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Role of Food Allergy Education: Measuring Teacher Knowledge, Attitudes, and Beliefs

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Abstract

Introduction: Almost 6 million children suffer from food allergies with roughly 2 affected per classroom. Deficiencies in knowledge and discrepancies in attitudes within school staff when addressing food allergies are associated with barriers to care. In this study, school teacher knowledge, beliefs, and attitudes were measured before and after a food allergy educational session.

Methods: Three hundred seventy-five personnel of similar age, socioeconomic status, ethnicity, and educational level completed the Chicago Food Allergy Research survey before and after a 1-hour educational session in 6 private schools in Houston randomly assigned into an intervention (n = 4) and control group (n = 2). Responses were measured using frequencies and percentages. The group score differences and survey question comparisons were evaluated with a linear mixed-effects model.

Results: Posttest, the intervention group had knowledge scores 19.58% points higher than control (95% confidence interval = 16.62–22.53; $P < .001$) with no differences pretest. Odds of agreeing that injectable epinephrine is important was higher in the intervention schools posteducation. Within the intervention group, personnel were more likely to agree to injectable epinephrine use for children posteducation.

Conclusion: A 1-hour educational session improved knowledge and attitudes in personnel in the intervention schools. Given the growing prevalence of food allergy, the emphasis on food allergy education is crucial to allow for familiarization of the condition, early recognition of anaphylaxis, and promotion of injectable epinephrine use.

Keywords

attitude, behavior, food allergy, knowledge, nurse, school education, teacher

Introduction

Approximately 6 million children suffer from food allergies with roughly 2 affected per classroom. Furthermore, 16% to 18% of students have their first food allergic reaction while attending school or day care.[1] In a 2013 to 2014 nationwide study, a 16% rate of anaphylaxis was reported among 5683 schools. Among these, 79% to 83% of severe food allergic reactions occurred in the classroom and 12% to 15% in the lunchroom.[2] Nineteen percent of life-threatening allergic reactions have been documented during field trips, at the playground, or while traveling to other schools.[3]

Despite these concerning statistics, recent studies have identified a knowledge deficit within school personnel when it comes to addressing food allergies.[4] Such examples can range from unintentionally providing children who suffer from egg allergies due to exposure to egg containing finger paint for arts and crafts or not being able to recognize vomiting as an initial sign of

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anaphylaxis.[1,5] Fifty-nine percent of teachers failed to recognize signs of an allergic reaction or follow an emergency plan such as administering injectable epinephrine. This is particularly alarming, given the associated deaths that can occur with anaphylaxis, with 63 cases reported from 2001 to 2006, and 6 of these at schools.[6,7]

In addition, variations within state and school beliefs have led to discrepancies in attitudes when approaching food allergies.[1] Examples include differing views when training personnel or opinions on school-wide rules on food allergies such as no sharing, ban of outside food, or nut-free allergy tables. One study revealed that a quarter of children with food allergies suffered from bullying in school with over 86% attributing the cause to their food allergies. Although classmates were the most common culprits, 21% of the teasing stemmed from their teachers or other staff.[8,9]

Finally, beliefs regarding food allergy-related policies such as the inconsistent utilization and storage of injectable epinephrine within schools remain an area of concern. Although the Centers for Disease Control and Prevention recommends readily available epinephrine at all hours, only 11 states made this a requirement.[10] Fourteen percent of children who suffered from food allergies while in school had no protocol in place, while 24% of children who were affected had no individualized health-care plan or prescribed epinephrine.[2,3] It is apparent that there is a lack of preparedness in schools when it comes to addressing and recognizing food allergic reactions including anaphylaxis.

There has been a preponderance of data supporting the role of education to help overcome this obstacle. However, there has been no specific investigation to evaluate teacher knowledge in private school settings.[11–13] In this study, we aim to evaluate the role of a 1-hour educational session on food allergies and to measure its efficacy on improving teacher knowledge, attitudes, as well as beliefs. Previous studies were conducted by our team on the Houston ISD public school district,[13] and we intend to expand our efforts by investigating the role of a food allergy education session in Houston private schools as well as evaluating teachers' knowledge, attitudes, and beliefs. The Chicago Food Allergy Research Survey developed by Gupta et al. was utilized for reliability, validity, and standardization.[14] We also report a summary of the changes in attitudes and beliefs of teachers postintervention.

Methods

Recruitment, Enrollment, and Randomization

Six Houston private schools were assigned to an intervention (n = 4) and control group (n = 2). Participants were recruited through flyers announcing the opportunity to participate in a food allergy educational session that was distributed throughout the Houston private school community. The first 4 schools that responded were assigned to the intervention group, while the following 2 schools were assigned to the control group. Three hundred seventy-five teachers were enrolled in the study (see Supplemental Table 1).

Educational Session

A 1-hour educational session was provided by 1 health care provider to the intervention schools. The intervention group completed a presession survey and completed the postsurvey after a 1-hour educational session. Control school teachers who did not participate in the educational session completed the postsurvey 1 month after their pretest. Case scenarios with true or false questions were incorporated to engage the audience and topics such as common source of food allergies, routes of exposure, and recognition of symptoms during a food allergic reaction as well as anaphylaxis were discussed. The correct administration of injectable epinephrine, methods to reduce risk of a reaction, the importance of a food allergy plan, bullying of food allergic patients, and class room protocols were also included. The questions were then reintroduced to the participants after the session to explain the reasoning behind the answers. The control groups received the same educational session 1 month after completing the postsurvey without intervention. The study was approved by the Baylor Institutional Research Board.

Survey

Three hundred two teachers in the intervention group completed a pretest survey and 285 completed the posttest survey after a 1-hour educational session. Seventy-three control school teachers who did not participate in the educational session completed the postest 1 month after their pretest. The survey utilized the Chicago Food Allergy Research Survey developed by Gupta et al. for standardization, reliability, and validity. This is included as Supplemental Material.

Measurement and Analysis

Subjects who were not teachers were excluded from the analysis. Responses were measured using frequencies and percentages for all teachers within both study groups. The groups' knowledge score differences and survey question comparisons were analyzed with a linear mixed-effects model with a focus on parental status as well as educational level. Furthermore, survey questions measuring attitudes and beliefs on a Likert scale were analyzed comparing responses that agreed (SA: strongly agree and A: agree) to neutral/disagree

(D: disagree and SD: strongly disagree) responses and pre- and posttest likelihoods between the control and intervention groups were analyzed utilizing a mixed-effect logistic regression model.

Results

Three hundred seventy-five teachers were divided into an experimental and control group with nonteachers excluded. Among the teaching population, surveys were assessed in the intervention (n = 302) and control arm (n = 73) for age, socioeconomic status, ethnicity, and educational level (Table 1). The subjects were between 25 and 65 years old, predominantly female, and a majority had prior exposure to food allergies through experience or work. Ethnicity was similar in both arms with the intervention schools exhibiting a slightly higher number of African American participants compared to control schools, although the difference was not significant (4% and 2% respectively, $P = .482$). Comparably, the level of education was analogous in both groups ($P = .274$). Peculiarly, none of the teachers reported having children with food allergy or relative with food allergy. The hypothesis was that these personnel might have a higher baseline knowledge base and should be excluded. Since this was not reported, no teachers were excluded. More teachers in the intervention group had a child with a food allergic friend or classmate. More teachers in the intervention group did not respond to the question regarding the details of their child's school. Teachers over the age of 65 years were more common in the intervention group.

The other notable differences between the groups included their opinions about the best way to learn about food allergy and the best way for schools to teach parents about how to protect children with food allergies. The control group were more likely to favor handouts and brochures in the mail to teach parents and learn about food allergy, and the intervention group was more likely to favor multiple modalities to learn and teach about food allergy. Prior to the intervention, 84% of teachers from the control group and 88% from the intervention group had prior exposure to food allergies. The analysis of the results based on prior exposure to food allergies did not change the results of the effect of the educational intervention. Seventeen teachers finished the pretests but did not complete the posttests in the intervention arm, and all teachers in the control arm completed both pre- and posttests.

Knowledge

As noted in Table 1, the intervention group had knowledge scores 19.85% points higher than the control posttest (95% confidence interval [CI] = 16.62–22.53; $P < .001$). Within the intervention group, the scores were 19.78 percentage points (95% CI = 18.17–21.38; $P < .001$) higher in the posttest versus the pretest. Increases in general knowledge scores did not vary by parental status. Increases pre- and posttests seen in the control arm were not significant by parental status (nonparent increase of 2.2 points, parent increase of 1.1 points). In the intervention arm, both parental groups had a pre- to posttest increase by 20.5% (95% CI = 18.47–22.60; $P < .001$) and 18.4% for nonparents and parents, respectively (95% CI: 15.55–21.27; $P < .001$). No significant differences were determined during the pretest survey (95% CI = −1.75 to 5.13; $P = .335$). All of the knowledge analyses were based on the mean score due to the nonskewed distribution.

Pretest values were higher in the knowledge scores of teachers who had a graduate school education at 9.5% (95% CI = 0.45–18.52; $P = .04$) and a college education at 10.4% (95% CI = 0.70–20.10; $P = .036$) versus that of those who did not complete college. Education level had no significant impact to the results of our study after intervention. Within our controls, however, respondents' scores for pre- to posttest surveys trended toward a larger increase in less educated teachers.

Within the intervention schools, a significant pre- to posttest score difference was observed (Supplemental

Table 1. Mean Scores for Total Participants, Education Level, and Parent Status.

Survey Scores in Intervention and Control Schools						
	Intervention Schools			Control Schools		
	Pre (N = 294)	Post (N = 272)	*P*	Pre (N = 68)	Post (N = 70)	*P*
Score (%), Median (SD)	70.8 (13)	91.7 (9.4)	<.001	68.8 (13.7)	70.8 (16.8)	.252
<HS, HS, 2 years	68.1 (9.1)	82.3 (12.5)	<.001	58.8 (14.0)	67.1 (12.0)	.081
Four years	68.3 (14.4)	90.0 (9.3)	<.001	67.9 (13.6)	69.9 (14.0)	.143
Graduate degree	69.9 (12.3)	88.9 (8.4)	<.001	69.8 (12.7)	71.7 (19.1)	.359
Nonparents	67.5 (13.3)	88.0 (9.5)	<.001	66.0 (14.2)	69.4 (19.3)	.222
Parents	71.5 (11.7)	89.9 (9.2)	<.001	67.9 (12.7)	68.8 (13.3)	.61

Abbreviations: HS, high school; SD, standard deviation.

Table 2). An improvement of 21.75% was noted among those who finished college (95% CI = 19.27–24.24; $P < .001$) and a 19.1% increase was seen in graduate school trained teachers (95% CI = 16.47–21.66; $P < .001$). Both groups scored higher than participants who had less than 4 years of a college education, but less educated teachers also demonstrated a 14.6% score difference pre- to postintervention (95% CI = 9.33–19.87; $P < .001$). Despite the pre- to posttest increase in scores for the education levels, the noted increases were not different from each other. The longevity of the participants' education levels did not correlate with their knowledge scores.

Attitudes

Participant's attitudes for both cohorts were also evaluated separately. Per the responses documented in Supplemental Table 3, several categories were highlighted such as recognizing the growing concern for food allergies as well as identifying the teasing and bullying that can characterize a food allergic patient's experience. Comparisons between the 2 groups and their odds for agreement regarding food allergy perceptions are demonstrated in Table 2. The median was chosen for comparison between groups because it was a more appropriate measurement given the skewed distribution of the results. In terms of recognizing food allergy as a serious health problem, the pretest intervention groups were similar in that they were 2.4 times more likely to agree with this statement. Posteducation, this number improved to a 16.3 times increased likelihood for agreement for the intervention group compared to the control ($P < .001$). Within the intervention group, participants were 3.3 times (95% CI = 1.6–6.7; $P = .001$) more likely to acknowledge the severity of the issue post- versus preeducation. On the other hand, the odds of agreeing that food allergies are a serious health concern was 52% lower posteducation compared to preeducation for control schools (95% CI = 0.18–1.24; $P = .131$).

The odds of agreeing that people with food allergies are treated differently because of their condition was 6 times more likely in respondents postintervention. Among intervention schools, 3.3 times (95% CI = 2–5.5; $P = .01$) more school teachers were more likely to agree that children experience discrimination due to their food allergies posteducation compared to preeducation. In contrast, control schools were less likely to agree. The odds of agreeing that children experienced bullying was 34% lower at an intervention school versus the control group prior to education. However postintervention, school teachers were 52 times more aware (intervention vs control) ($P < .01$) with a notable 25.6 times increased likelihood to agree with this statement posteducation versus preeducation (odds ratio [OR] = 25.55; 95% CI = 9.86–66.25; $P < .001$).

Beliefs

This survey also sought to investigate school teacher's thoughts regarding protocols for avoidance and special tables. Posteducation, intervention schools were 5 times more likely to recognize the difficulty of food avoidance in allergic patients compared to control schools (OR = 5.21; 95% CI = 1.73–15.70; $P = .003$) Control schools that were unable to receive this education showed that their odds for agreeing with avoidance protocols did not change. The intervention arm was 4 times more likely to agree to the utilization of special tables at schools after undergoing the educational session. This was 114 times more likely than their control counterparts (OR = 113.90; 95% CI = 1.68–7728.32; $P = .028$). The large odds ratio noted above reflects that almost all of our participants for the intervention group answered "agreed or strongly agreed" to this question.

Finally, the intervention arm revealed an upward trend in the amount of responses that recognize

Table 2. Odds of Agreement for FA Perceptions.

Odds of Agreement for FA Perceptions		
	Preintervention Compared to Precontrol	Postintervention Compared to Postcontrol
FA is a serious health problem	2.38 (CI = 0.91, 6.18); $P = .076$	16.3 (CI = 5.35, 49.48); $P < .001$
Children with FA are treated differently	1.33 (0.26, 6.88); $P = .731$	6.1 (1.14, 32.56); $P = .034$
Children with FA are teased at school	0.66 (0.05, 9.64); $P = .762$	52 (2.9, 930.75); $P = .007$
Staying away from food allergens is difficult	2.75 (0.94, 8.05); $P = .065$	5.21 (1.73, 15.70); $P = .003$
People with FA worry a lot about their allergy	1.56 (0.39, 6.16); $P = .529$	3.69 (0.91, 14.97); $P = .067$
Injectable epinephrine is important for most children with FA	3.71 (0.2, 68.49); $P = .379$	873.77 (0.05, 1.48×10^{-7}); $P = .173$
Schools should have special tables for FA students	16.33 (0.29, 914.23); $P = .174$	113.9 (1.68, 7728.32); $P = .028$
Unfair to be unable to eat peanut butter around other children	0.24 (0.04, 1.36); $P = .107$	0.19 (0.03, 1.13; $P = .069$
You would worry about having a FA child play at your house	41.04 (1.37, 1231.4); $P = .032$	1.12 (0.06, 20.59); $P = .941$

Abbreviations: CI, confidence interval; FA, food allergy.

the importance of available injectable epinephrine as a lifesaving measure during unforeseen episodes of anaphylaxis (OR = 873.77; $P = .173$). Compared to control schools, intervention schools were 874 times more likely to agree to injectable epinephrine use for children with food allergies while at school after the educational session. The large odds ratio noted above reflects that almost all of our participants for the intervention group answered "agreed or strongly agreed" to this question.

Discussion

Role in Knowledge Development

One didactic session on food allergies significantly improved knowledge in teachers within the intervention schools and clearly demonstrated a significant improvement compared to schools not receiving education. This study contributes to the current work on food allergy education aimed at school systems to address the lack of understanding in its staff when addressing food allergy-related reactions. Recognizing that such improvements were not heavily influenced by our participant's parental status and education level suggests that the 1-hour didactic session can function as a modality to bridge the gap in comprehension within teachers regardless of their background. This can help address a problem reported by Hogue et al. which exhibited that 36% of schools restricted food allergy training to nursing staff or select workers only.[1] By demonstrating that an improvement in general knowledge scores can still occur despite educational status, we hope our study can be reproduced to a wider audience in order to increase awareness beyond school and medical personnel.

Role in Physician Diagnosis

Interestingly, the teachers reported a low rate of physician diagnosis for their food allergic children. This could be for reasons that include the teachers not having biological children who suffer from food allergies or a reflection of results from Gupta et al.'s on parent report of physician diagnosis of pediatric food allergy.[15] This showed that the diagnosis of pediatric food allergy within the Chicago children was only 30%. Among these, 32.6% were diagnosed by a physician without diagnostic testing, 47.3% were determined through a skin prick test, 20.2% were confirmed with an oral food challenge, and 39.9% supported by serum-specific immunoglobulin E testing.[15] Having 30% of children undiagnosed by a physician is alarming, as it can cause parents to misconstrue the source of an allergic reaction and develop poor comprehension regarding the progression as well as pathogenesis of the disease. Lack of physician involvement can also preclude access from injectable epinephrine.[16] This observation emphasizes the detrimental effects associated with the lack of a physician diagnosis and the physician's role in promoting community awareness regarding suspected food allergies.

Role in Increasing Awareness and Shifting Attitudes

Furthermore, this study highlighted the preexisting perceptions and beliefs surrounding food allergy. Our results suggest that posteducation participants were more likely to recognize the severity of food allergies as a condition and act accordingly regarding certain school-wide-based rules such as nut-free allergy tables compared to their control counterparts. Twichell et al. who evaluated school nurses attitudes toward food allergies within the Washington DC School District also demonstrated these findings. In their study, although a majority recognized that food allergies required appropriate guidelines for management, the nonintervention cohort disagreed strongly on the use of nut-free tables for nut allergic students. This was in contrast to the beliefs of the nurses who received food allergy education who were more amenable to this approach.[17] This is consistent with our study and emphasizes the importance of food allergy education in influencing community beliefs. This, in turn, can help promote school-wide-based rules that are food allergy friendly.

Also, this study suggests that a 1-hour education session increased awareness of the discrimination food allergy students experience in school. Many children experience repetitive bullying in the school setting.[8] The noted improvement in attitudes within our subjects toward bullying in food allergic children posteducation further reinforced the importance of the 1-hour didactic session.

Role in Transforming Beliefs and Advocacy

Finally, our study introduces the role of our didactic session as a means to advocate for injectable epinephrine use within schools. Given its life-saving properties and the importance of minimizing delay in the setting of anaphylaxis, the availability of injectable epinephrine is crucial to prevent morbidity and mortality. Furthermore, given that some children with no allergic history may present initially with an anaphylactic reaction,[18] keeping injectable epinephrine in stock is very important.[19] Because one-fifth of parents of children with food allergy are fearful due to their belief that their child has a moderate to high chance of dying from food-induced anaphylaxis, stock epinephrine in school would mitigate some of this anxiety.[20] Not to mention, the EpiPen4Schools Program study demonstrated that 49% of children with an anaphylactic reaction utilized the school's stock epinephrine during these

events with approximately 9% requiring a second injection due to failing initial treatment.[21] A recent cross-sectional web-based survey study showed anaphylaxis occurred in ~11% of participating schools, and that it occurred across grade levels and in individuals without known risk factors.[18]

As of today, only 11 states make stock epinephrine mandatory with only 3% of schools allowing students and the entire workforce to administer the medication.[22] This not only bolsters the importance of injectable epinephrine availability but also emphasizes the need to train all students as well as staff of the correct use of injectable epinephrine. Our study has demonstrated that regardless of background, the didactic session has improved knowledge in its participants, but most importantly positively influenced attitudes toward recognizing the necessity of having injectable epinephrine in schools. Thus, we hope education can shift the paradigm behind preexisting beliefs regarding injectable epinephrine use that may influence current rules regarding its mandatory storage in schools. Finally, we hope reproducibility of this session and its effect on improving knowledge can overcome the restriction placed on who administers the medication.

Limitations

This study included a large number of subjects and demonstrated reproducibility within the Houston private school system. However, certain limitations to our study include the selection bias of Houston private schools and not being able to distribute the schools participating into evenly distributed groups. However, this study's findings were similar to previous literature in public school settings.[13,23] In addition, some of our calculations regarding the teacher's beliefs have yielded very high odd ratios in a setting of very few people. For example, having 2 teachers respond disagree when the rest of the teachers answered agreed can make the odds ratio appear very high (ie, >800). Despite these limitations, the educational session implemented has allowed overall for increased understanding, acceptance, and adaptability within the participants regarding food allergy management.

Conclusion

With the growing prevalence of food allergies, the emphasis on educating first respondents, school teachers, has become more vital. One food allergy didactic session has significantly improved the knowledge, attitudes, and beliefs in a group of private school teachers. In addition, it played a role in familiarizing school staff with food allergies, shifting attitudes regarding school-wide-based rules, and promoting injectable epinephrine use. Through promoting education, awareness and preparedness within the community, a safer school environment can be created for food allergic children.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

This study was approved by the Baylor College of Medicine Institutional Review Board.

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Statement of Human and Animal Rights

This article does not contain any studies with animal subjects. Human subjects were included with informed consent.

Statement of Informed Consent

Human subjects in this article signed an informed consent form prior participation in the study.

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Supplemental Material

Supplemental material for this article is available online.

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