinephrine to students without a prior allergy diagnosis.⁴⁸ At least 85% of schools surveyed had at least one child with an epinephrine prescription, and in 2014 to 2015, 9% of schools administered epinephrine.⁴⁸

Device storage of stock units may also be variable. In the aforementioned medication administration surveys, only 59% of student-provided epinephrine was stored in a locked container (77% of which was kept in the nurse's office), and 55% of stock epinephrine was not stored in a locked container. Only 69.1% of the schools had a standing stock device order. Nearly half the stock epinephrine was donated by a drug company, and only 30% was purchased using

district funds. This pattern suggests potential vulnerability in who will pay for stock epinephrine if device companies no longer provide free units.⁴⁸

Needs Assessment for Anaphylaxis Management in Schools

Given increasing recognition of anaphylaxis as a critical health issue, we must create more unified diagnostic criteria for anaphylaxis that all practitioners agree on and will have minimal interpretive variation. The 2006 National Institute of Allergy and Infectious Disease and the Food Allergy and Anaphylaxis Network guidelines were a first attempt at this, but there is a paucity of data that demonstrate what outcomes these criteria have influenced, including if these have increased timely epinephrine use.⁴ There is a need to reexamine the opinions and experiences of the key stakeholders within allergy, emergency medicine, and other medical disciplines to better understand the application and use of current criteria and identify variations that are of benefit and detriment. Updated criteria should consider investigating whether laypersons (including parents) and medically trained health care professionals should be using the same criteria and treatment strategies to diagnose and manage anaphylaxis in the inpatient, office, home, or school setting and to what extent such practices may currently be divergent. Enhancing training for front-line recognition of anaphylaxis, irrespective of the criteria used, should be nested into these efforts. Establishment of a national anaphylaxis registry (for health care–related facilities and for schools) and increasing the number of current acute events databases that can track actual symptom-level data (to match this to medication administration and hospital-based outcomes) would be useful to better define, understand, and track outcomes. The present national data sets generally lack such symptom-level reporting. There remain potentially critical needs regarding how schools stock, maintain, store, and administer epinephrine. Educational efforts to help support the process are paramount, given that many nonmedical personnel are tasked with caring for these children at school. Clarity in how to optimally manage the child's condition after epinephrine is administered is also needed because this may significantly affect outcomes of the policy. It is important to remember that stock epinephrine is still a new concept for school educators who do not have health backgrounds, and trends should improve with more time.

Conclusion

The rates of anaphylaxis have increased in the past several years. Consensus diagnostic criteria have existed since 2006, but there are no national-level data to support that these are associated with widespread implementation or understanding of what key outcomes such criteria have affected. Although now 49 states have stock epinephrine legislation, more data are needed to demonstrate that this program has been effectively implemented, demonstrate the outcomes of this program, and elucidate whether there is any variation attributable to the nature of mandated vs opt-in laws. Better and more centralized programs are needed to help facilitate the school nurse, a primary person on the forefront of managing any acute anaphylaxis episodes at school, to successfully assess, treat, and document use of stock and nonstock devices in the school setting. Although we are light-years ahead of where we were just 5 years ago, we must continue to undergo process improvement to enhance the efficacy of these programs.

References

- [1] Simons FE, Ebisawa M, Sanchez-Borges M, et al. 2015 update of the evidence base: world Allergy Organization anaphylaxis guidelines. *World Allergy Organ J*. 2015;8:32.

- [2] Simons FE, Sampson HA. Anaphylaxis: unique aspects of clinical diagnosis and management in infants (birth to age 2 years). *J Allergy Clin Immunol*. 2015; 135:1125–1131.
- [3] Sicherer SH, Simons FER. Section on allergy and immunology. Epinephrine for first-aid management of anaphylaxis. *Pediatrics*. 2017;139:e1–e11.
- [4] Sampson HA, Munoz-Furlong A, Campbell RL, et al. Second symposium on the definition and management of anaphylaxis: summary report–Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network Symposium. *J Allergy Clin Immunol*. 2006;117:391–397.
- [5] McIntyre CL, Sheetz AH, Carroll CR, Young MC. Administration of epinephrine for life-threatening allergic reactions in school settings. *Pediatrics*. 2005; 116:1134–1140.
- [6] Virginia Allergy Death Index. Allergy kills Virginia girl at school. 2012. <http://www.cnn.com/2012/01/04/health/virginia-allergy-death/index.html>. Accessed October 15, 2017.
- [7] Bacal LR. The impact of food allergies on quality of life. *Pediatr Ann*. 2013;42: 141–145.
- [8] Ravid NL, Annunziato RA, Ambrose MA, et al. Mental health and quality-of-life concerns related to the burden of food allergy. *Immunol Allergy Clin North Am*. 2012;32:83–95.
- [9] Greenhawt M. Food allergy quality of life and living with food allergy. *Curr Opin Allergy Clin Immunol*. 2016;16:284–290.
- [10] Marrs T, Lack G. Why do few food-allergic adolescents treat anaphylaxis with adrenaline? reviewing a pressing issue. *Pediatr Allergy Immunol*. 2013;24:222–229.
- [11] Sicherer SH, Noone SA, Munoz-Furlong A. The impact of childhood food allergy on quality of life. *Ann Allergy Asthma Immunol*. 2001;87:461–464.
- [12] Howe L, Franxman T, Teich E, Greenhawt M. What affects quality of life among caregivers of food-allergic children? *Ann Allergy Asthma Immunol*. 2014;113: 69–74, e2.
- [13] Cummings AJ, Knibb RC, King RM, Lucas JS. The psychosocial impact of food allergy and food hypersensitivity in children, adolescents and their families: a review. *Allergy*. 2010;65:933–945.
- [14] Greenhawt M. Food allergy quality of life. *Ann Allergy Asthma Immunol*. 2014; 113:506–512.
- [15] Sampson HA, Mendelson L, Rosen JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. *N Engl J Med*. 1992;327:380–384.
- [16] Bock SA, Munoz-Furlong A, Sampson HA. Fatalities due to anaphylactic reactions to foods. *J Allergy Clin Immunol*. 2001;107:191–193.
- [17] Bock SA, Munoz-Furlong A, Sampson HA. Further fatalities caused by anaphylactic reactions to food, 2001–2006. *J Allergy Clin Immunol*. 2007;119:1016–1018.
- [18] Greenhawt MJ, Singer AM, Baptist AP. Food allergy and food allergy attitudes among college students. *J Allergy Clin Immunol*. 2009;124:323–327.
- [19] Gupta RS, Springston EE, Warrier MR, et al. The prevalence, severity, and distribution of childhood food allergy in the United States. *Pediatrics*. 2011;128: e9–e17.
- [20] Sicherer SH, Mahr T. American Academy of Pediatrics Section on Allergy and Immunology. Management of food allergy in the school setting. *Pediatrics*. 2010; 126:1232–1239.
- [21] Allergy & Asthma Network. School Stock Epinephrine. Vienna, VA: Allergy & Asthma Network; 2016.
- [22] Centers for Disease Control and Prevention. Food Allergies. 2013. https://www.cdc.gov/healthyschools/foodallergies/pdf/13_243135_A_Food_Allergy_Web_508.pdf. Accessed October 1, 2017.
- [23] Panel NI-SE, Boyce JA, Assa'ad A, et al. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. *J Allergy Clin Immunol*. 2010;126:S1–S58.
- [24] Bartnikas LM, Huffaker MF, Sheehan WJ, et al. Impact of school peanut-free policies on epinephrine administration. *J Allergy Clin Immunol*. 2017;140:465–473.
- [25] Young MC, Munoz-Furlong A, Sicherer SH. Management of food allergies in schools: a perspective for allergists. *J Allergy Clin Immunol*. 2009;124:175–182, e1–4. quiz 83–84.
- [26] 34 CFR §504.34 Education. B. Regulations of the offices of the department of education. Chapter I—Office for civil rights, Department of Education. Part 104—Nondiscrimination on the basis of handicap in programs or activities receiving federal financial assistance. 1980. <https://www2.ed.gov/policy/rights/reg/ocr/edlite-34cfr104.html>. Accessed March 23, 2018.
- [27] Wang J, Sicherer SH. Section on allergy and immunology. Guidance on completing a written allergy and anaphylaxis emergency plan. *Pediatrics*. 2017; 139:e1–e11.
- [28] Turner PJ, DunnGalvin A, Hourihane JO. The emperor has no symptoms: the risks of a blanket approach to using epinephrine autoinjectors for all allergic reactions. *J Allergy Clin Immunol Pract*. 2016;4:1143–1146.
- [29] Greenhawt MJ, Weiss CC. We must create a national policy to protect and manage food allergic students at school. *Ann Allergy Asthma Immunol*. 2012; 109:292–294.
- [30] School Access to Emergency Epinephrine Act. Pub L 113–48. November 13, 2013. Accessed September 1, 2017.
- [31] Tsuang A, Demain H, Patrick K, Pistiner M, Wang J. Epinephrine use and training in schools for food-induced anaphylaxis among non-nursing staff. *J Allergy Clin Immunol Pract*. 2017;5:1418–1420, e3.

- [32] White L, Aubin J, Bradford C, Alix C, Hughes L, Phipatanakul W. Effectiveness of a computer module to augment the training of school staff in the management of students with food allergies. *Ann Allergy Asthma Immunol*. 2015;114:254–255, e3.
- [33] DeSantiago-Cardenas L, Rivkina V, Whyte SA, Harvey-Gintoft BC, Bunning BJ, Gupta RS. Emergency epinephrine use for food allergy reactions in Chicago Public Schools. *Am J Prev Med*. 2015;48:170–173.
- [34] Tsuang A, Wang J. Childcare and school management issues in food allergy. *Curr Allergy Asthma Rep*. 2016;16:83.
- [35] CNN. Food Allergies in Schools. 2012. <https://www.cnn.com/2012/01/11/health/living-well/food-allergies-schools/index.html>. Accessed March 23, 2018.
- [36] National Association of School N, Maughan E, Bobo N, Butler S, Schantz S, Schoessler S. Framework for 21st century school nursing practice: an overview. *NASN Sch Nurse*. 2015;30:218–231.
- [37] National Association of School Nurses. School Nurses in the United States. 2017. <https://schoolnursesnet.nasn.org/blogs/nasn-profile/2017/05/10/school-nurse-workforce-study-results>. Accessed September 17, 2017.
- [38] Commonwealth of Massachusetts. Life-Threatening Allergies, Anaphylactic Events and the Administration of Epinephrine in School. 2016. <http://www.mass.gov/eohhs/docs/dph/com-health/school/epi-data-14.pdf>. Accessed September 7, 2017.
- [39] Illinois State Board of Education. Report of Use of Undesignated Epinephrine School Year 2014–15. 2016. <https://www.isbe.net/Documents/epinephrine-use-report14-15.pdf>. Accessed September 7, 2017.
- [40] National Association of School Nurses. School Nurses in the United States. 2017. <https://schoolnursesnet.nasn.org/blogs/nasn-profile/2017/05/10/school-nurse-workforce-study-results>. Accessed September 7, 2017.
- [41] Love MA, Breeden M, Dack K, Milner A, Rorie AC, Gierer SA. A law is not enough: geographical disparities in stock epinephrine access in Kansas. *J Allergy Clin Immunol*. 2016;137:AB56.
- [42] White MV, Hogue SL, Bennett ME, et al. EpiPen4Schools pilot survey: occurrence of anaphylaxis, triggers, and epinephrine administration in a U.S. school setting. *Allergy Asthma Proc*. 2015;36:306–312.
- [43] American Nurses Association & National Association of School Nurses. Scope and Standards of School Nursing. Silver Spring, MD: 2017. nursesbook.org.
- [44] Pub Act 99–0711. Epinephrine Auto-injector Act. July 20, 2015. <http://www.ilga.gov/legislation/publicacts/99/PDF/099-0711.pdf>. Accessed March 23, 2017.
- [45] National Center for Education Statistics. Homeschooling; 2012. <https://nces.ed.gov/fastfacts/display.asp?id=91>. Accessed September 18, 2017.
- [46] McCarthy AM, Kelly MW, Johnson S, Roman J, Zimmerman MB. Changes in medications administered in schools. *J Sch Nurs*. 2006;22:102–107.
- [47] Bergren MD. The feasibility of collecting school nurse data. *J Sch Nurs*. 2016;32:337–346.
- [48] Maughan ED, McCarthy AM, Hein M, Perkhounkova Y, Kelly MW. Medication management in schools: 2015 survey results. *J Sch Nurs*. 2017;doi:10.1177/1059840517729739.