

Benefits of school nurse training sessions for food allergy and anaphylaxis management

Angela Tsuang, MD, MSc^a, Zara Atal, BS^a,
Haidi Demain, MD^b, Kathleen Patrick, RN^c,
Michael Pistiner, MD, MMSc^d, and Julie Wang, MD^a



Clinical Implications

- In-person nurse training sessions on food allergy and anaphylaxis management not only increase knowledge and confidence for up to 24 months, but nurses also report being better able to train school staff, improving food allergy prevention strategies and preparedness for anaphylaxis.

TO THE EDITOR:

Food allergies are common and have been increasing in prevalence among children in recent years.¹ Therefore, school nurses and staff are faced with the expectation to manage food allergies and recognize and treat allergic reactions and anaphylaxis.² Given that timely recognition and treatment of anaphylaxis has been shown to be associated with better outcomes,³ training school nurses on these topics is important.⁴ The aim of this study was to determine the effects of school nurse training on food allergy and anaphylaxis management.

Anonymous written questionnaires were distributed before and after the Colorado school nurse in-person food allergy and anaphylaxis training sessions in spring 2015. Questions were adapted from a study questionnaire that assessed a computer-based food allergy program used to train school staff.⁵ The questionnaires assessed knowledge, attitude, and confidence levels regarding food allergy and anaphylaxis management (see Table E1 and Figure E1 in this article's Online Repository at www.jaci-inpractice.org). The survey was modified by this study's pediatric allergists with the addition of knowledge and confidence questions specific to anaphylaxis and Colorado reporting guidelines, whereas attitude questions were unchanged. The total knowledge level was calculated out of 13 knowledge-based questions. The 6 confidence questions were given the following answer choices for an overall possible score of 30: very confident = 5, fairly confident = 4, somewhat confident = 3, not too confident = 2, and not confident at all = 1. The 7 attitude questions were given the following answer choices for an overall possible score of 35: strongly agree = 5, agree = 4, not sure = 3, disagree = 2, and strongly disagree = 1.

School nurses were asked to complete questionnaires every 6 months in the 2 years after the 2015 training session. Twelve- and 24-month follow-up questionnaires were completed in-person during training sessions for non-food allergy and anaphylaxis topics; the 6- and 18-month questionnaires were distributed electronically. Only those nurses who had attended the initial training session in 2015 were asked to complete the follow-up questionnaires. The number of epinephrine administrations within schools that were reported to the Colorado

Department of Education in the year before and after the 2015 nurse training session was also analyzed. Analysis was completed using STATA 11 (StataCorp, College Station, Texas), and *t* test was used to compare means. This study was exempt from institutional review board approval at the Icahn School of Medicine at Mount Sinai.

A total of 1066 surveys were completed. The number of questionnaire responses per follow-up period is presented in Table I. The nurse training session in 2015 was attended by 550 nurses, and about half of the attendees completed the pretraining and posttraining surveys as well as 12-month follow-up surveys.

The knowledge score remained significantly higher at all time points ($P < .0001$) from immediately after training (86%) to 24 months (88%) in comparison with the pretraining knowledge score of 77% as shown in Figure 1. Similar significant findings were found for the attitude score, with a pretraining score of 78% that increased to 85% immediately after training. This increase in the attitude score was maintained for all follow-up time points up until 24 months ($P < .0001$). Confidence scores also improved after training, with an increase in the confidence score from 81% pretraining to 86% immediately after training. Although there was no significant difference in the confidence score at 6 months compared with the pretraining score ($P = .25$), confidence levels remained significantly elevated at all other time points: 12 months ($P = .0002$), 18 months ($P = .0003$), and 24 months ($P < .0001$).

Eighteen percent of participants had a perfect score on the knowledge questions posttraining session, a significant increase from 7% of nurse participants before training ($P = .001$). On the pretraining questionnaires, 5% of nurses had a score of less than 50% and 3 nurses (1%) answered 0 question correctly. The knowledge question with the lowest score on pretraining surveys was "Which method is an effective way to clean hands of allergens?" with only 28% of subjects answering correctly. This percentage improved to 64% after the training session, but went back down to 36% by the 12-month follow-up. Significant improvement in answering the following 2 knowledge questions correctly was maintained both posttraining and at 12-month follow-up in comparison with pretraining:

- Which of the following is true? *Correct answer:* Schools must submit a report to the State School Nurse Consultant at the Department of Education within 10 days regarding any incidence at the school involving a severe allergic reaction.
- When should someone be transported to the hospital by an ambulance? *Correct answer:* Every time a person experiences anaphylaxis whether or not epinephrine was given.

The area of lowest confidence before training was regarding "How confident do you feel in your ability to recognize the symptoms of anaphylaxis (a life-threatening allergic reaction)?" with an average score of 3.5 (out of 5 for "very confident"). However, confidence levels were significantly higher posttraining (mean, 3.8; $P < .0001$) and at 12 months (mean, 3.7; $P = .04$) in comparison with pretraining levels. Attitude scores were the lowest for "It is reasonable to not allow outside food (like baked goods, candy, or fruit) in the classroom for celebrations or parties" on the pretraining survey (mean, 3.1 out of 5 for

TABLE 1. Number of nurse questionnaire responses at each follow-up period

Time of survey	n	Response (%)
Pretraining	243	44
Posttraining	259	47
6 mo	92	17
12 mo	246	45
18 mo	94	17
24 mo	132	24
Total	1066	

Note. Unless otherwise noted, number of months refers to the number of months after training session. A total of 550 nurses attended the initial training session. Twelve- and 24-mo questionnaires were in-person, whereas 6- and 18-mo questionnaires were online.

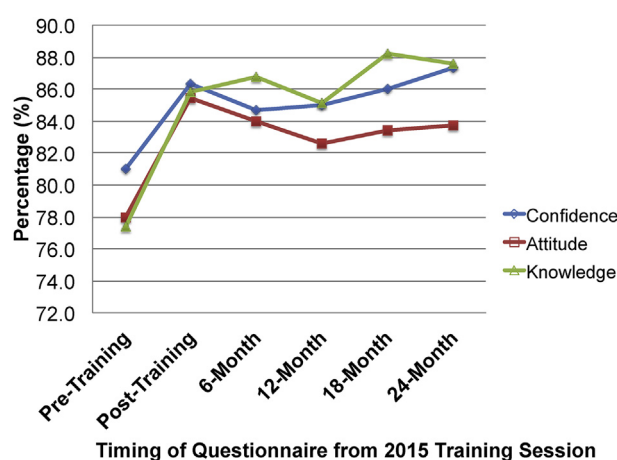


FIGURE 1. Two-year follow-up of knowledge, confidence, and attitude scores after nurse training sessions for food-induced anaphylaxis. All percentages are significantly higher ($P < .05$) than pretest percentage with the exception of 6-month confidence score ($P = .25$).

“strongly agree”), but significantly improved posttraining (mean, 3.8; $P < .0001$) and 12 months after training (mean, 3.4; $P = .009$). When assessed by individual questions, all confidence and attitude levels significantly improved posttraining compared with pretraining. By 12 months, this significant difference was maintained for all with the exception of the following confidence and attitude questions:

- How confident do you feel in your *delegated* staff's ability to recognize and treat anaphylaxis when you, the school nurse, are not in the building?
- It is reasonable to keep allergens out of the classroom where there are students with food allergies.
- Families in your school have reasonable concerns and expectations about the management of their child with food allergies.

In Colorado, there is mandated reporting of anaphylaxis and epinephrine autoinjector administration in schools. It was hypothesized that epinephrine autoinjector use may increase in the year after the training session because of increased awareness among the school nurses. However, there was no significant

difference in reported epinephrine autoinjector use in the academic year before and after the 2015 training session.

On the 12-, 18-, and 24-month surveys, most of the nurses indicated that it would be appropriate to have similar training sessions every other year (43%-53%), whereas some preferred annual training sessions (28%-36%). On these same questionnaires, most nurses reported that the training “allowed me to better educate my staff” (71%-80%).

The results demonstrate that school nurse training sessions have positive, lasting effects on knowledge, attitude, and confidence. This finding that the effects of a training session can be maintained 2 years later differs from previous findings reported in the literature. The frequency of training for epinephrine autoinjector use has been previously studied among physician trainees. Trainees' usage skills of the autoinjector began to decline 6 months after training.⁶ In addition, a study among child care staff found that knowledge levels declined by 6 months and 12 months after participating in an allergy and anaphylaxis seminar.⁷ Sicherer et al⁸ reported similar findings that patient skills after receiving epinephrine autoinjector training during the clinic visit had declined 1 year later but remained significantly higher than pretraining levels. However, improvement in knowledge scores regarding food-induced anaphylaxis was maintained 12 months later.

The difference between our nurse training findings and those of the physician trainees or patients could potentially be attributed to the higher experience level of the nurses at baseline. In a study of school staff training, the most notable improvement in self-efficacy to manage anaphylaxis was among nurses in comparison with other staff.⁴ Another possibility could be that the repeat questionnaires every 6 months served as a frequent reminder of food allergy and anaphylaxis concepts, allowing the nurses to continue to recall what they learned in training after 2 years. Although the data demonstrate that every other year in-person training sessions may be sufficient among nurses, this could be augmented by brief updates in the form of questions and answers every 6 months to assist with recall.

The effect of nurse training sessions may be even wider reaching because most (71%-80%) of the nurses felt that they were also better able to train other staff members. We have previously shown that the odds of epinephrine administration by nonnursing staff was 2 times as likely among schools where a nurse was covering 4 or more school buildings in comparison with fewer than 4 buildings.⁹ Anaphylaxis training of the school staff is important for awareness, prevention, and recognition of anaphylaxis. Nonnursing staff may also be called upon to treat anaphylaxis in an emergency situation, particularly when a school nurse is not available at that time.

There were some limitations of this study. The survey, which was modified from a previous study, was not validated. In addition, there was no control group of nurses who did not undergo the training session for comparison because the follow-up questionnaires alone could have triggered interest in food allergies. It is possible that knowledge, attitude, and confidence levels were overestimated because perhaps those nurses who chose to complete the online questionnaires and in-person surveys had increased interest and exposure to food allergies in their schools. However, information regarding nurses who chose not to participate was not available. Furthermore, only half of the nurses initially surveyed completed the 24-month questionnaires and less than half completed the 18-month questionnaires. It is

unknown whether those nurses who did not complete the 18- and 24-month questionnaires differed in terms of knowledge, attitude, and confidence. A potential follow-up study would include closer follow-up of all nurse participants and discuss the reasons why some chose not to complete later surveys.

Nurse training sessions on food allergy and anaphylaxis can have multiple positive, lasting effects. Significant improvement was noted among nurses' knowledge, attitude, and confidence toward food allergies up to 24 months later. Furthermore, most of the participants in the training session feel that they are better able to train their own school staff, improving care and safety for students with food allergies in schools.

Acknowledgment

We specially thank John Lee, MD, for technical and IT support.

^aDivision of Allergy and Immunology, Department of Pediatrics, Icahn School of Medicine at Mount Sinai, New York, NY

^bAllergy Safe Kids, Inc, Denver, Colo

^cColorado Department of Education, Denver, Colo

^dFood Allergy Center, Mass General Hospital for Children, Harvard Medical School, Boston, Mass

This project was supported by Allergy Safe Kids, Inc, AllergyHome, and the Icahn School of Medicine at Mount Sinai. A.T. was supported in part by The Louis and Rachel Rudin Foundation, Inc.

Conflicts of interest: A. Tsuang and Z. Atal declare no relevant conflicts of interest. H. Demain is the founder and director of Allergy Safe Kids, Inc. K. Patrick is employed by the Colorado Department of Education. M. Pistiner has received consultancy fees from the Massachusetts Department of Public Health Early Education and Care; has received lecture fees from the Allergy Asthma Network and the Maine Department of Public Health and School Nutrition Services; receives royalties for "Everyday Cool with Food Allergies"; has received payment for developing educational presentations from Allergy Safe Kids, Inc; is cofounder and content creator of AllergyHome LLC and AllergyCertified Training LLC; and

has received consultancy fees from Kaleo and DBV Technologies. J. Wang has received consultancy and lecture fees from Aimmune and DBV Technologies; receives royalties from UpToDate; and has stock options in JDP Therapeutics.

Received for publication January 26, 2018; revised April 17, 2018; accepted for publication May 15, 2018.

Available online May 26, 2018.

Corresponding author: Julie Wang, MD, Icahn School of Medicine at Mount Sinai, 1 Gustave L. Levy Place, PO Box 1198, New York, NY 10029. E-mail: julie.wang@mssm.edu.

2213-2198

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<https://doi.org/10.1016/j.jaip.2018.05.015>

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TABLE E1. Confidence and attitude questions

Confidence questions

1. How confident do you feel in your ability to manage students with life-threatening allergies?
2. How confident do you feel in your knowledge about how to prevent exposure to food allergens?
3. How confident do you feel in your ability to recognize the symptoms of anaphylaxis (a life-threatening allergic reaction)?
4. How confident do you feel in your ability to treat anaphylaxis (a life-threatening allergic reaction)?
5. How confident do you feel in your *delegated* staff's ability to recognize and treat anaphylaxis when you, the school nurse, are not in the building?
6. How confident do you feel in your *designated* staff's ability to recognize and treat anaphylaxis when you, the school nurse, are not in the building?

Attitude questions

1. It is reasonable to keep allergens out of the classroom where there are students with food allergies.
2. It is reasonable to not allow outside food (like baked goods, candy, or fruit) in the classroom for celebrations or parties.
3. Students with food allergies are at risk of being bullied by others in school.
4. If you witness food allergy–related bullying, it is your responsibility to intervene.
5. Yearly food allergy staff training is important.
6. Food allergies in school are an important issue.
7. Families in your school have reasonable concerns and expectations about the management of their child with food allergies.

Note. The 6 confidence questions were given the following answer choices for a total possible score of 30: very confident = 5, fairly confident = 4, somewhat confident = 3, not too confident = 2, and not confident at all = 1. The 7 attitude questions were given the following answer choices for a total possible score of 35: strongly agree = 5, agree = 4, not sure = 3, disagree = 2, and strongly disagree = 1.

1. Which method is an effective way to clean hands of allergens? A. Soap and water B. Hand wipes C. Hand sanitizing gel D. A and B E. None of the above	9. Which of the following is TRUE? A. Only school nurses can report epinephrine administrations on the online form. B. Schools must submit a report to the State School Nurse Consultant at the Department of Education within 10 days regarding any incident at the school involving a severe allergic reaction. C. Any staff member can give stock epinephrine to any child experiencing anaphylaxis. D. Stock epinephrine needs to be kept in a secure and locked area.
2. Which method is an effective way to clean tables of allergens? A. Commercial cleaners B. Commercial wipes C. Soap and water D. All of the above E. None of the above	10. Which of the following is TRUE? A. All anaphylactic reactions in schools must be reported through the Colorado Department of Education's website and online reporting form. B. Any staff member who witnessed the reaction can fill out the online reporting form. C. Reporting must be completed within 10 days of the witnessed event. D. If a school voluntarily adopts stock epinephrine, they must adopt the school guidelines for stock epinephrine published by the Colorado Department of Education (CDE). E. All of the above
3. Which classroom item may be a source of a potential food allergen? A. Paste B. Shaving cream C. Finger paint D. Macaroni art E. All of the above	11. Epinephrine auto injectors are given in the: A. Shoulder B. Buttocks C. Thigh D. Any of the above
4. Which of the following sequences of actions is in an appropriate order in the event that a child with a known allergy is experiencing anaphylaxis (a life threatening allergic reaction)? A. 1st) give epinephrine , 2nd) call 911, 3rd) call parents B. 1st) give epinephrine, 2nd) call parents, 3rd) call 911 C. 1st) give antihistamine, 2nd) call 911, 3rd) give epinephrine D. 1st) call 911, 2nd) call parents, 3rd) give epinephrine E. 1st) call 911, 2nd) give antihistamine, 3rd) give epinephrine	12. For students with anaphylaxis, they should be transported to the hospital by: A. Ambulance B. School transport C. Parents D. Any of the above
5. It is okay to wait and see if a mild anaphylactic reaction will resolve before giving epinephrine? A. True B. False	13. When should someone be transported to the hospital by an ambulance? A. Every time a person experiences anaphylaxis whether or not epinephrine was given B. After epinephrine has been given to a student, but only if symptoms are worsening C. Only if stock epinephrine has been given D. Before epinephrine is administered in the case of severe anaphylaxis
6. If you know a child has eaten a food safely before you don't need to read the label again. A. True B. False	
7. Using a sponge is a preferred method to clean the table tops in the cafeteria. A. True B. False	
8. Which of the following would not require epinephrine? A. A child who was just in the cafeteria and now has red, raised, itchy marks on their face and is vomiting. B. A child who has no known allergies but is sick to their stomach, is coughing and has hives all over their chest and back. C. A child who was on the soccer field, was stung by a bee who is now wheezing and feels dizzy. D. A child who has a fever, had diarrhea earlier in the morning and has just vomited in class.	

FIGURE E1. Knowledge questions. *Note.* Correct answers are in bold.