

Management of Anaphylaxis in Kindergarten Teachers: Comparison Between Face-to-Face and Distance Education

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ABSTRACT

Objective: Anaphylaxis is seen as a growing health problem. Studies indicate that 82% of anaphylactic reactions in children occur during the school-age years. In addition, most deaths from anaphylaxis occur in schools. This study aimed to determine the awareness and knowledge levels of kindergarten teachers about anaphylaxis, to measure the change in knowledge levels before and after education, and to compare the effectiveness of face-to-face and distance education.

Materials and Methods: Two hundred and sixty teachers in kindergartens were included. The participants were divided into two groups: the face-to-face training group and the distance training group. The questions were directed at the participants before the training, immediately after the training, and in the third and sixth months thereafter. Of the teachers who attended the training, 135 (51.9%) completed all four questionnaires, 62 (45.9%) received face-to-face training, and 73 (54.1%) received training remotely via a live video connection.

Results: There was a significant increase in the correct answers to the questionnaire questions in the diagnosis and treatment steps of anaphylaxis after face-to-face and distance education ($p < 0.01$). There was no statistical difference in the number of correct answers between the post-training and the third-month questionnaires. At six months, the number of correct answers decreased to the pre-training level.

Conclusion: In this study, the awareness of kindergarten teachers about anaphylaxis was found to be insufficient. They could learn effective diagnosis and treatment methods with face-to-face and distance education. Remote live videos were as effective as face-to-face education, and the training sessions should be repeated every six months.

Keywords: Anaphylaxis, anaphylaxis education, epinephrine, kindergarten, distance education, face-to-face education, awareness

INTRODUCTION

Anaphylaxis is a severe systemic hypersensitivity reaction that can be life-threatening or fatal. The diagnosis of anaphylaxis is made through physical examination and the history using generally accepted clinical criteria. Therefore, when taking the history, the following should be carefully questioned: when the event happened, how long it lasted, how it happened, whether treatment was administered, and possible triggers (1).

The overall incidence rate of anaphylaxis is 49.8 per 100,000 person-years, while the incidence rate among individuals aged 0-19 years is 70 per 100,000 person-years (2). It has been determined that 12.7% of the cases admitted to public hospitals in Istanbul and diagnosed with anaphylaxis were under the age of 10 (3). The most common cause of anaphylaxis in children is food, accounting for 37–85% of cases (4). Insect bites and stings occur in 5–13% while drug reactions are involved in 5–12% of cases, respectively (5). 16–18% of children with food allergies ex-

perience a reaction at school (6). In addition, 24% of allergic reactions occur in individuals without a history of allergy (7).

In a survey conducted with 237 teachers at Yeditepe University, only 10% reported that they had heard of the epinephrine auto-injector. The survey also revealed that no one knew of epinephrine as the first-line drug (8). The kindergarten period is when many children are separated from their families for the first time. In this situation, a kindergarten-age student experiencing anaphylaxis can cause panic in the teacher, who may not be prepared to address her student's life-threatening condition. For this reason, kindergarten teachers should be educated about diagnosing and treating anaphylaxis.

This study aimed to determine kindergarten teachers' knowledge about the diagnosis and treatment of anaphylaxis and the effects of face-to-face education (FFE) and distance education (DE) on their knowledge levels following this instruction. It also aimed to determine the difference between FFE and DE, and the half-life of knowledge with repeated surveys.

MATERIAL and METHODS

This research was carried out in 2021 with the cooperation of Necmettin Erbakan University Meram Faculty of Medicine, Department of Pediatric Immunology and Allergy, and the Konya National Education Directorate, including all kindergartens in Konya Central districts. The study included a total of 790 kindergarten teachers from 68 states and 43 private kindergartens. Informed consent was obtained from all participating teachers.

To reach the sample size in the face-to-face education group, 112 kindergarten teachers were trained by reaching nine kindergartens over four separate days. Due to the coronavirus disease 2019 (COVID-19) pandemic, training was conducted in appropriate kindergarten areas using Microsoft PowerPoint, while following mask and distancing rules.

DE was presented to 148 kindergarten teachers selected by the National Education Directorate selected through random sampling. The presentation, including the materials used in FFE, was delivered by the person who prepared the FFE, live on Turkish Radio and Television, Distance Education TV (TRT EBA TV). After the presentation, questions were answered live.

A total of 153 teachers voluntarily completed the surveys before the training. After the training, the number of teachers who voluntarily completed the surveys was 135. When comparing the teachers' pre- and post-training responses, each survey was evaluated independently. We acknowledge that limiting the analysis to paired data from participants who completed both surveys (n=135) would strengthen internal validity. However, due to incomplete longitudinal matching, descriptive percentage-based comparisons are presented.

The study's sample size was calculated using the G*Power program, accounting for the medium effect size (0.5), a 5% margin of error, 95% confidence interval, 95% power, and a minimum sample size for the t-test in dependent groups. The calculation determined that at least 54 participants were needed for each group in order to reduce the cluster effect, and the goal was to reach at least twice the number of teachers for the sample size, compared to the original calculation. All teachers working in the kindergartens designated for FFE that day were included in the study. The study was terminated when the targeted sample size was reached.

Participants were randomly assigned to either the face-to-face education group or the online education group using simple randomization to ensure comparability between the groups.

Teachers who had been actively working in kindergartens during the study period and voluntarily agreed to participate were included in the study. Teachers who did not agree to participate in the study, who did not complete the training, or who failed to complete the questionnaire were excluded.

Kindergarten teachers who participated in the training, namely FFE and DE, were included in two separate groups. Participants were asked to fill out the same questionnaires three and six months after the training. Just before and immediately after each training, the participants were asked to complete the questionnaire prepared with Google Forms. There were 30 questions in the questionnaire (Appendix 1). Most of the questions were adopted from a study by Ercan H, et al., which was conducted with primary school teachers (8). The questions were asked as multiple choice, short answers, checkbox, and ranking forms. For example, in the question, "Indicate the order of action in the event of a serious allergic reaction (anaphy-

laxis),” participants were asked to put the randomly listed eight-item procedures in the correct order to evaluate the correct approach in case of a serious allergic reaction. Examples were provided to demonstrate how to respond. Two actions were predetermined to have the correct response as “never.” These two actions were: “I would take them to the hospital immediately without doing anything” and “I would give them fluids orally.” For the remaining six actions, participants were asked to rank them correctly in order of priority according to the sequence specified in the training. The first correct choice was accepted as “I check their vital signs and breathing.” The second correct choice was accepted as “I lay them flat on their back on a firm surface” or “I help them sit upright,” as indicated in the trainings. The third correct choice was accepted as “I elevate their legs.” The fourth and fifth correct choices were accepted as “I administer the epinephrine auto-injector” and “I call 112,” respectively. Scores were calculated by awarding 1 point for each correctly placed step according to the predetermined criteria from the trainings, resulting in a total score.

The information on the identity, age, and sex of the teachers participating in the study was kept confidential. The teachers were assigned the three-letter name codes that they determined, and the answers given were evaluated based on these codes.

Statistical Analysis

The SPSS 28.0 statistical analysis program was used for the evaluation of the data, while GraphPad Prism 6.0 was used for the design of the graphs. Chi-square or Fisher’s exact probability test was used to compare the frequencies of categorical data. Numerical data conforming to the normal distribution were given as mean ± standard deviation, and those not conforming to the normal distribution were given as the interquartile range (IQR).

Student’s t-test was used to compare the means of the data with a normal distribution, and the Mann–Whitney U test was used to compare the means of the data that did not fit the normal distribution. The McNemar and Wilcoxon tests were used to compare the rates obtained in repeated measurements. Cases with a *P*-value less than 0.05 were considered statistically significant.

RESULTS

The professional teaching period of teachers included in the study was 14.1 ± 5.7 (10–18) years, 14.5 ± 5.9 (10–18) years for those with FFE, and 13.8 ± 5.7 (10–18) years for those with DE (*p* = 0.43). Fifty-one (33.3%) teachers stated that they did not have a history of allergies in their families, nor did they have one themselves. Sixty-one (39.9%) stated that they or their family members had rhinitis (allergic rhinitis). The differences in knowledge between teachers with and without a history of allergies were not compared. This comparison could be the subject of another study. Furthermore our study found that there were no teachers with prior experience in managing an anaphylaxis case.

Table I provides information on the questions asked about whether there is an action plan for anaphylaxis and the availability of drugs that can be used in the kindergartens where the participants work. It also addresses whether exercise is one of the causes of severe allergic reactions.

The distribution levels of those who answered “yes” to the questions about allergic reactions in the groups receiving FFE and DE are shown in Table II.

Five (3.3%) of the 153 teachers who filled out the questionnaires stated that there was an action plan for anaphylaxis, while two (1.3%) stated that the medications to be used in case of anaphylaxis were available, at their schools.

Table I: Answers to the questions about allergic reaction of FFE and DE groups at before education and after education of the first visit

Survey questions	Face-to-face education n= 67 n (%)			Distance education n= 86 n (%)		
	Yes	No	I don't know	Yes	No	I don't know
Does your school have an action plan to use in case of a serious allergic reaction?	2 (3)	16 (23.9)	49 (73.1)	3 (3.5)	26 (30.2)	57 (66.3)
Do you think exercise is one of the causes of serious allergic reactions?	3 (4.5)	24 (35.8)	40 (59.7)	1 (1.2)	25 (29.1)	60 (69.8)
Are there any medications that can be used in case of a serious allergic reaction at your school?	1 (1.5)	29 (43.3)	37 (55.2)	1 (1.2)	32 (37.2)	53 (61.6)

Before the education, 115 (75.2%) teachers reported they did not receive training on anaphylaxis, while 20 (13.1%) reported receiving training through social media before.

In Table III, a comparison of the four questions asked to measure the participants' knowledge of the questionnaires made just before and immediately after the training is presented. Correct answers are shown in the table. There was a significant increase for all four questions; however, no significant difference in effectiveness of the training was observed.

Teachers were asked about any serious allergic reaction symptoms they knew of before education (BE) and after education (AE) responses are shown in Table IV. While 136 (88.9%) teachers marked rash on the skin, the least marked symptom was headache (21 teachers, 13.7%). In the AE group, 131 (97%) teachers marked skin rash, while 58 (42.9%) marked headache. While 25.4% of teachers in the BE group selected vertigo in the questionnaire, this increased to 93.7% after training. Among teachers who received FFE, 70.1% were aware of the symptoms of wheez-

ing before the education, which increased to 96.8% after the training. Similarly, in the DE group, the rate of the BE group was 70.9%, rising to 91.8% after the training.

Seventy-eight (50.98%) teachers who responded to the question "How would you react in case of a possible life-threatening allergic reaction?" in BE and AE stated that they felt inadequate in handling the intervention and were afraid of encountering it. Four (2.61%) were concerned about the intervention. In the AE group, 72 (53.3%) of the respondents stated that they were knowledgeable about the intervention and believed that they would do it correctly, while no participant expressed a lack of knowledge that would lead to incorrect application.

In response to the question, 'Indicate the order of action in the event of a severe allergic reaction (anaphylaxis)', the participants' scores reflecting the correct approach were compared between the FFE and DE phases, as well as at the third and sixth months (Figure 1). It was observed that the number of correct answers increased significantly in both the FFE and DE groups ($p < 0.01$). While no significant difference was found between the number

Table II: Distribution levels of those who answered "yes" to the questions about allergic reaction in face-to-face and distance education groups

Survey questions	Face-to-face education n=67 n (%)	Distance education n= 86 n (%)	Total n= 153 n (%)
Do you know what the symptoms of a serious allergic reaction are?	57 (85.1)	72 (83.7)	129 (84.3)
Do you know which of your students have allergies?	41 (61.2)	66 (76.7)	107 (69.9)
Have you ever heard of epinephrine (adrenaline) as a medicine?	17 (25.4)	40 (46.5)	57 (37.2)
Have you heard of an auto-injector?	14 (20.9)	22 (25.6)	36 (23.5)
Have you seen someone who has had a serious allergic reaction?	15 (22.38)	20 (23.25)	35 (22.8)
Do you know how to use the auto-injector?	5 (7.5)	10 (11.6)	15 (9.8)
Have any of your students ever had a serious allergic reaction?	3 (4.47)	3 (3.4)	6 (3.9)

Table III: Correct answers and comparisons before and after the training on drug use

Survey questions	Face-to-face education		Distance education		Before education n=67 n (%)	After education n=62 n (%)
	Before education n=67 n (%)	After education n=62 n (%)	Before education n=86 n (%)	After education n=73 n (%)		
Should she/he wear something that alerts others?	63 (94)	62 (100)	76 (88.4)	69 (94.5)	0.357	0.082
In which area should the auto-injector be applied?	12 (17.9)	61 (98.4)*	19 (22.1)	70 (95.9)*	0.663	0.347
How should adrenaline be administered?	5 (7.5)	59 (95.2)*	6 (6.9)	64 (87.7)*	0.574	0.22
What is the first drug to be used?	4 (6)	59 (95.2)*	10 (11.6)	73 (100)*	0.357	0.094

* $p < 0.01$; ** $p < 0.05$ Comparison of education methods before and after education

of correct answers in the third month of AE and the overall AE period, it was observed that the number of correct answers decreased to the level of BE six months after training.

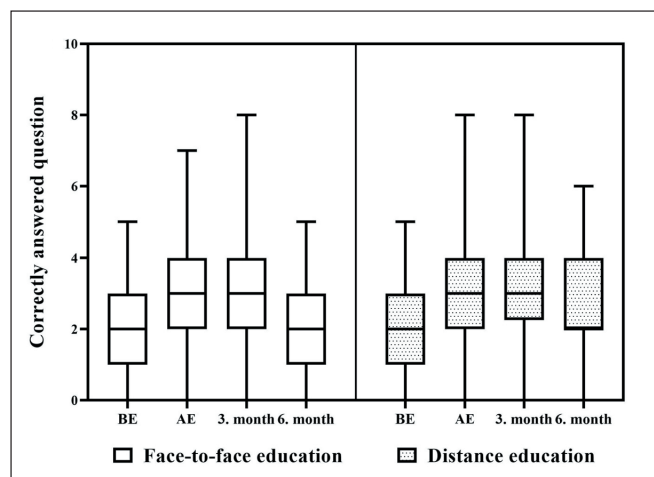


Figure 1: Number of correctly answered questions about the procedures to be performed during anaphylaxis

BE: Before education, AE: After education

ing. Throughout these phases, there was no difference in the number of correctly answered questions between the FFE and DE groups ($p=0.51$).

Regarding teaching time and the number of correct answers, no relationship was found between BE and AE, at the third month, and at the sixth month, except for the third-month answers of FFE ($r=0.28$, $p=0.04$). It was observed that at the third month in FFE, the number of correct answers decreased as the duration of teaching increased.

Strengths and Limitations

In our literature review, we did not identify a study that previously provided both face-to-face and distance education on anaphylaxis. Moreover, no study followed the results of such long-term education. We highlight this as the strongest feature of our study. At the same time, we could not find an international scale to measure teachers' knowledge on this subject. From another perspective,

Table IV: Comparison of severe allergic reaction symptoms and responses marked in the questionnaire by teachers between FFE and DE

Question: What are the symptoms of a serious allergic reaction that you know of?				
Options	Face-to-face education		Distance education	
	Before education n=67 n (%)	After education n=62 n (%)	Before education n=86 n (%)	After education n=73 n (%)
Headache	9 (13.4)	31 (50)*	15 (17.4)	27 (37)*
Dizziness	17 (25.4)	58 (93.5)*	25 (29.1)	61 (83.6)*
Fainting	21 (31.4)	59 (95.2)*	26 (30.2)	72 (98.6)*
Skin rash	63 (94)	60 (96.8)	73 (84.9)	71 (97.3)*
Wheezing	47 (70.1)	60 (96.8)*	61 (70.9)	67 (91.8)*
Diarrhea	27 (40.3)	51 (82.3)*	31 (36)	42 (57.5)*
Stomachache	28 (41.8)	57 (91.9)*	36 (41.9)	61 (83.6)*
Tachycardia	30 (44.8)	47 (75.8)*	44 (51.2)	48 (65.8)**
Bradycardia	9 (13.4)	29 (46.8)*	18 (20.9)	27 (37)*
Fear or panic	10 (14.9)	25 (40.3)*	14 (16.3)	18 (24.7)
Vomiting	29 (43.3)	60 (96.8)*	47 (54.7)	61 (83.6)*
Shortness of breath	45 (67.2)	61 (98.4)*	57 (66.3)	66 (90.4)*
Cough	27 (40.3)	43 (69.4)*	37 (43)	53 (72.6)*
Temperature rise	14 (20.9)	30 (48.4)*	20 (23.3)	18 (24.7)
Hypotension	11 (16.4)	29 (46.8)*	16 (18.6)	19 (26)
Hypertension	11 (16.4)	25 (40.3)*	15 (17.4)	13 (17.8)
Sweating	33 (49.3)	38 (61.3)*	36 (41.9)	28 (38.3)

* $p<0.01$; ** $p<0.05$ Comparison of education methods before and after education

we interpreted the lack of a scale as both a strength and a weakness of our study.

Teachers were not asked if they or their families had a history of anaphylaxis. We consider this a limiting factor as well.

Our literature review for the questions we asked the teachers did not reveal any internationally valid questionnaires. Therefore, we were unable to subject our questionnaire to validity and reliability tests.

Although it was not reflected in the results of our study, conducting face-to-face education during the COVID-19 pandemic was very challenging for us. The situation made the study more valuable for our research purposes.

DISCUSSION

Anaphylaxis is a life-threatening clinical condition that requires immediate intervention and can be treated quickly with sufficient knowledge (1,9). In our society, the process by which the mother and child are separated for the first extended period begins with kindergarten education. During this period, the families and teachers, especially children with a previous history of allergy have insufficient information about what to do in case of serious reactions, which causes concern. This study aimed to determine the level of knowledge of kindergarten teachers, who may encounter students with anaphylaxis symptoms, regarding the recognition and treatment of anaphylaxis; to compare FFE and DE methods; and to determine the half-life of knowledge with repetitive questionnaires. A pilot study by Faqerah et al. shows that simulation-based training can improve school staff's knowledge and attitudes toward anaphylaxis management (10).

It was observed that kindergarten teachers lacked the knowledge to diagnose and treat the symptoms of anaphylaxis. Most were not aware of epinephrine treatment before; and they did not have the self-confidence to perform emergency first aid in case of an anaphylactic reaction. In addition, almost all participants stated that their school did not have a first aid kit or an action plan for anaphylaxis intervention. Yildirim and Haney's study found that combining food allergy and anaphylaxis management training in schools significantly increased self-efficacy levels (11).

The results showed that only 3.9% of teachers had students who experienced a severe allergic reaction. No difference in knowledge level was observed between teachers

whose students had previously experienced severe allergic reactions and those whose students had not. Therefore, we want to emphasize that education is important regardless of experience. While 75.2% stated that they had not received training related to anaphylaxis before, 13.1% stated that they had received training through social media. While 51% of the teachers who participated in the study stated that they had insufficient knowledge of intervention and were afraid of encountering the condition BE, this rate decreased to 2.2% after the training. Similarly, AE, the percentage of teachers who believe they have sufficient knowledge and can intervene correctly regarding anaphylaxis increased from 2.61% to 53.3%.

The most critical treatment step in anaphylaxis is the administration of epinephrine as quickly as possible and at the correct dose (9). However, the majority of the teachers (76%) reported that they had not heard of an epinephrine auto-injector before. Additionally, a low rate (9.1%) reported that epinephrine should be used as the first drug in the case of anaphylaxis. Similarly, in a study conducted at Yeditepe University, only 10% reported that they had heard of epinephrine auto-injectors, while none stated epinephrine as the first drug to be used (8). These data show that in situations requiring urgent intervention, such as anaphylaxis, our teachers lack sufficient knowledge, highlighting the need for training. We recommend incorporating simulation-based training or practical applications into future research or educational programs (12).

It was observed that the teachers incorrectly identified certain findings as allergy symptoms (Table IV). A study showed that clinicians could diagnose the symptoms much more easily with better education. No significant difference between the FFE and DE methods was observed.

Mortality due to allergic reactions occurs in schools, where the cause of death is attributed to delays in epinephrine administration (9,13). Although it is alarming that delays in epinephrine administration may result in death, its practical and rapid application is advantageous (9,14). This requires schools to be involved in managing children with potentially life-threatening allergies (14,15). In this study, only 3.3% of the teachers stated that there is an action plan to be used in case of a serious allergic reaction in schools, and 1.3% stated that the drugs to be used in such a situation are available in their schools. Studies recommend the availability of spare epinephrine auto-injectors at all schools (15). We recommend providing training,

preparing an action plan, and ensuring the availability of epinephrine auto-injectors.

Participants were asked about actions that should or should not be taken in case of a serious allergic reaction. The scores were compared (Figure 1) when the order of the procedure and the “dos and don’ts” were stated correctly. There was a significant increase in the scores after AE. The BE knowledge levels of the teachers, who took FFE and DE, were similar. No significant difference between the surveys conducted immediately after the training and those at the end of three months was observed. The six-month survey data regressed to the level before the training. Both DE and FFE showed similar features. In another study, it has been shown that DE is as effective as traditional methods in increasing knowledge immediately after training, when training healthcare professionals (16).

In conclusion, this study has shown that DE is as effective as FFE and that teachers can recognize and manage the diagnosis and treatment of anaphylaxis. The DE method, which has advantages such as facilitating mass education, providing standards in education programs, reducing the cost of education, increasing the quality of education, and providing first-hand information, can also be used for diagnosis and treatment training for anaphylaxis. The study by Emeksiz et al. evaluated the anaphylaxis management and adrenaline auto-injector application skills of pediatric residents, noting that training improved application ability but that the duration of the effect of a single training session could not be assessed (17). However, in our study, we also obtained data on the half-life of knowledge through repeated questionnaires. Therefore, on-the-job training should be repeated every six months in order to keep anaphylaxis knowledge up-to-date.

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Key Message

What is already known about this topic?

Anaphylaxis is a life-threatening clinical condition that requires immediate intervention and can be treated quickly with sufficient knowledge. Most deaths from anaphylaxis occur in schools because kindergarten teachers lack sufficient knowledge of anaphylaxis.

What does this article add to our knowledge?

Distance education is as effective a method as face-to-face education for anaphylaxis management. Moreover, the educational content should be updated every six months. This integrated approach will lead to rapid and cost-effective training.

How does this study impact current management guidelines?

Either face-to-face or distance education of the teachers will enhance awareness of anaphylaxis. Consequently, this promotes early diagnosis and appropriate and urgent therapies, resulting in favorable outcomes, and thereby will prevent unexpected mortality and morbidity in children.

Ethical Approval

The study was approved by the Necmettin Erbakan University Meram Medical School Ethics Committee (Date: 01.08.2021/No: 2021/2979), and Konya Governorship Provincial Directorate of National Education (02.26.2021/No: 19771612)

Conflict of Interest

The authors declare no conflicts of interest related to this work.

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Author Contributions

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REFERENCES

1. Muraro A, Worm M, Alviani C, Cardona V, DunnGalvin A, Garvey LH, et al. European Academy of Allergy and Clinical Immunology, Food Allergy, Anaphylaxis Guidelines Group. EAA-CI guidelines: Anaphylaxis (2021 update). *Allergy* 2022;77:357-77.
2. Decker WW, Campbell RL, Manivannan V, Luke A, St Sauver JL, Weaver A, et al. The etiology and incidence of anaphylaxis in Rochester, Minnesota: a report from the Rochester Epidemiology Project. *J Allergy Clin Immunol* 2008;122(6):1161-5.
3. Cetinkaya F, Incioglu A, Birinci S, Karaman BE, Dokucu AI, Sheikh A. Hospital admissions for anaphylaxis in Istanbul, Turkey. *Allergy* 2013;68:128-30.
4. Dinakar C. Anaphylaxis in children: current understanding and key issues in diagnosis and treatment. *Curr Allergy Asthma Rep* 2012;12:641-9.
5. Bansal PJ, Marsh R, Patel B, Tobin MC. Recognition, evaluation, and treatment of anaphylaxis in the child care setting. *Ann Allergy Asthma Immunol* 2005;94:55-9.
6. Nowak-Wegrzyn A, Conover-Walker MK, Wood RA. Food-allergic reactions in schools and preschools. *Arch Pediatr Adolesc Med* 2001;155:790-5.
7. Sicherer SH, Furlong TJ, DeSimone J, Sampson HA. The US Peanut and Tree Nut Allergy Registry: characteristics of reactions in schools and day care. *J Pediatr* 2001;138(4):560-5.
8. Ercan H, Ozen A, Karatepe H, Berber M, Cengizlier R. Primary school teachers' knowledge about and attitudes toward anaphylaxis. *Pediatr Allergy Immunol* 2012;23:428-32.

9. Brown JC, Simons E, Rudders SA. Epinephrine in the Management of Anaphylaxis. *J Allergy Clin Immunol Pract* 2020;8:1186-95.
10. Faqerah N, Habiballah SB, Damanhori M, Alsaggaf A, Halwani MA. Evaluating teachers' knowledge and attitude toward food allergy and anaphylaxis: a pilot simulation-based questionnaire study in Rabigh elementary schools. *Front Public Health* 2025;13:1631540.
11. Yıldırım A, Haney MO. Effects of training on teachers' food allergy and anaphylaxis management self-efficacy levels. *Allergol Immunopathol (Madr)* 2023;51(4):158-63.
12. Donovan P, O'Connor P. The confidence and competence of primary school staff to administer an adrenaline auto-injector. *Eur J Pediatr* 2024;183(7):2899-904.
13. Turner PJ, Jerschow E, Umasunthar T, Lin R, Campbell DE, Boyle RJ. Fatal Anaphylaxis: Mortality Rate and Risk Factors. *J Allergy Clin Immunol Pract* 2017;5:1169-78.
14. Sampson HA. Fatal food-induced anaphylaxis. *Allergy* 1998;53(46 Suppl):125-30.
15. McIntyre CL, Sheetz AH, Carroll CR, Young MC. Administration of epinephrine for life-threatening allergic reactions in school settings. *Pediatrics* 2005;116:1134-40.
16. Salter SM, Vale S, Sanfilippo FM, Loh R, Clifford RM. Long-term effectiveness of online anaphylaxis education for pharmacists. *Am J Pharm Educ* 2014 15;78:136.
17. Sengul Emeksiz Z, Güngör AA, Demirel AC, Dibek Mısırlıoğlu E. Knowledge Levels of Pediatric Assistants on Anaphylaxis Management and Adrenaline Autoinjector Application Skills: Pretraining and Posttraining Evaluation. *J Contemp Med* 2022;12(5):789-93.

Appendix 1:

Questionnaire form

1. Do you agree to voluntarily participate in this survey study?*
- ☐ I agree
2. Can you write the last 4 digits of your phone number and the initials of your name / name-surname?*
3. Cell Phone Number *
4. What type of education are you involved in?*
- ☐ Distance education
- ☐ YüzFace-to-face education
5. Which questionnaire are you filling out?*
- ☐ Before education
- ☐ Immediately after education
- ☐ 3 months after education
- ☐ 6 months after education
6. The name of the kindergarten you work at *
7. How long have you been a teacher?*
8. Do you or your family have a known history of allergic disease? If yes, tick which one.*
- ☐ Nope
- ☐ Allergic rhinitis
- ☐ Asthma
- ☐ Food allergy
- ☐ Eczema - skin allergy
- ☐ Drug allergy
9. What would your approach be in the event of a possible life-threatening allergic reaction?*
- ☐ I am well informed about the intervention and I believe I will do it the right way.
- ☐ I am well informed about intervention, but I am worried that I will be able to respond effectively.
- ☐ I am well informed about the intervention, but I fear that I will panic when faced with a problem.
- ☐ I feel inadequate to intervene and afraid to encounter.
- ☐ I don't know how to intervene, I avoid intervention because I fear legal responsibility.
10. Have any of your students ever had a serious allergic reaction?*
- ☐ Yes
- ☐ No
11. Have you seen someone who has had a serious allergic reaction?*
- ☐ Yes
- ☐ No
12. Do you know which of your students have allergies?*
- ☐ Yes, all of them
- ☐ Of some
- ☐ No
13. Have you been informed about anaphylaxis before?*
- ☐ Yes
- ☐ No
14. If you were informed, how were you informed? (You can mark more than one option)*
- ☐ Video training
- ☐ Seminar
- ☐ Social media
- ☐ Booklet
- ☐ I was not informed

15. Does your school have an emergency kit that you can intervene in an emergency??*
- ☐ Yes
 - ☐ No
 - ☐ I don't know
16. What kind of substances can cause severe allergic reaction? (You can tick more than one.)*
- ☐ Mite
 - ☐ Insect bite
 - ☐ Drugs
 - ☐ Animal fluff
 - ☐ Pollen
 - ☐ Food and beverage
 - ☐ I don't know
17. What type of foods can cause a serious allergic reaction?(You can tick more than one.)*
- ☐ Fish
 - ☐ Wheat
 - ☐ Strawberry
 - ☐ Tomatoes
 - ☐ Meat
 - ☐ Sweetcorn
 - ☐ Rice
 - ☐ Milk
 - ☐ Sesame
 - ☐ Peanut
 - ☐ Egg
18. Do you think exercise is one of the causes of serious allergic reactions?*
- ☐ Yes
 - ☐ No
 - ☐ I don't know
19. Do you know what the symptoms of a serious allergic reaction are?*
- ☐ Yes, I know
 - ☐ I know some
 - ☐ No, I don't know
20. What are the symptoms of a serious allergic reaction that you know of? (You can mark more than one option.) *
- ☐ Headache
 - ☐ Dizziness
 - ☐ Fainting
 - ☐ Runny nose
 - ☐ Skin rash
 - ☐ Wheezing
 - ☐ Diarrhea
 - ☐ Stomachache
 - ☐ Tachycardia
 - ☐ Bradycardia
 - ☐ Fear or panic
 - ☐ Vomiting
 - ☐ Shortness of breath
 - ☐ Cough
 - ☐ Temperature rise
 - ☐ Hypotension
 - ☐ Hypertension
 - ☐ Sweating

21. What is the initial drug to be used in the event of a life threatening allergic reaction?*
- ☐ Antihistamines (allergy medicines)
 - ☐ Epinephrine-adrenaline
 - ☐ Cortisone
 - ☐ Inhaling drugs (Salbutamol inhalation)
 - ☐ No idea
22. Should children with serious allergies wear something alerting others to their allergy?*
- ☐ Yes
 - ☐ No
23. Does your school have an action plan to use in case of a serious allergic reaction?*
- ☐ There are
 - ☐ Not
 - ☐ I don't know
24. Are there any medications that can be used in case of a serious allergic reaction at your school?*
- ☐ There are
 - ☐ Not
 - ☐ I don't know
25. Have you ever heard of epinephrine (adrenaline) as a medicine?*
- ☐ Yes
 - ☐ No
26. How should adrenaline be administered?*
- ☐ No idea
 - ☐ Intravenous
 - ☐ Subcutaneous
 - ☐ Intramuscular
27. Have you heard of an auto-injector?*
- ☐ Yes
 - ☐ No
28. Do you know how to use the auto-injector?*
- ☐ Yes
 - ☐ No
29. In which area should the auto-injector be applied?*
- ☐ Shoulder area
 - ☐ Side of the hip
 - ☐ Side of the thigh
30. Indicate the order of action in case of a serious allergic reaction (anaphylaxis). (First mark the action you want to do as '1', then mark 2-3... in order of priority.)*
- | | Never | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| I call 112 emergency service | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| I check her/his vital signs and breathing | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| I'll take you to the hospital right away without doing anything. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| I'll lift your legs up | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| I apply the epinephrine auto-injector | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| I make her/him sit | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Lays on the back flat on the floor | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| I make him/him take fluids by mo | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |