

Anaphylaxis Awareness and Adrenaline Use Among Healthcare Professionals

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ABSTRACT

Objective: Anaphylaxis is life-threatening and guidelines recommend adrenaline as a first-line treatment. However, previous studies have shown significant shortcomings in the appropriate management of anaphylaxis. Our study aimed to measure healthcare professionals' current knowledge and experience with anaphylaxis and to raise awareness of anaphylaxis management and adrenaline use practices.

Methods: The study included healthcare professionals working at Kayseri City Training and Research Hospital. A 19-question multiple-choice written questionnaire was performed face-to-face by an allergist. Inclusion criteria for the study were healthcare professionals (physician, nurse, paramedic) working in an inpatient or emergency department.

Results: In the study of 260 participants, only 15% preferred "Inject adrenaline 0.5 mg (adult) or 0.3 mg (child) intramuscularly" as the correct first line step in the treatment algorithm and only 5% knew the correct sequence, and 88% had never used an adrenaline auto-injector. When comparing professions, physicians were found to have more accurate answers than nurses and paramedics for questions about diagnostic criteria, symptom recognition ($p=0.007$), the correct dose of adrenaline ($p=0.001$), and the correct route of administration ($p=0.001$). Both physicians and nurses preferred adrenaline as the first treatment drug (79.67%, $n=192$), followed by pheniramine (14.94%, $n=36$) and glucocorticoids (4.56%, $n=11$). Furthermore, 69.8% ($n=167$) of participants correctly answered the question about the adult adrenaline dose.

Conclusion: Healthcare personnel, including physicians, lack sufficient knowledge of anaphylaxis diagnosis and treatment. Since anaphylaxis is a condition requiring urgent intervention and can be fatal if left untreated, the knowledge and skills of all personnel should be improved to minimize the risk of delayed treatment and serious complications.

Keywords: adrenaline, anaphylaxis, awareness, healthcare professionals, questionnaire

INTRODUCTION

Anaphylaxis is a serious allergic (hypersensitivity) reaction that can progress rapidly and cause death [1]. It occurs in 30 out of 100000 people annually in the United States, with a reported mortality rate of 1-2% [2]. A study using ICD-10 codes in patients admitted to hospitals in Istanbul, Turkey, estimated the annual incidence at 1.95 per 100000 [3]. A multicentre study in Turkey found a mortality rate of 0.4% in children [4].

The European Academy of Allergy and Clinical Immunology recommends intramuscular adrenaline injection in the mid-thigh as the first-line treatment for anaphylaxis [5]. However, previous studies have shown significant shortcomings in the appropriate management of anaphylaxis [6,7], originated from the difficulty of diagnosing and treating anaphylaxis. Since allergic reactions can progress rapidly and lack a clear definition, this can lead to underdiagnosis [8].

A 2013 questionnaire of 1172 healthcare professionals, including physicians, nurses, and paramedics in Northeastern Anatolia, showed that anaphylaxis is inadequately diagnosed and managed, regardless of institution, employment status, or specialty [9]. A 2020 study of only pediatric nurses demonstrated that their knowledge of anaphylaxis, particularly regarding disease recognition and treatment, is inadequate [10].

Therefore, our study aimed to measure healthcare professionals' current knowledge and experience with anaphylaxis and to raise awareness regarding anaphylaxis management and adrenaline use practices.

Main Points

- Healthcare personnel, including physicians, lack sufficient knowledge of anaphylaxis diagnosis and treatment.
- Only 15% preferred injecting adrenaline as the first treatment step, only 5% knew the correct sequence in the treatment algorithm, and 88% had never used an adrenaline auto-injector.
- The knowledge and skills of all personnel should be improved to minimize the risk of delayed treatment and serious complications

MATERIALS AND METHODS

Healthcare professionals working at Kayseri City Training and Research Hospital were included in the study. A written 19-question multiple-choice questionnaire was developed, administered by an allergist, and feedback was obtained (Table 1). The questions were designed in accordance with our national anaphylaxis guidelines and adapted from the questionnaire in the study by Baççioğlu et al. [9,11]. The questionnaires were performed face-to-face.

Inclusion criteria for the study included healthcare professionals (physicians, nurses and paramedics) between the ages of 18 and 65, working in inpatient or emergency departments. Personnel working in units providing only outpatient services were excluded.

Ethical approval was obtained from the Non-interventional Clinical Trials Ethics Committee of Kayseri City Training and Research Hospital (Decision number: 596, Date: September 26, 2025). This retrospective study fully complies with the principles of the Declaration of Helsinki.

Statistical Analysis

Descriptive characteristics of continuous variables are given as mean, standard deviation, median, minimum, and maximum. Descriptive characteristics of categorical variables are given as numbers and percentages. The chi-square test was used to determine relationships between categorical data. Statistically significant level was considered to 5%, and SPSS (version: 29) was used for all statistical computations.

RESULTS

The study included 260 healthcare professionals, including physicians, nurses, and paramedics, working at Kayseri City Training and Research Hospital. The majority of participants were female (62.69, n=163) The median age of the patients was 32.62 years (22-62). The majority of participants were nurses (53.46%, n=139), followed by physicians (45.38%, n=118). Only 2.31% (n=6) had a high school education, while the remainder had at least a university degree (Table 2). The multiple correspondence analysis of demographic characteristics is given in Figure 1.

When comparing professions, physicians had significantly higher rates of correct answers to questions about diagnostic criteria, symptom recognition (84% physicians, 70% nurse and

33% for paramedics, $p=0.007$), the correct dose of adrenaline (73 % physicians, 56 % nurse and 66% for paramedics, $p=0.007$) $p=0.001$), and the correct route of administration (83% physicians, 56% nurse and 66 % for paramedics, $p=0.007$) $p=0.001$) than nurses and paramedics (Table 3).

When comparing physicians from internal medicine and surgical specialties, internal medicine specialists provided more accurate answers than surgical specialists only in recognizing symptoms ($p=0.001$), while there were no significant differences between the other questions. The specialists included in the study were anaesthesiology, emergency medicine, internal medicine, general surgery, dermatology, pulmonology, thoracic surgery, infectious diseases, urology, orthopedy, ophthalmology, and general practitioners. However, the numbers were insufficient to make a comparison across specialties. Furthermore, those with more than 15 years of experience were less likely to answer questions about symptom recognition ($p=0.044$) and the route of adrenaline administration ($p=0.037$) than those with 0-4 years and 5-15 years of experience.

Seventy-five % ($n=197$) of participants could identify all symptoms, while 23.85% ($n=62$) believed that gastrointestinal symptoms were not among the symptoms of anaphylaxis. In the ranking of all treatment steps, the most frequently preferred first-line treatment step according to the treatment algorithm

was “Assess circulation, respiratory tract, mental status, and skin” (50.85%, $n=119$). The second most frequently preferred step was “Place patient supine with lower extremities elevated” (28.63%, $n=67$), followed by “Inject adrenaline 0.5 mg (adult) or 0.3 mg (child) intramuscularly” (15.38%, $n=36$) which must be the correct first treatment step. The percentage of participants who knew the correct order of all treatment steps was 5.8% ($n=14$).

Adrenaline was the most frequently preferred first-line treatment drug by both physicians and nurses (79.67%, $n=192$), followed by pheniramine (14.94%, $n=36$) and glucocorticoids (4.56%, $n=11$). Furthermore, 69.8% ($n=167$) of participants correctly answered the question about the adult adrenaline dose.

Although 88.02% ($n=213$) of participants had never used an adrenaline auto-injector, 52.34% ($n=124$) stated that they would administer it correctly in an emergency.

Previous encounters with an anaphylactic patient were associated with increased correct responses regarding adrenaline dose and route of administration ($p<0.001$). Previous encounters were divided into two subgroups as >5 patients and ≤ 5 patients. When these two groups were compared, the number of anaphylactic patients encountered was not associated with correct response rates (Table 4).

Table 1. Questionnaire form

<p>1. Age</p> <p>2. Gender:</p> <p><input type="checkbox"/> Male</p> <p><input type="checkbox"/> Female</p>	<p>12. What are the signs and symptoms of anaphylaxis? (You may select more than one option)</p> <p><input type="checkbox"/> Generalized hives, angioedema, rash, and pruritus</p> <p><input type="checkbox"/> Itching in the mouth/lips/throat areas</p> <p><input type="checkbox"/> Dyspnea, cough, wheezing, and stridor</p> <p><input type="checkbox"/> Hypotension, tachycardia, and syncope</p> <p><input type="checkbox"/> Diarrhea, nausea, vomiting, cramps, and abdominal pain</p> <p>All</p>
<p>3. Employment status:</p> <p><input type="checkbox"/> Nurse</p> <p><input type="checkbox"/> Doctor</p> <p><input type="checkbox"/> Paramedic</p>	<p>13. What are the clinical criteria for the diagnosis of anaphylaxis?</p> <p><input type="checkbox"/> An acute-onset illness affecting the skin and at least one of the following: respiratory or cardiovascular symptoms</p> <p><input type="checkbox"/> Acute low blood pressure after exposure to a known allergen</p> <p><input type="checkbox"/> At least two of the following: skin, respiratory distress, low blood pressure, or gastrointestinal symptoms after exposure to an allergen</p> <p>All</p> <p><input type="checkbox"/> None</p>

<p>4. What is your speciality?</p> <p>5. In which department do you work?</p>	<p>14. Please number the anaphylaxis treatment steps from 1 to 5.</p> <p>Place the victim in a supine position with the lower extremities elevated. 3</p> <p><input type="checkbox"/> Administer high-flow supplemental oxygen. 4</p> <p>Inhale a beta-2 adrenergic agonist via nebulizer. Obtain intravenous access and rapidly administer saline. 5</p> <p>Administer an H1-antihistamine and glucocorticoid intravenously. 6</p> <p>Assess circulation, respiratory tract, mental status, and skin. 2</p> <p>Administer adrenaline 0.5 mg (adult) or 0.3 mg (child) intramuscularly. 1</p>
<p>6. How long have you been working in this job?</p> <p><input type="checkbox"/> 0-4 years</p> <p><input type="checkbox"/> 5-15 years</p> <p><input type="checkbox"/> > 15 years</p>	<p>15. Which is the first-line medication in treating a patient with anaphylaxis? (Choose only one option)</p> <p><input type="checkbox"/> Dopamine</p> <p><input type="checkbox"/> Epinephrine</p> <p><input type="checkbox"/> Glucocorticoid (methylprednisolone-dexamethasone)</p> <p><input type="checkbox"/> Pheniramine maleate (Avil)</p>
<p>7. What is your level of education?</p> <p><input type="checkbox"/> High school</p> <p><input type="checkbox"/> University</p> <p><input type="checkbox"/> Master's degree</p> <p><input type="checkbox"/> Postdoctoral degree</p>	<p>16. Which route of administration should you use to administer adrenaline in the treatment of anaphylaxis?</p> <p><input type="checkbox"/> intravenous</p> <p><input type="checkbox"/> intramuscular</p> <p><input type="checkbox"/> subcutaneous</p> <p><input type="checkbox"/> inhalation</p>
<p>8. Do you think allergy can be life-threatening?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>	<p>17. What is the adult dose of adrenaline for the treatment of anaphylaxis?</p> <p><input type="checkbox"/> 0.1 mg</p> <p><input type="checkbox"/> 1 mg</p> <p><input type="checkbox"/> 0.5 mg</p>
<p>9. Have you ever encountered a patient experiencing anaphylaxis?</p> <p><input type="checkbox"/> Yes (How many people?)</p> <p><input type="checkbox"/> No</p>	<p>18. Have you ever had to use an adrenaline auto-injector?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>
<p>10. Have you ever treated a patient experiencing anaphylaxis?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>	<p>19. Do you know the correct application method in case you need to use it in an emergency?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>
<p>11. Do you have adrenaline medication in your department?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>	

Table 2. Demographic Characteristics of Participants

Variables		n	%
Age	Years (median(min-max))	32.62 (22-62)	
Gender	Female	163	62,69
	Male	97	37,31
Occupation	Physician	118	45,38
	Nurse	139	53,46
	Paramedic	3	1,15
Speciality	Internal Medicine	87	69,60
	Surgical Medicine	38	30,40
Employment duration - years	0-4 years	98	37,69
	5-15 years	115	44,23
	>15 years	47	18,08
Education level	High school	6	2,31
	University	130	50,00
	Master's degree	109	41,92
	Postdoctoral degree	15	5,77

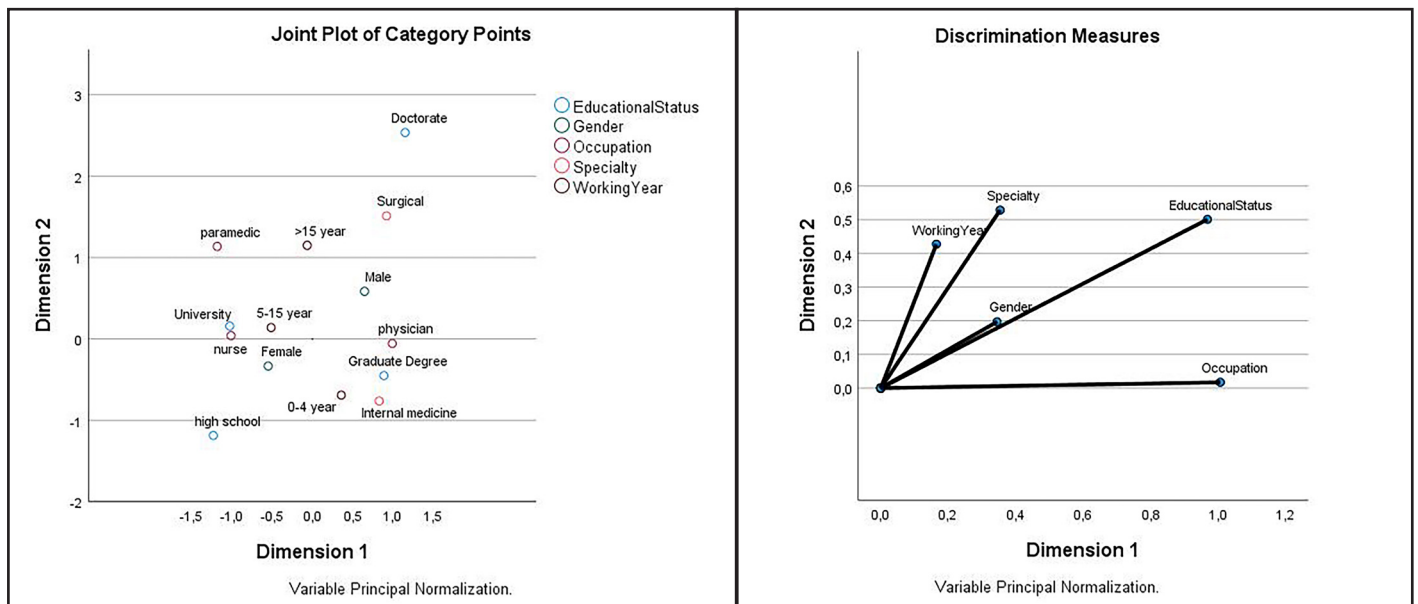


Figure 1. The multiple correspondence analysis of demographic characteristics

Table 3. Comparison of answers across professions

Variables		Physician		Nurse		Paramedics		p
		n	%	n	%	n	%	
Symptom recognition	True	99	50,3	97	49,2	1	0,5	0.007
	False	18	29,5	41	67,2	2	3,3	
Clinical diagnostic criteria	True	80	47,1	89	52,4	1	0,6	0.411
	False	38	42,2	50	55,6	2	2,2	
First-line treatment drug	True	108	56,3	82	42,7	2	1,0	0.001
	False	10	14,7	57	83,8	1	1,5	
Route of adrenaline administration	True	99	55,0	79	43,9	2	1,1	0.001
	False	19	23,8	60	75,0	1	1,3	
Adult adrenaline dosage	True	87	52,1	78	46,7	2	1,2	0.013
	False	31	33,3	61	65,6	1	1,1	
Treatment sequence	True	11	78,6	3	21,4	0	0,0	0.063
	False	105	46,3	120	52,9	2	0,9	

Table 4. Comparison of correct responses according to the number of patients encountered (question 9)

Variables		Number of patients with anaphylaxis encountered				p
		≤5 patients		>5 patients		
		n	%	n	%	
Defining Symptoms	True	33	51,6	31	48,4	0.406
	False	6	60,0	4	40,0	
Clinical diagnostic criteria	True	31	57,4	23	42,6	0.183
	False	8	40,0	12	60,0	
First-line treatment drug	True	30	50,0	30	50,0	0.335
	False	9	64,3	5	35,7	
Route of adrenaline administration	True	28	50,0	28	50,0	0.411
	False	11	61,1	7	38,9	
Adult adrenaline dosage	True	30	51,7	28	48,3	0.748
	False	9	56,3	7	43,8	
Treatment sequence	True	2	50,0	2	50,0	0.933
	False	36	52,2	33	47,8	

DISCUSSION

Our study demonstrates that physicians provide more accurate answers than nurses to questions about anaphylaxis and its treatment, that internal medicine physicians are more effective at recognizing symptoms than surgical teams, that those with a practice duration of more than 15 years provide fewer correct answers, and that overall awareness of the gastrointestinal

symptoms of anaphylaxis is inadequate. Only 15% of participants preferred “Inject adrenaline 0.5 mg (adult) or 0.3 mg (child) intramuscularly” for the first line treatment step in the treatment algorithm, only 5% knew the correct sequence. Eighty- eight % reported never using an adrenaline auto-injector. Although Adrenaline was the most frequently preferred first-line drug by both physicians and nurses (79.67%, n=192),

pheniramine or glucocorticoids continue to be preferred by a significant percentage of both physicians and nurses as the first drug of treatment. A recent study on anaphylaxis awareness in the general population, conducted in Saudi Arabia and including at least university graduates, showed that 18.4% considered adrenaline a first-line treatment, and 25% knew the correct route of administration (intramuscular) [12]. Therefore, according to our results, the initial preference for adrenaline remained very low in our study compared to general population, which included only healthcare professionals providing patient care.

Antihistamines and/or glucocorticoids are not reliable treatment options for preventing biphasic anaphylaxis [13]. Another study has also shown that antihistamines are insufficient to reverse the life-threatening symptoms of anaphylaxis, particularly cardiovascular and respiratory symptoms [14]. Our study showed that pheniramine and glucocorticoids are still the first choice of treatment by some physicians and non-physician personnel in clinics. When these findings are considered together with the results of the multicentre study of Baçcıoğlu et al. in 2013 [9], they demonstrate that despite the 12 years that have passed, knowledge and skills gaps in the diagnosis and treatment of anaphylaxis persist despite the increase in the use of digital technology and social media. In that study, 84.7% of participants correctly answered the symptoms of anaphylaxis, 62.6% were able to implement the correct anaphylaxis treatment steps, and 44.7% preferred adrenaline as the first choice when anaphylaxis was suspected.

When considering healthcare professionals from other countries, a recent questionnaire of 1645 Brazilian paediatrics found that 48.5% had sufficient knowledge of anaphylaxis management, and that approaches to selecting the preferred drug for anaphylaxis and the route of administration were among the most challenging issues physicians faced [15]. A study from Spain showed that over 90% of podiatry emergency room physicians correctly identified anaphylaxis but failed to diagnose a drop in blood pressure after exposure to a known allergen (69.7%), and 100% identified epinephrine as the first-line treatment [16]. The data in our study demonstrate that our knowledge level, particularly regarding the use of adrenaline, is inadequate compared to other countries.

Possible cultural, educational, or systemic reasons can be responsible for the large discrepancy between our findings and the other countries. This suggests that health literacy is low even

among healthcare professionals in our country and the fact that personnel with long-term experience (15+ years) gave fewer correct answers may reflect potential difficulties in adopting current guidelines or a habit of “applying what was learned when it was learned. This finding underscores the importance of continuing medical education (CME) and indicates the need for further interest.

The most frequently preferred first-line treatment step according to the treatment algorithm was “Assess circulation, respiratory tract, mental status, and skin” according to our results; in the context of the general approach in emergency training this finding indicate a tendency to prioritize basic life support principles. But this is an incomplete approach; therefore, prioritizing adrenaline in anaphylaxis must be emphasized. In a previous study, although most participants agreed that anaphylaxis can lead to serious outcomes such as organ failure (191 (38%)) and death (258 (51.5%)), a significant number were unsure or disbelieved that these complications were possible [17]. In our study, a high proportion of participants, 96%, agreed that anaphylaxis can be life-threatening, but the vast majority did not consider administering adrenaline as the first line of treatment. In fact, this appears to perpetuate the misconception held by some healthcare professionals that the clinical picture of anaphylaxis consists solely of skin findings. Accepting the disappearance of skin findings with these treatments as clinical improvement may lead to overlooked fatal reactions. Delaying the use of adrenaline is among the factors that increase the severity of anaphylaxis and the risk of biphasic anaphylaxis [13]. Therefore, despite accurate diagnosis and accurate assessment of the severity of anaphylaxis, deficiencies, delays, and sequencing errors in treatment may still not prevent the development of fatal reactions.

In a study from our country regarding the use of adrenaline auto-injectors, a team of physicians, dentists, pharmacists, and school personnel was recruited. Of the 697 participants, 31.1% were able to demonstrate its use correctly [18]. While 52.2% (n=124) of participants in our study reported knowing the correct use techniques in an emergency, we believe the same high rate would not be achieved if practical demonstrations of correct use were required.

Knowledge levels across specialties were not compared, but another study observed a significant difference in response rates across all specialty groups. Post-hoc analysis revealed that, as

expected, allergy and immunology specialists had higher correct response rates than general medicine practitioners (62.9% vs. 25%) [19]. Furthermore, the group with the highest correct response rate in the study was healthcare workers with 30 years or more of experience. In our study, healthcare workers with 0-4 years and 5-15 years of experience provided more accurate answers to questions about symptom recognition and adrenaline administration. This is promising for the increased attention to detail and retention of anaphylaxis training in recent years.

We believe that our study increased anaphylaxis awareness in the hospital where it was performed. The accurate responses provided to healthcare personnel following the questionnaire and the brief information about anaphylaxis will enable them to take more accurate and informed steps when faced with anaphylaxis. The small number of participants, the inclusion of healthcare personnel from a single centre, and the lack of cross-specialty comparisons are among the study's limitations. Future multicentre studies with larger participation comparing the knowledge of physicians from different specialties may be meaningful to address the need for departmental training. Since the study is a survey study, the risk of Observer Bias (Hawthorne Effect) might be a limitation.

CONCLUSION

Healthcare personnel, including physicians, lack sufficient knowledge of anaphylaxis diagnosis and treatment. Since anaphylaxis is a condition requiring immediate intervention and can be fatal if left untreated, all personnel must have complete knowledge and skills to minimize the risk of delayed treatment and serious complications. Hospital administrations and allergy societies should increase the number and frequency of training and meetings on this topic. It is important that healthcare professionals, such as physicians, nurses, emergency medicine specialists, and intensive care physicians, diagnose and treat anaphylaxis, and refer patients to allergy and clinical immunology specialists for personalized diagnosis and treatment.

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Author Contributions: Bahar Arslan: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Roles/Writing - original draft; and Writing - review & editing.

Neslihan Cerrah Demir: Data curation; Formal analysis; Investigation; Methodology, Writing - review & editing.

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