

# Saudi teachers' confidence and attitude about their role in anaphylaxis management

Mohammed A. Alsuhaibani<sup>1</sup>, Salman Alharbi<sup>2</sup>, Salman Alonazy<sup>2</sup>,  
Marwa Almozeri<sup>2</sup>, Malak Almutairi<sup>2</sup>, Aqeel Alaqeel<sup>1</sup>

<sup>1</sup>Department of Pediatrics, College of Medicine, Qassim University, <sup>2</sup>Medical Intern, College of Medicine, Qassim University, Qassim, Saudi Arabia

## ABSTRACT

**Background and Aims:** Anaphylaxis is a common emergency and life-threatening hypersensitivity reaction defined as a rapid generalized allergic reaction. Prior international studies have shown that school personnel is often not familiar with the signs of hypersensitivity or with appropriate management strategies that should be initiated at school for children with an anaphylactic reaction. Moreover, no studies have evaluated the awareness of anaphylaxis by school teachers in Saudi Arabia. The aim of this study was to determine teachers' knowledge, attitudes, and practices toward anaphylaxis in Al-Qassim, Saudi Arabia. **Methods:** This was a cross-sectional study conducted at a public school in Al-Qassim, Saudi Arabia via a validated fourteen items questionnaire aimed to survey teacher knowledge, attitudes, and practices toward anaphylaxis. The questionnaires were disseminated using a multistage random sampling technique to Saudi national's teachers from different regions in Al-Qassim. **Results:** Most teachers had a low level of knowledge (85.3%) of anaphylaxis and positive attitudes (72.9%), and the level of practice was reported as low (48.9%) to moderate (47.5%). The most common sources of information regarding anaphylaxis were the internet and social media. When considering significant factors associated with knowledge, attitudes, and practices (KAP), we found that sex, years of experience in teaching and witnessing students suffering from anaphylaxis were all positively associated with KAP. **Conclusion:** The overall knowledge and practices of teachers regarding anaphylactic reactions were poor, although teachers' attitudes toward learning this information were positive. Thus, teachers need further education regarding the management of allergic reaction.

**Keywords:** Allergic reactions, anaphylaxis, children, Saudi Arabia, school teachers

## Introduction

Anaphylaxis is a common medical emergency and life-threatening acute allergic reaction. This rapid, multisystem, serious immunological reaction can be fatal if left untreated, owing to rapid progression to respiratory collapse.<sup>[1]</sup> Anaphylaxis is typically described as a serious, life-threatening systemic allergic reaction characterized by fast onset which may compromise respiratory or circulatory system.<sup>[2]</sup> Since anaphylaxis is a multisystemic body reaction, various unpredictable signs and

symptoms occur depending on the individual as well as the type of allergens exposure. For example, cardiovascular and cutaneous manifestations are often more common in adults, whereas respiratory symptoms are more common in children.<sup>[3]</sup>

In general, the most frequent clinical presentation of anaphylaxis are urticaria, angioedema, erythema, itching, difficulty breathing, tongue swelling, and death owing to cardiovascular collapse or respiratory obstruction.<sup>[3]</sup> The prevalence of anaphylaxis has grown within the last few years, potentially because of a noticeable spread in allergic sensitization to foods, particularly in the pediatric population, besides an increase in outdoor activity and the different biologic medications.<sup>[4]</sup> Therefore, as the

**Address for correspondence:** Dr. Mohammed A. Alsuhaibani, Qassim Collage of Medicine, Qassim University, P. O. Box 6666, Buraidah - 51452, Saudi Arabia.  
E-mail: salman-hamd@hotmail.com

Received: 21-07-2019 Revised: 22-08-2019 Accepted: 29-08-2019

### Access this article online

#### Quick Response Code:



**Website:**  
www.jfmipc.com

**DOI:**  
10.4103/jfmipc.jfmipc\_562\_19

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

**How to cite this article:** Alsuhaibani MA, Alharbi S, Alonazy S, Almozeri M, Almutairi M, Alaqeel A. Saudi teachers' confidence and attitude about their role in anaphylaxis management. J Family Med Prim Care 2019;8:2975-82.

prevalence of allergy increases, school-age children are at greater risk of developing an anaphylactic reaction.<sup>[5,6]</sup> Anaphylaxis occurs annually in 30 of 100,000 people in the United States of America, with a reported death rate of 1-2%,<sup>[7]</sup> and it is estimated that one in 10,000 children has an anaphylactic reaction each year, approximately 82% of which occur in school-age children.<sup>[8]</sup>

The prevalence of anaphylaxis is unknown in Saudi Arabia. However, a study conducted in Riyadh, Saudi Arabia revealed that the most prevalent manifestations were urticaria and angioedema and that the most common triggers for anaphylaxis were food and drug allergies.<sup>[9]</sup> In general, the most common triggers of anaphylaxis globally are foods, such as peanuts, tree nuts, shellfish, fish, cow's milk, eggs, and wheat. Medications (most commonly penicillin), exercise, and natural rubber latex can also cause anaphylaxis. However, the cause of anaphylaxis is sometimes unknown.<sup>[10]</sup> Among the many causes of anaphylaxis, food allergies are the most frequently encountered causes in children.<sup>[11,12]</sup> Studies have indicated that 16-18% of children with food allergies have a reaction after accidentally ingesting foods.<sup>[13,14]</sup> In addition, 25% of reported serious and life-threatening reactions in school occur in children without prior food allergy diagnosis.<sup>[14,15]</sup>

Since there is no cure for food allergy, the first and best defense is to avoid known triggers.<sup>[16]</sup> However, some causes might not have been recognized earlier and avoiding the triggers is not possible each time. So, as the incidence of food allergies in children increases, schools should be prepared to respond appropriately to unexpected anaphylactic events.<sup>[15]</sup> Anaphylaxis is a serious condition needs early diagnosis and evidence-based guidelines suggest that immediate epinephrine administration should be the first line of treatment for an anaphylactic episode.<sup>[4,17]</sup> In schools, the patient, school nurse, teacher, and other trained school staff may use an epinephrine auto-injector. The European Academy of Allergology and Clinical Immunology emphasize the importance of the school personnel's knowledge in recognizing and providing first aid measurement for children with an allergic reaction and others.<sup>[10,18-20]</sup> Prior international studies have shown that school personnel not familiar with hypersensitivity signs and management strategies that should be initiated at school for children with an anaphylactic reaction.<sup>[21,22]</sup>

According to available literature, no studies have been conducted in our region regarding the school teachers' awareness of anaphylaxis. Accordingly, in this study, we examined the knowledge of school teachers regarding the clinical features and acute management of anaphylaxis in Saudi Arabia.

## Methods

This was a cross-sectional conducted using a validated questionnaire designed to survey teacher awareness, knowledge, and attitudes regarding anaphylaxis. The questionnaire was distributed to Saudi national teachers from different regions in Al-Qassim. We used a multistage random sampling technique.

The first stage included all schools in the largest three cities in the Al-Qassim region based on population size (Buraydah, Unaizah, and Alrass). In the second stage, we selected 16 elementary, intermediate, and secondary government schools (8 for boys and 8 for girls, each) in each city from the Ministry of Education official list, using a simple random sampling technique. This gave 48 schools. In the final stage, the teachers were chosen from each school by convenience sampling. Inclusion criteria were as follows: Saudi teachers in primary, intermediate, and secondary schools in the Al-Qassim region. Non-Saudi teachers were excluded. The total number of teachers in Al-Qassim was 20,291 teachers. The required sample size was 384 using  $n = z^2pq/d^2$  and a Z-statistic value of 1.96, and a significance level of 0.05.

The questionnaire included three main sections. First, the demographic characteristics of the teachers, including age, sex, and years of service, were determined. In the second section, we used 10 questions to examine teachers' awareness with regard to the causes and clinical features of anaphylactic reactions. The questionnaire was adopted from a study by Ercan *et al.*<sup>[20]</sup> with some modifications. The questionnaire was validated in two steps. First, it was revised by three faculty members with clinical and research experience. Second, following a pilot study with a sample size of 20 teachers who were not included in this study, minor Arabic language modifications were made.

500 self-administered questionnaires were distributed by 8 volunteer medical students to teachers after a brief explanation of the purpose of the study and assurance that the information provided would be kept secure and confidential. The questionnaire was filled and collected on the same day from 476 teachers (95.2% response rate). Consent to participate in this study from the teachers was verbally obtained.

We used MS Excel to gather all data in this project. After necessary data cleaning and recoding, the data were exported to Statistical Packages for Social Sciences (SPSS) version 20 for further tabulation and subsequent statistical data analyses. Descriptive statistics are presented using numbers and percentages for all categorical variables, whereas continuous variables were summarized using means  $\pm$  standard deviations. Correlations were evaluated using Pearson correlations. The associations of knowledge, attitudes, and practices (KAP) scores with sociodemographic characteristics of participants were assessed using Mann-Whitney U and Kruskal-Wallis tests as nonparametric or independent t-tests, respectively, and one-way analysis of variance as a parametric test. Results with *P* values of less than or equal to 0.05 were considered statistically significant. Normality tests were conducted using Shapiro-Wilk tests and Kolmogorov-Smirnov tests, and results with *P* values of less than 0.05 were considered significant.

Evaluation of teachers' knowledge of anaphylaxis was performed using a questionnaire with 10 items. In this questionnaire, the most appropriate answer was identified and marked for each question; the correct answer was coded as 1, and the incorrect

answers were coded as 0. For items #4 and #7, more than one answer could be marked as correct. By summing up all questions, total scores ranged from 1 to 16, and by using the cutoff points of 60–80%, participants were classified as having low knowledge if the score range was from 1 to 8, moderate knowledge if the score range was from 9 to 12, and high knowledge, if the score range was from 13 to 16.

Measurement of teachers' attitudes toward anaphylaxis was performed using four questions, where "strongly disagree" was coded as 1, "disagree" was coded as 2, "I don't know" was coded as 3, "agree" was coded as 4, and "strongly agree" was coded as 5; the total score was calculated by adding scores for all four questions. The minimum score was 5, and the maximum score was 20. By using cutoff points of 60–80% of the total score, scores of 5–12 were classified as a negative attitude, scores of 13–16 were classified as a neutral attitude, and scores of 17–20 were classified as a positive attitude.

Assessment of teachers' practices with regard to anaphylaxis was performed using four questions, in which "yes" was coded as 2, "no" was coded as 1, and "I don't know" was coded as 0. By adding all four questions, the minimum score generated was 1, and the maximum score generated was 8. By using cutoff points of 60–80% of the total score, scores of 1–3 were classified as low practice, scores of 4–6 were classified as moderate practice, and scores of 7–8 were classified as high practice.

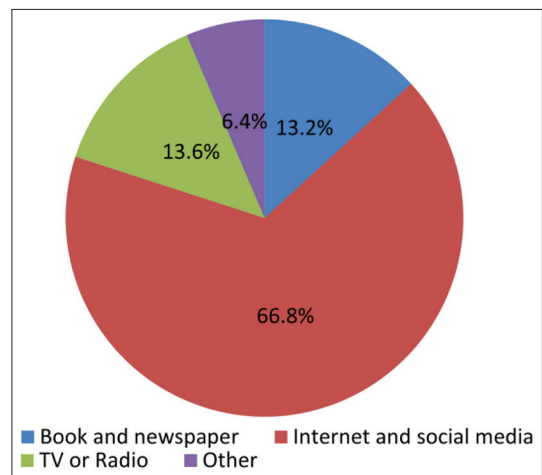
### Results

Table 1 shows the sociodemographic characteristics of 476 Saudi teachers. The age range was from 23–60 years old, and the majority was in the middle age group (36–45 years). More than half of the respondents were men. Moreover, 28.6% of the respondents had witnessed a student suffering from anaphylaxis.

Knowledge of teachers regarding anaphylaxis is presented in Table 2. Approximately one-fourth of teachers had prior students with anaphylactic reactions. The most common substances reported to cause anaphylaxis were insect stings (54.4%), followed by nuts (54.2%). Only 8% percent believed that sport activities could cause anaphylaxis. Furthermore, the teachers believed that the most common foods triggering anaphylaxis were eggs (27.7%) and nuts (22.1%). Surprisingly, in cases of anaphylaxis, the most common first aid action that would be carried out by the teachers in our study was to inform the family or to take the patient to the hospital (26.3%); only 8.2% of teachers would consider administering epinephrine injection. In terms of the first administered drug in case of anaphylaxis, half of the teachers reported that they would use an antihistamine, whereas 13.3% reported that they would use epinephrine injection. When asked about the proper route of epinephrine administration, most of the teachers in our sample (77.5%) did not know, and only 6% selected the appropriate method, which is intramuscular injection.

**Table 1: Sociodemographic characteristics of participants**

Study data	n (%) (n=476)
Age group in years	
23-35 years	168 (35.3%)
36-45 years	240 (50.4%)
>45 years	68 (14.3%)
Sex	
Male	252 (52.9%)
Female	224 (47.1%)
Governorate	
Alrass	185 (38.9%)
Buraidah	176 (37.0%)
Onaizah	115 (24.2%)
Educational level	
Secondary	12 (02.5%)
Diploma	78 (16.4%)
University	370 (77.7%)
Master degree	16 (03.4%)
School level taught	
Primary	150 (31.5%)
Middle	160 (33.6%)
Secondary	166 (34.9%)
Specialty	
Arabic language	84 (17.6%)
Science	83 (17.4%)
Math	76 (16.0%)
English	30 (06.3%)
Islamic studies	92 (19.3%)
Others	111 (23.3%)
Years of service in education	
1-10 years	206 (43.3%)
11-15 years	103 (21.6%)
>15 years	167 (35.1%)
Had witnessed students suffering from anaphylaxis	
Yes	136 (28.6%)
No	340 (71.4%)



**Figure 1: Source of anaphylaxis information**

From a practical point of view, 31.3% of teachers had knowledge of epinephrine as a medication and 14.3% were aware of the administration method of self-injection using an

**Table 2: Statement of teachers' knowledge of anaphylaxis**

Statement	n (%) (n=476)
K1. Knowledge of any of students with anaphylaxis	
Yes*	121 (25.4%)
No	355 (74.6%)
K2. Aware of anaphylaxis	
Yes*	235 (49.4%)
No	241 (50.6%)
K3. Knowledge about the symptoms of anaphylaxis	
Yes*	220 (46.2%)
No	256 (53.8%)
K4. Substances that can cause anaphylaxis <sup>†</sup>	
Drugs*	162 (34.0%)
Insect sting*	259 (54.4%)
Seafood*	225 (47.3%)
Pollen*	238 (50.0%)
Nuts*	258 (54.2%)
K5. Sport activities may be considered one of the causes of anaphylaxis	
Yes	42 (08.8%)
No*	212 (44.5%)
I don't know	222 (46.6%)
K6. Rubber products, such as Gauntlet, are one cause of anaphylaxis	
Yes*	124 (26.1%)
No	85 (17.9%)
I don't know	267 (56.1%)
K7. Common foods that can cause anaphylaxis <sup>†</sup>	
Eggs*	132 (27.7%)
Nuts*	105 (22.1%)
Bananas*	84 (17.6%)
Seafood*	36 (07.6%)
Strawberries*	20 (04.2%)
Others*	149 (31.3%)
K8. First aid that must be performed in cases of anaphylaxis	
Give epinephrine injection (Epipen) *	39 (08.2%)
Tell his family/her to take him to the hospital	125 (26.3%)
Call ambulance service	115 (24.2%)
Performed CPR	15 (03.2%)
Antihistamines injection	70 (14.7%)
I don't know	112 (23.5%)
K9. Initial drug that should be used in case of anaphylaxis <sup>#</sup>	
Epinephrine*	61 (13.3%)
Antihistamine	228 (49.9%)
Herbal medicine	16 (03.5%)
Analgesics	106 (23.2%)
I don't know	46 (10.1%)
K10. Route of epinephrine administration as initial drug in the management of anaphylaxis	
Intravenous	29 (06.1%)
Intramuscular*	28 (05.9%)
Subcutaneous	50 (10.5%)
I don't know	369 (77.5%)

<sup>†</sup>Variable with multiple responses. <sup>#</sup>Missing cases were excluded from the analysis. \*Correct answer

Epipen. Moreover, 8.2% and 7% of teachers reported that their schools had an action plan and first aid medicine in case of an anaphylactic reaction, respectively [Table 3].

**Table 3: Statement of teachers' practical knowledge of anaphylaxis**

Statement	n (%) (n=476)
P1. Did you ever heard of epinephrine as a drug?	
Yes	149 (31.3%)
No	327 (68.7%)
P2. Have you ever heard before about self-injection (Epipen)?	
Yes	68 (14.3%)
No	408 (85.7%)
P2.1 If yes, do you have knowledge of self-injection (Epipen) <sup>‡</sup>	
Yes	31 (45.6%)
No	37 (54.4%)
P3. In cases of anaphylaxis: is there an action plan in your school?	
Yes	39 (08.2%)
No	200 (42.0%)
I don't know	237 (49.8%)
P4. Are first-aid medicines for anaphylaxis available in your school?	
Yes	34 (07.1%)
No	200 (42.0%)
I don't know	242 (50.8%)

<sup>‡</sup>Only 68 teachers had heard about self-injection and were included in the analysis

The most common sources of information regarding anaphylaxis were demonstrated [Figure 1], and teachers reported that the most common symptoms of anaphylaxis were shortness of breath (37.7%), followed by itching (30.9) [Figure 2].

Figure 3 depicted the attitude of the respondents toward anaphylaxis. Based on the results, most teachers either agreed or strongly agreed with the four attitude statements regarding anaphylaxis.

Table 4 describes the KAP scores of teachers toward anaphylaxis. The mean knowledge score based on the given criteria was 5.7 (standard deviation: 2.6), and most of the participants (85.3%) had low level of knowledge. Additionally, 13.7% of participants had moderate knowledge, and only five teachers had high knowledge. When analyzing the attitudes of teachers toward anaphylaxis, based on the given criteria, the mean attitude score was 17.8 (standard deviation: 2.1), and analysis of the level of attitude revealed that 2.3%, 24.8%, and 72.9% of teachers had negative, neutral, and positive attitudes, respectively. With regard to practices, the mean practice score was 3.6 (standard deviation: 1.4); 48.9%, 47.5%, and 3.6% of teachers reported low, moderate, and high levels of practice, respectively.

Pearson correlations were conducted to measure the correlations among KAP scores [Table 5]. We observed statistically significant correlations between knowledge and attitude scores ( $r = 0.003$ ,  $P = 0.003$ ) and between knowledge and practice scores ( $r = 0.290$ ,  $P < 0.001$ ). When measuring the correlations of attitude scores with knowledge and practice scores, both knowledge ( $r = 0.138$ ,  $P = 0.003$ ) and practice scores ( $r = 0.290$ ,  $P < 0.001$ ) showed significant correlations.

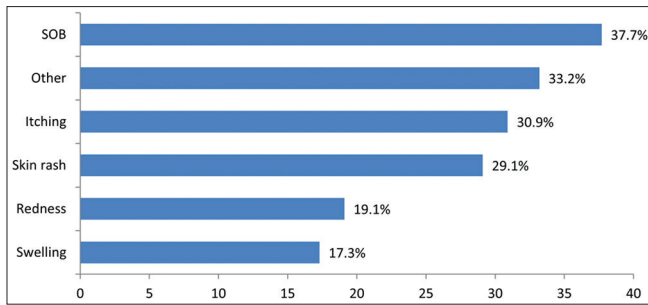


Figure 2: Symptoms of anaphylaxis

When comparing KAP scores according to sociodemographic characteristics of participants, the average knowledge ( $P = 0.002$ ) and attitude scores ( $P = 0.001$ ) were significantly higher in women than in men. In contrast, men had significantly higher practice scores ( $P < 0.001$ ). The mean practice score of teachers who had a Bachelor's degree or higher was significantly higher than that in teachers with only diploma or less ( $P = 0.050$ ). Those with 11–15 years of teaching experience had significantly higher mean knowledge scores than teachers in other categories ( $P = 0.004$ ). In contrast, the mean practice score was significantly higher for teachers with 1–10 years of experience. The mean knowledge ( $P < 0.001$ ), attitude ( $P = 0.002$ ), and practice scores ( $P = 0.028$ ) of those who witnessed students suffering from anaphylaxis were significantly higher than scores for teachers who had not witnessed such events. There were no other significant differences in KAP scores according to age group and school level [Table 6].

## Discussion

At school, teachers are in charge of caring for children. Thus, it is critical that teachers are aware of the medical conditions of their students. Anaphylaxis is an acute life-threatening condition that can result in death if not managed promptly and appropriately. In this study, we evaluated teachers' knowledge, awareness, and attitudes toward anaphylaxis. Our results showed that teachers generally had only a low level of overall knowledge regarding anaphylaxis. Moreover, this is the first paper measuring the overall knowledge, attitudes, and practices of anaphylaxis in teachers in Saudi Arabia.

In this study, one-fourth of the teachers were able to identify which of their students had anaphylactic reactions. In contrast, in Turkey, 52% of teachers knew whether any children in their classes had anaphylaxis. However, in Spain, only 3.5% of teachers had witnessed anaphylactic reaction among their students.<sup>[20,21]</sup> Teachers' awareness regarding which students have a history of anaphylaxis is essential and a critical step for initial detection and intervention. Importantly, because the lives of children are in danger during allergic reactions, teachers must understand the signs, symptoms, and treatments of anaphylactic reactions.

Saudi teachers had positive attitudes toward anaphylaxis, consistent with a published in Slovenia,<sup>[23]</sup> where a group of researchers

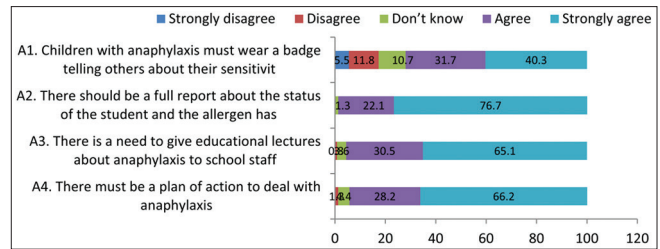


Figure 3: Attitudes of teachers toward anaphylaxis

Table 4: Prevalence of knowledge, attitudes, and practices toward anaphylaxis

Predictor	n (%) (n=476)
Knowledge total score (mean±SD)	05.7±02.6
Level of knowledge	
Low	406 (85.3%)
Moderate	65 (13.7%)
High	05 (01.1%)
Attitude total score (mean±SD)	17.8±02.1
Level of attitude	
Negative	11 (02.3%)
Neutral	118 (24.8%)
Positive	347 (72.9%)
Practice total score (mean±SD)	03.6±01.4
Level of practice	
Low	233 (48.9%)
Moderate	226 (47.5%)
High	17 (03.6%)

Table 5: Correlations between knowledge, attitude, and practice scores (n=476)

Predictor	Knowledge score	Attitude score	Practice score
Knowledge score			
Pearson correlation	1	0.138	0.290
P		<b>0.003**</b>	<b>&lt; 0.001**</b>
Attitude score			
Pearson correlation	0.138	1	0.019
P	<b>0.003**</b>		0.685
Practice score			
Pearson correlation	0.290	0.019	1
P	<b>&lt; 0.001**</b>	0.685	

\*\*Means significant at  $P \leq 0.05$  level

studied future teachers' attitudes and knowledge regarding the management of potential students and life-threatening allergic reactions. Additionally, Devetak *et al.* reported that 85% of future teachers in Slovenia demonstrated a positive attitude towards learning more about the management of life-threatening allergic reactions in potential students.<sup>[24]</sup> Consistent with this, in our study, we found that most teachers agreed or strongly agreed with the statement that “there is a need to give educational lectures about anaphylaxis to school staff”. Educational session can play an excellent role to improve the teacher's knowledge and practice toward anaphylaxis.<sup>[25]</sup>

**Table 6: Comparisons among knowledge, attitude, and practice scores according to the sociodemographic characteristics of participants (n=476)**

Factor	Knowledge score Mean±SD Total score (16)	Attitude score Mean±SD score (20)	Practice score Mean±SD score (8)
Age group in years			
23-35 years	05.9±02.8	17.8±02.0	03.7±01.5
36-45 years	05.7±02.6	17.8±02.1	03.6±01.4
> 45 years	05.3±02.5	17.9±02.6	03.5±01.4
<i>P</i> <sup>a</sup>	<b>0.463</b>	<b>0.531</b>	<b>0.750</b>
Sex			
Male	05.3±02.4	17.5±02.3	03.9±01.4
Female	06.1±02.8	18.2±01.7	03.2±01.4
<i>P</i> <sup>b</sup>	<b>0.002**</b>	<b>0.001**</b>	<b>&lt;0.001**</b>
Governorate			
Alrass	05.5±02.5	17.5±02.1	03.5±01.4
Buraidah	05.8±02.8	18.0±01.9	03.8±01.4
Onaizah	05.8±02.8	18.1±02.1	03.5±01.5
<i>P</i> <sup>a</sup>	<b>0.675</b>	<b>0.012**</b>	<b>0.113</b>
Educational level			
Diploma or below	05.5±02.5	17.5±02.4	03.3±01.3
University or higher	05.7±02.7	17.9±01.9	03.7±01.4
<i>P</i> <sup>b</sup>	<b>0.674</b>	<b>0.277</b>	<b>0.050**</b>
Years of service in education			
1-10 years	05.9±02.8	17.7±02.0	03.8±01.5
11-15 years	06.2±02.5	18.1±01.9	03.5±01.4
> 15 years	05.2±02.5	17.9±02.2	03.4±1.3
<i>P</i> <sup>a</sup>	<b>0.004**</b>	<b>0.160</b>	<b>0.013**</b>
Witnessed students suffered from anaphylaxis			
Yes	06.6±02.5	18.4±01.7	03.8±01.4
No	05.3±02.6	17.6±02.2	03.5±01.4
<i>P</i> <sup>b</sup>	<b>&lt; 0.001**</b>	<b>0.002**</b>	<b>0.028**</b>

The bold is reflecting *P* value result. <sup>a</sup>*P* values were calculated using Kruskal Wallis tests. <sup>b</sup>*P* values were calculated using Mann-Whitney U tests. \*\*Significant at *P*≤0.05

Knowing the symptoms and causes of anaphylaxis is necessary for preventing allergic reactions. In this study, teachers reported that the most common symptoms of anaphylaxis were shortness of breath, itching, and skin rash and that the most common causes were insect stings, pollen, and drugs. Alkanhal *et al.* published their experience in one tertiary center in Saudi Arabia. They reported that among 161 cases of anaphylaxis, the most common symptoms were urticaria, angioedema and shortness of breath, whereas the most common triggers of anaphylaxis were food, insect bites, drugs and environmental causes.<sup>[26]</sup>

Knowledge about first aid to perform during an anaphylactic event is crucial. In this study, the most common initial reaction of teachers towards an anaphylactic event would be to tell to the child's family and to call for an emergency ambulance. Ercan *et al.* showed that the most common initial step in cases of anaphylaxis was to notify the nurse, who would then administer first aid.<sup>[20]</sup> In contrast, Dumeier *et al.* published a study based on a 4–12-week educational session for preschool teachers addressing allergies, anaphylactic emergencies, and administering auto-injectors. Before the educational session, only 11% felt prepared for an anaphylactic emergency situation; however, this percentage increased to 79% after 4–12 weeks of education.<sup>[23]</sup> Therefore, these findings confirmed the importance of training teachers

to be able to deal with anaphylaxis. Moreover, Juliá-Benito *et al.* found that most teachers would not know how to act in cases of anaphylaxis or be able to administer the required medication, although most expressed interest in receiving training and having an interventional protocol applicable to such situations.<sup>[21]</sup> Importantly, delay of epinephrine injection is associated with increased mortality rates. Thus, teachers should be prepared to encounter anaphylaxis in children and to administer lifesaving interventions. Anaphylaxis reactions can be reduced by providing food information, training program for teachers and promotion of a primary care and emergency plan at school.<sup>[27]</sup>

In this study, we measured which sociodemographic factors were associated with increased KAP scores. Our results showed that mean knowledge and attitude scores were significantly higher in women than in men, whereas mean practice scores were significantly higher in men. In contrast, the mean practice scores were higher for teachers who had a Bachelor's degree or higher than for teachers with only a diploma or less.

Moreover, we showed that the mean KAP scores of teachers who had witnessed their students suffering from anaphylaxis were significantly higher than those for teachers who had not witnessed such events. Additionally, specialty was significantly associated

with both knowledge and attitude scores. The relationships of these sociodemographic factors with knowledge and attitude scores could facilitate the development of solutions to detect and treat anaphylaxis episodes in schools.

This study had some limitations. For example, the study setting was focused on one region only (Al-Qassim) Qassim research ethics committee No: 1440-1676269. In general, more reliable results could be obtained if we included other regions in Saudi Arabia. Another limitation was that we used a convenience sampling method which did not allow us to address any biases in data gathering. Therefore, the overall outcomes of this study should be confirmed in further studies.

## Conclusion

The overall knowledge and practices of teachers in this study regarding anaphylactic reactions were quite poor, although teachers had positive attitudes toward learning about management of such conditions. In this regard, teachers need further education regarding the management of allergic reactions. Educational programs on allergic management would be beneficial among teachers who have insufficient knowledge of such allergic events. Moreover, identifying children with anaphylaxis is essential to preventing severe allergic reactions among children. Cultivation of an allergic reaction care plan is necessary; this includes interventions involving healthcare providers in the primary care, parents, teachers, and the school administration to enable complete assimilation of these groups of children at school.

## Acknowledgments

We would like to thank all teachers in the Qassim region, Saudi Arabia who volunteered to participate in this study. We would like to thank the following medical students for their efforts in data collection: Naif Abdullah Alharbi, Mayar Abdulrahman Alofi, Mohammad Ali Almozine, Abrar Marzouq Alharbi, Shoug Saleh Alnasyan, and Abdulaziz Fahed Alharbi.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

1. McLendon K, Sternard BT. Anaphylaxis. StatPearls. StatPearls Publishing; 2018.
2. Tanno LK, Gonzalez-Estrada A, Olivieri B, Caminati M. Asthma and anaphylaxis. *Curr Opin Allergy Clin Immunol* 2019;19:447-55.
3. Nunez J, Santillanes G. Anaphylaxis in pediatric patients: Early recognition and treatment are critical for best outcomes. *Pediatr Emerg Med Pract* 16;2019:1-24.
4. Irani AM, Akl EG. Management and prevention of anaphylaxis. *F1000Res* 2015;4:F1000 Faculty Rev-1492.
5. Bock SA, Muñoz-Furlong A, Sampson HA. Fatalities due to anaphylactic reactions to foods. *J Allergy Clin Immunol* 2001;107:191-3.
6. Golden DB, Kagey-Sobotka A, Norman PS, Hamilton RG, Lichtenstein LM. Outcomes of allergy to insect stings in children, with and without venom immunotherapy. *N Engl J Med* 2004;351:668-74.
7. Anagnostou K. Anaphylaxis in children: Epidemiology, risk factors and management. *Curr Ped Rev* 2018;14:180-6.
8. Bohlke K, Davis RL, DeStefano F, Marcy SM, Braun MM, Thompson RS, *et al.* Epidemiology of anaphylaxis among children and adolescents enrolled in a health maintenance organization. *J Allergy Clin Immunol* 2004;113:536-42.
9. Sheikh F, Amin R, Rehan Khaliq AM, Al Otaibi T, Al Hashim S, Al Gazlan S. First study of pattern of anaphylaxis in a large tertiary care hospital in Saudi Arabia. *Asia Pac Allergy* 2015;5:216-21.
10. Kim H, Fischer D. Anaphylaxis. *Allergy Asthma Clin Immunol* 2011;7(Suppl 1):S6.
11. Muraro A, Clark A, Beyer K, Borrego LM, Borres M, Lødrup Carlsen KC, *et al.* The management of the allergic child at school: EAACI/GA2LEN task force on the allergic child at school. *Allergy* 2010;65:681-9.
12. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, *et al.* NIAID-sponsored expert panel. 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:S1-58.
13. 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;138:560-5.
14. Nowak-Wegrzyn A, Conover-Walker MK, Wood RA. Food-allergic reactions in schools and preschools. *Arch Pediatr Adolesc Med* 2001;155:790-5.
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. National School Boards Association. Safe at school and ready to learn: A comprehensive policy guide for protecting students with life-threatening food allergies. National School Boards Association Online. Available from <http://www.nsba.org/Board-Leadership/SchoolHealth/Food-Allergy-Policy-Guide.pdf>. [Last accessed on 2012 Oct 24].
17. Alen Coutinho I, Ferreira D, Regateiro FS, Pita J, Ferreira M, Fonseca IA, *et al.* Anaphylaxis in an emergency department: A retrospective 10-year study in a tertiary hospital. *Eur Ann Allergy Clin Immunol* 2019. doi: 10.23822/EurAnnACI.1764-1489.98.
18. Muraro A, Agache I, Clark A, Sheikh A, Roberts G, Akdis CA, *et al.* Managing patients with food allergy in the community. In: Muraro A, Roberts G, editors. EAACI Guidelines, Food Allergy and Anaphylaxis. Zurich: EAACI; 2014. p. 245-9.
19. Vale S, Smith J, Said M, Mullins RJ, Loh R. ASCIA guidelines for prevention of anaphylaxis in schools, pre-school and childcare: 2015 update. *J Paediatr Child Health* 2015;51:949-54.
20. Sheetz AH, Goldman PG, Millett K, Franks JC, McIntyre CL, Carroll CR, *et al.* Guidelines for managing life-threatening food allergies in Massachusetts schools. *J Sch Health* 2004;74:155-60.

21. 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.
22. Juliá-Benito JC, Escarrer-Jaume M, Guerra-Pérez MT, Contreras-Porta J, Tauler-Toro E, Madroñero-Tentor A, *et al.* Knowledge of asthma and anaphylaxis among teachers in Spanish schools. *Allergol Immunopathol (Madr)* 2017;45:369-74.
23. Dumeier HK, Richter LA, Neining MP, Freerk Prenzel F, Kiess W, Bertsche A, *et al.* Knowledge of allergies and performance in epinephrine auto-injector use: A controlled intervention in preschool teachers. *Eur J Pediatr* 2018;177:575-81.
24. Devetak I, Devetak SP, Tina Vesel T. Future teachers' attitudes and knowledge regarding the management of the potential students' life-threatening allergic reactions in Slovenian schools. *Zdr Varst* 2018;57:124-32.
25. Canon N, Gharfeh M, Guffey D, Anvari S, Davis CM. Role of food allergy education: Measuring teacher knowledge, attitudes, and beliefs. *Allergy Rhinol (Providence)* 2019;10:2152656719856324.
26. Alkanhal R, Alhoshan I, Aldakhil S, Alromaih N, Alharthy N, Salam M, *et al.* Prevalence triggers and clinical severity associated with anaphylaxis at a tertiary care facility in Saudi Arabia: A cross-sectional study. *Medicine (Baltimore)* 2018;97:e11582.
27. Pouessel G, Dumond P, Liabeuf V, Kase Tanno L, Deschildre A, Beaumont P, *et al.* Gaps in the management of food-induced anaphylaxis reactions at school. *Pediatr Allergy Immunol* 2019. doi: 10.1111/pai. 13091.