ORIGINAL ARTICLE

KNOWLEDGE, PRACTICE AND AWARENESS LEVELS OF PHYSICIANS IN THE MANAGEMENT OF ANAPHYLAXIS: A CROSS-SECTIONAL SURVEY STUDY

Anafilaksi Yönetiminde Hekimlerin Bilgi, Uygulama ve Farkındalık Düzeyleri: Kesitsel Bir Anket Çalışması

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Received/Geliş tarihi: 14.11.2025
Accepted/Kabul tarihi: 27.04.2026
DOI: 10.16919/bozoktip.1823734

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

ABSTRACT

Objective: To evaluate physicians' awareness regarding the management of anaphylaxis, an acute medical emergency that can occur in adults due to various triggers.

Material and Methods: The study included general practitioners, residents, specialists, and faculty members, excluding those in Pediatrics, Allergy-Immunology, and Basic Medical Sciences. Of 434 respondents, one declined participation and 23 were excluded based on criteria, leaving 410 participants. The 30-item questionnaire comprised two sections: demographic/professional information (10 items) and knowledge-attitude-practice domains (20 items) covering anaphylaxis diagnosis, clinical features, treatment, and follow-up.

Results: Of the participants, 242 were female and 168 were male, with a mean age of 37.9±9.1 years. The rates of correct responses regarding the definition of anaphylaxis, affected organ systems, and common allergens causing anaphylaxis in adults were 81.7%, 82%, and 20%, respectively. Adrenaline was correctly identified as the first-line treatment by 68.8% of respondents. A total of 223 physicians reported prior anaphylaxis training, with 109 indicating that more than five years had passed since. The proportion of physicians completing all management steps, including referral to an Allergy-Immunology specialist, was 61.2%. A significant correlation was found between years of professional experience and accuracy in anaphylaxis management. Prior training significantly improved response accuracy, whereas a longer time since training negatively affected performance.

Conclusion: Physicians demonstrated a high need for continued education on anaphylaxis. Persistent uncertainty was noted in diagnostic criteria and mild case management, emphasizing the necessity for regular, standardized training in accordance with current anaphylaxis guidelines. Targeted educational interventions may improve early recognition and appropriate management of anaphylaxis. Enhancing physician awareness could also contribute to reducing morbidity associated with delayed or inadequate treatment.

Keywords: *Anaphylaxis; Epinephrine; Physicians; Questionnaire; Health Education*

ÖZET

Amaç: Erişkin hastalarda çeşitli tetikleyiciler ile ortaya çıkabilen ve akut acil bir tablo olan anafilaksinin yönetimi ile ilgili hekimlerdeki farkındalığı araştırmak.

Gereç ve Yöntemler: Çalışmaya pratisyen hekimler, asistanlar, uzmanlar ve öğretim üyeleri dahil edilmiştir. Pediatri, Alerji-İmmünoloji ve Temel Tıp Bilimleri hekimleri dahil edilmemiştir. Toplam 434 katılımcı yanıtlamıştır, 1 kişi katılmayı reddetmiş ve 23 kişi dışlama kriterleri nedeniyle çalışmadan çıkarılmıştır. Anket 30 sorudan oluşmaktadır; demografik ve mesleki bilgiler (10 soru) ve bilgi-tutum-uygulama alanları (20 soru) olmak üzere iki ana bölümden oluşmuştur. İlk bölümde demografik veriler, anafilaksi eğitimi/deneyimi sorgulanmıştır. İkinci bölümde anafilaksinin tanı, klinik, tedavi ve izlem süresiyle ilgili sorular mevcuttur.

Bulgular: Ankete katılanların 242'si kadın, 168'si erkekti. Yaş ortalaması 37,9±9,1 idi. Anafilaksi tanımı, anafilaksi sırasında etkilenen sistemler, yetişkinlerde anafilaksiye neden olan en yaygın alerjenler sorularına doğru cevap verenlerin oranı %81,7, %82 ve %20 olarak saptanmıştır. Anafilaksi tedavisinde ilk tercih olarak adrenalin kullanılması yanıtını verenlerin oranı %68,8 saptandı. Çalışmamızda 223 kişi anafilaksi ile ilgili eğitim aldığını ifade etmiş ve 109'unun eğitimden sonra geçen sürenin >5 yıl olduğu öğrenilmiştir. İmmünoloji-Alerji uzmanına yönlendirme dahil tüm adımları yapan hekim oranı %61,2 idi. Meslekteki deneyim yılı ile anafilaksi yönetimi sorusundaki doğru yanıt oranı arasında güçlü ve anlamlı bir ilişki saptanmıştır. Anafilaksi eğitimi almış olmak, doğru yanıt oranını anlamlı biçimde etkilemiştir. Eğitimden geçen süre ile doğru yanıt oranı arasında anlamlı ilişki bulunmuştur.

Sonuç: Hekimlerin anafilaksiye yönelik farkındalık ve eğitim gereksinimlerinin yüksek olduğu, tanısal gereklilikler ve hafif olgu yönetimi konularında bazı belirsizliklerin sürdüğü görülmüştür. Tüm hekimlerin güncel rehberler ışığında düzenli eğitim alması gerekliliği ortaya çıkmıştır.

Anahtar Kelimeler: *Anafilaksi; Epinefrin; Hekim; Anket; Sağlık Eğitimi*

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Cite this article as: Çevirme L, Dik S, Özden G. Knowledge, Practice and Awareness Levels of Physicians in the Management of Anaphylaxis: A Cross-Sectional Survey Study. Bozok Med J 2026;16(2):224-234. DOI: https://doi.org/10.16919/bozoktip.1823734

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

INTRODUCTION

Anaphylaxis is a life-threatening, acute hypersensitivity reaction characterized by the rapid onset of symptoms following exposure to an allergen and may involve multiple organ systems. Anaphylaxis is a clinical emergency that requires immediate intervention. Therefore, all healthcare professionals should be knowledgeable about the recognition and management of anaphylaxis (1). The causes of anaphylaxis may vary depending on age and geographic region. However, in general, the most common triggers are foods, medications, and Hymenoptera venom (2). In children, foods are the most common cause of anaphylaxis, most frequently triggered by egg, cow's milk, wheat, peanuts, tree nuts, fish, shellfish, and soy. Although some food allergies may persist into adulthood, the most common triggers of anaphylaxis in adults are medications and venoms such as Hymenoptera stings (3). There are several challenges in epidemiological research on anaphylaxis, as most available data are derived from medical records of patients treated in emergency departments or hospitalized for the condition. The lifetime prevalence of anaphylaxis is estimated to range between 1.6% and 5.1% (4). Anaphylaxis may occur through immunological mechanisms (IgE-mediated or non-IgE-mediated), non-immunological pathways, or may be idiopathic. The primary mechanism in anaphylaxis is IgE-mediated activation. Upon exposure to the allergen, IgE antibodies bind to high-affinity receptors on mast cells and basophils, leading to cellular degranulation. As a consequence, various mediators-including histamine, arachidonic acid metabolites, neutral proteases, and chemotactic factors-are released. The effects of these mediators induce smooth muscle contraction, vasodilation, and increased capillary permeability, resulting in the clinical manifestations of anaphylaxis. Clinical symptoms may include urticaria, angioedema, flushing, pruritus, wheezing, rhinorrhea, dyspnea, nausea, vomiting, diarrhea, abdominal pain, syncope, and hypotension (5). Cutaneous manifestations are present in more than 90% of anaphylaxis cases and are often accompanied by respiratory and/or cardiovascular and/or gastrointestinal symptoms. Epinephrine is the only treatment shown to reduce hospitalization and mortality, and it is recommended as the first-line therapy (1). Despite the well-defined clinical features of anaphylaxis, real-world data regarding physicians' knowledge and management practices, particularly among adult care physicians, remain limited. Therefore, this study aimed to evaluate physicians' awareness, diagnostic approaches, and management strategies for anaphylaxis in clinical practice. Therefore, healthcare professionals must be able to recognize the symptoms of anaphylaxis and initiate the appropriate treatment promptly.

MATERIAL AND METHODS

Study design and participants; This was a cross-sectional descriptive Knowledge-Attitude-Practice (KAP) survey conducted between October 15, 2025 and October 30, 2025 among physicians who provide care for adult patients. Ethical approval was received from the Adana City Training and Research Hospital Ethics Committee (decision no: 17/743, date: 25.09.2025). The aim of the study was to evaluate physicians' knowledge, attitudes, and practices regarding the diagnosis, treatment, and management of adult anaphylaxis.

The study included general practitioners, residents, specialists, and faculty members (assistant professors, associate professors, and professors). Physicians working in Pediatrics, Allergy-Immunology, and Basic Medical Sciences were excluded from the study. A total of 434 responses were received; one participant declined to participate, and 23 respondents were excluded based on predefined exclusion criteria. Ultimately, data from 410 participants were included in the final analysis.

Participation was voluntary, anonymous, and without compensation.

The questionnaire was developed based on an extensive literature review and current international anaphylaxis guidelines (1). In addition, previously published Knowledge-Attitude-Practice (KAP) surveys on anaphylaxis and emergency management were reviewed during questionnaire development. Item relevance and clarity were evaluated by expert opinion from physicians experienced in allergy and immunology. Content validity was assessed through expert consensus, and items considered unclear or redundant were revised or removed. Although the questionnaire

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

was not previously validated as a standardized scale, this expert-based development approach was used to ensure content validity. The form consisted of 30 questions and was structured into two main sections: demographic/professional characteristics (10 items) and knowledge-attitude-practice domains (20 items). Prior to the main study, the questionnaire was reviewed for clarity and feasibility, and minor wording modifications were made.

In the first section, participants were asked about their gender, age, medical specialty, professional title, years of experience, type of institution (state hospital, university hospital, private hospital, primary care/family medicine center), and previous training or experience regarding anaphylaxis.

The second section included; knowledge domain (7 items): definition of anaphylaxis, clinical manifestations, triggers, first-line treatment, contraindications, and duration of observation.

Attitude domain (6 items): perceived severity of the condition, perceived need for regular training, and awareness of atypical presentations. These items were assessed on a 5-point Likert scale (1=strongly disagree; 5=strongly agree).

Practice domain (7 items): case-based questions evaluating correct adrenaline dose, route of administration, injection site, decision for a second dose, discharge criteria, and long-term management/follow-up.

The draft form was reviewed by experts for content validity and clarity, and revisions were made accordingly before finalization.

Data collection procedure; the questionnaire was generated using Google Forms and distributed via multiple social media platforms. Digital informed consent was obtained from all participants prior to survey initiation. This approach enabled participation from physicians across different specialties and healthcare settings and allowed for a diverse sample. Each participant completed the survey only once, and no personally identifiable information was collected.

Statistical Analysis

Data were analyzed using jamovi statistical software (The jamovi project, Version 2.3). Categorical variables were presented as frequencies (n) and percentages (%), whereas continuous variables were expressed as mean±standard deviation (SD).

Comparisons between groups were performed using Chi-square or Fisher's exact tests for categorical variables, and ANOVA or Kruskal-Wallis tests for continuous variables, as appropriate. For ordinal variables, Kendall's Tau-b and Goodman-Kruskal Gamma coefficients were used to assess the direction and strength of associations. Linear trends in ordinal variables were evaluated using the Mantel-Haenszel test.

When significant differences were detected in multiple group comparisons, post-hoc analyses with Bonferroni correction were performed. Pairwise comparisons were conducted using the Mann-Whitney U test where appropriate.

Effect sizes were reported as Cramer's V for categorical variables, epsilon squared (ε^2) for non-parametric tests, and Cohen's d for parametric comparisons. A p-value<0.05 was considered statistically significant.

Ethical approval; the study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Adana City Training and Research Hospital (decision no:17/743, date:25.09.2025). Electronic informed consent was obtained from all participants at the beginning of the questionnaire.

RESULTS

A total of 410 physicians were included in the analysis. Of the participants, 242 (59.0%) were female and 168 (41.0%) were male. The mean age was 37.9±9.1 years. General characteristics of the participants and profession-related data are presented in Table 1.

In response to the question "Have you ever received training on anaphylaxis?", 223 participants (54.4%) answered "yes," whereas 187 (45.6%) answered "no." Among those who had received training, 109 (48.9%) stated that more than five years had elapsed since the training, 61 (27.4%) had received training within the previous 3-5 years, and 53 (23.8%) within ≤2 years. Regarding the frequency of encountering anaphylaxis within the past 12 months, 210 participants (51.3%) reported no cases, 121 (29.6%) reported 1-2 cases, 41 (10.0%) reported 3-5 cases, and 37 (9.0%) reported more than 5 cases.

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

Table 1. Demographic and professional characteristics of participants

Variable	Category	n	%
Gender	Female	242	59.0
	Male	168	41.0
Professional title	Main specialty resident	95	23.2
	Main specialty specialist	180	43.9
	General practitioner	54	13.2
	Associate professor	19	4.6
	Subspecialty specialist	18	4.4
	Assistant professor	18	4.4
	Professor	13	3.2
	Subspecialty resident	13	3.2
Department	Emergency medicine	65	15.9
	Anesthesiology	13	3.2
	Obstetrics & gynecology	27	6.6
	Internal medicine	47	11.5
	Pulmonology	80	19.5
	Family medicine	46	11.2
	Neurology	17	4.1
	Hematology	6	1.5
	Infectious diseases	6	1.5
	Other surgical clinics	15	3.7
	General practitioner	13	3.2
	Radiology	7	1.7
	Occupational diseases	4	1.0
	Psychiatry	7	1.7
	Otolaryngology	6	1.5
	Urology	6	1.5
	General surgery	5	1.2
	Dermatology	5	1.2
Experience (years)	<1	13	3.2
	1-5	120	29.3
	6-10	93	22.7
	11-15	71	17.3
	16-20	30	7.3
	>20	83	20.2
Workplace	Training & research hospital	136	33.2
	State hospital	133	32.4
	University hospital	81	19.8
	Primary care center	33	8.0
	Private hospital	27	6.6

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

Physicians' knowledge regarding the definition, clinical presentation, triggers, treatment, and monitoring of anaphylaxis is summarized in Table 2. Most participants correctly identified key clinical features, including the multisystem nature of anaphylaxis (82.0%) and the absence of absolute contraindications to adrenaline use (92.4%). However, important knowledge gaps were identified. Only 83 participants (20.2%) correctly identified medications as the most common trigger of anaphylaxis in adults. Similarly, only 111 participants (27.1%) correctly identified that intramuscular adrenaline is not an adjunctive treatment, and only 56 participants (13.7%) correctly identified the appropriate observation duration.

Analysis of the six Likert-scale attitude items demonstrated generally positive attitudes toward anaphylaxis recognition and management (Table 3). Most participants agreed that anaphylaxis can range from mild to life-threatening reactions and may occur without skin involvement. Nearly all respondents agreed that regular training improves anaphylaxis management. However, some misconceptions persisted, particularly regarding serum tryptase testing and the use of adrenaline in mild cases.

Regarding clinical practice (Table 4), 296 participants (72.2%) correctly selected intramuscular injection as the first route of adrenaline administration. For injection site, 295 (72.1%) correctly selected the mid-anterolateral thigh. The correct adult adrenaline dose (0.5 mg) was identified by 235 participants (57.3%). Regarding discharge procedures, 251 participants (61.2%) reported performing all recommended steps, while 114 (27.8%) reported referral only. For long-term management, 225 participants (54.9%) selected all correct steps, whereas 155 (37.8%) selected only referral.

A strong and statistically significant association was found between years of professional experience and correct anaphylaxis management responses ($p<0.001$).

Table 2. Knowledge questions and accuracy rates

Question no	Question summary	Correct n (%)	Incorrect n (%)
11	Definition of anaphylaxis - incorrect statement	335 (81.7%)	75 (18.3%)
12	Systems involved during anaphylaxis	336 (82.0%)	74 (18.0%)
13	Most common allergen causing adult anaphylaxis	83 (20.2%)	327 (79.8%)
14	First-line drug for anaphylaxis	282 (68.8%)	128 (31.2%)
15	Epinephrine contraindications	379 (92.4%)	31 (7.6%)
16	Adjunctive treatments in anaphylaxis	111 (27.1%)	299 (72.9%)
17	Observation time after anaphylaxis	56 (13.7%)	354 (86.3%)

Table 3. Attitude questions and response distribution with n and (%)

Question no	Statement summary	Strongly disagree (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)
18	Anaphylaxis ranges from mild to life-threatening reactions	13 (3.2%)	8 (2.0%)	4 (1.0%)	44 (10.7%)	341 (83.2%)
19	Anaphylaxis may occur without skin/ mucosal findings	10 (2.4%)	9 (2.2%)	8 (2.0%)	101 (24.6%)	282 (68.8%)
20	Regular training of physicians improves anaphylaxis management	7 (1.7%)	9 (2.2%)	5 (1.2%)	92 (22.4%)	297 (72.4%)
21	Anaphylaxis diagnosis requires serum tryptase measurement	70 (17.1%)	122 (29.8%)	143 (34.9%)	52 (12.7%)	23 (5.6%)
22	Epinephrine should be avoided in mild anaphylaxis	103 (25.1%)	122 (29.8%)	55 (13.4%)	112 (27.3%)	18 (4.4%)
23	All patients should receive adrenaline auto-injector prescription before discharge	19 (4.6%)	60 (14.6%)	82 (20.0%)	121 (29.5%)	128 (31.2%)

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

Table 4. Practice questions and response distribution (n, %)

Question no	Question summary	Correct/preferred response n (%)	Other responses (main alternatives)
24	First route of adrenaline administration in suspected anaphylaxis	Intramuscular: 296 (72.2%)	Subcutaneous: 61 (14.9%); Intravenous: 33 (8.0%); None: 15 (3.7%)
25	Next step if second epinephrine dose fails	Start IV fluid resuscitation: 204 (49.8%)	Corticosteroid: 174 (42.4%); Antihistamine: 24 (5.9%); Wait: 8 (2.0%)
26	Recommended injection site for adrenaline	Mid-lateral thigh: 295 (72.1%)	Deltoid: 69 (16.9%); Gluteal: 19 (4.6%)
27	Appropriate adult adrenaline döşe	0.5 mg: 235 (57.3%)	0.1 mg: 75 (18.3%); 1 mg: 69 (16.8%)
28	Most common discharge practice after anaphylaxis	All combined (auto-injector, referral, written advice): 251 (61.2%)	Allergy referral: 114 (27.8%); Written advice: 27 (6.6%)
29	Long-term management after anaphylaxis	All combined (auto-injector, referral, plan): 225 (54.9%)	Allergy referral only: 155 (37.8%); Written plan: 19 (4.6%)
30	Presence of simulation training in institution	No simulation: 211 (51.5%)	Limited: 62 (15.1%); Regular: 21 (5.1%); Unknown: 116 (28.3%)

Physicians with less experience had significantly higher accuracy rates: 92.3% (<1 year), 80.0% (1-5 years), and 87.1% (6-10 years), whereas accuracy decreased with increasing experience: 67.6% (11-15 years), 36.7% (16-20 years), and 41.0% (>20 years). This inverse relationship between professional experience and correct management responses represents one of the most notable findings of the study.

Receiving prior anaphylaxis training significantly increased correct response rates ($p<0.001$). The accuracy rate was 76.7% for trained participants compared with 59.4% for untrained participants; however, the effect size was weak. There was also a significant relationship between time since training and accuracy ($p<0.001$). Correct response rates decreased over time: ≤2 years (88.7%), 3-5 years (86.9%), and >5 years (65.1%).

Total knowledge score was significantly associated with the number of anaphylaxis cases encountered in the previous 12 months ($p=0.003$). Participants who had managed >5 cases had significantly higher scores (mean knowledge score: 4.38) than those with no experience (3.69) ($p=0.006$). Similarly, professional experience was significantly associated with total correct responses ($p<0.001$). Post-hoc analysis showed that those with<1 year of experience had the highest scores, whereas those with >20 years had the lowest. Knowledge scores were also higher in those who had received training ($p<0.001$), and among the trained group, knowledge declined with increasing time since the last training ($p=0.023$).

Across all analyses, statistically significant differences were observed ($p<0.001$). The strongest determinant was the inverse relationship between professional experience and knowledge level. While receiving training and recent training improved knowledge, their effects were weaker. Overall, these findings highlight the need for regular, updated, and repeated educational programs to maintain competency in anaphylaxis management.

DISCUSSION

Despite the establishment of consensus definitions since the 2005 anaphylaxis symposium results, the publication of the 2020 World Allergy Organization Anaphylaxis Guidance and its updates and the most recent EAACI Guidelines: Anaphylaxis 2021 update anaphylaxis continues to be underrecognized and inadequately treated by physicians (1,6,7). This inadequate management of anaphylaxis has also been demonstrated in previous studies conducted in Türkiye (8).

The diagnosis of anaphylaxis requires prompt recognition of clinical manifestations. In our study, the proportion of participants who correctly answered key

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

diagnostic questions-definition of anaphylaxis, organ systems affected during anaphylaxis, and the most common triggers of anaphylaxis in adults-was 81.7%, 82%, and 20%, respectively. In addition, 385 participants correctly responded that anaphylaxis can range from mild forms to life-threatening clinical presentations. Similarly, 283 participants (68.8%) "strongly agreed" and 101 (24.6%) "agreed" that anaphylaxis may occur in the absence of skin or mucosal symptoms. These results indicate that physicians in our study had higher knowledge levels regarding the clinical presentation and diagnosis of anaphylaxis compared with existing literature. For example, a study conducted among pediatricians in Brazil reported that only approximately 48% correctly identified the clinical features and diagnostic criteria of anaphylaxis, which is lower than the rate observed in our study (5). Similarly, in a study conducted in Egypt, the diagnosis of anaphylaxis was evaluated using four clinical scenarios, and participants were asked to identify all possible true scenarios. Only 91 participants were able to correctly identify all four proposed scenarios, corresponding to an accuracy rate of 37.6% (9). The same study also demonstrated that the most frequently identified triggers of anaphylaxis were medications, blood products, and foods. In contrast, in our study, the etiological question was largely answered incorrectly. This discrepancy suggests that although physicians were relatively successful in recognizing the clinical presentation of anaphylaxis, they had greater difficulty identifying epidemiologic and trigger-related aspects, particularly those relevant to adult practice. These discrepancies between the literature and our results may be attributed to differences in sample size, local clinical and educational conditions, and the fact that the majority of our participants were physicians working in training and research hospitals, state hospitals, or university hospitals-with no pediatricians included in the sample.

In our study, 210 physicians (51.3%) reported that they had never encountered an anaphylaxis case. In contrast, a study conducted in Türkiye in 2022 reported that 64% of participants had managed at least one case of anaphylaxis (10). In a study conducted among pediatric physicians, the proportion of clinicians with experience in managing anaphylaxis was reported as 52.7% (5). The results of our study are in agreement with previous findings in the literature.

According to Ausubel's theory of meaningful learning, new information is retained more effectively when it is integrated with prior knowledge. Therefore, the relevance and timeliness of a topic enhance learning motivation and contribute to the permanence of knowledge (11). It remains essential that physicians from all medical specialties receive training on anaphylaxis and learn its management based on current evidence. In our study, 223 participants (54.4%) reported having received training on anaphylaxis, and among them, 109 (48.9%) indicated that more than five years had passed since their last training. In comparison, the study conducted in Egypt reported that 63.6% of participants had not received any anaphylaxis-related training whereas the study from Türkiye stated that 72% of participants had received training on the topic (9-10). The variation in these rates suggests that training status may differ according to hospital characteristics, geographic region, years of professional experience, and the inclusion of non-physician healthcare professionals in some studies, as well as differences in training opportunities. Nearly all of our participants (n=398) responded positively to the statement that regular training improves anaphylaxis management. This finding indicates that physicians generally have a high level of awareness regarding anaphylaxis and a strong need for continued education on the subject.

Serum tryptase levels may serve as an objective and useful laboratory parameter for distinguishing anaphylaxis from other conditions such as septic shock, or in situations where anaphylaxis symptoms and signs have resolved due to medical intervention, particularly during anesthesia or surgical procedures (12). Many studies have evaluated the diagnostic accuracy of serum tryptase measurements in anaphylaxis; however, the certainty of the evidence remains very low, as most results are derived from case series or case-control studies (13). Therefore, it is accepted that the absence of elevated tryptase levels does not exclude the diagnosis of anaphylaxis (1). In our survey, 146 participants selected the "unsure" option regarding serum tryptase measurement for the diagnosis of anaphylaxis, and this response was

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

considered correct, as elevated tryptase is not required to establish the diagnosis.

The current European Academy of Allergy & Clinical Immunology (EAACI) anaphylaxis guideline recommends intramuscular administration of adrenaline into the mid-anterolateral thigh as the first-line treatment for anaphylaxis. The guideline also emphasizes that healthcare professionals responsible for managing anaphylaxis should be trained in the immediate administration of intramuscular adrenaline. Furthermore, according to the guideline, early administration of adrenaline appears to reduce the risk of biphasic reactions (1). Evidence comparing intramuscular and subcutaneous administration of adrenaline has shown that the intramuscular route results in higher plasma adrenaline concentrations. Injection into the mid-anterolateral thigh achieves higher adrenaline levels than injection into the deltoid muscle (14). The National Anaphylaxis Guideline of Türkiye also recommends intramuscular administration of adrenaline into the anterolateral thigh as the first-line treatment. A study published in 2022 reported that 87.2% of participants were aware that epinephrine is the first and life-saving treatment for anaphylaxis. In the same study, 42.7% of physicians correctly recognized the recommended dose of epinephrine, and 71.9% correctly identified the route of administration (10). In a study conducted in another country, 75.2% of participants reported that epinephrine is the first-line treatment for anaphylaxis, 53% stated that fluid resuscitation is the second-line treatment, and 26.7% identified corticosteroids and antihistamines as third-line treatment options. The same study also reported that 45.5% of participants correctly stated the recommended dose of epinephrine as 0.01 mg/kg/dose, 56.0% identified the intramuscular route as the preferred method of administration, and 62.1% stated that subsequent doses of epinephrine should be administered at 5-10 minute intervals (12). However, two earlier publications reported considerably lower levels of correct practice: in one study only 38.3% of participants preferred the intramuscular route, while in the other study, the proportion of participants who preferred intramuscular administration was as low as 16.5% (15-16). In our study, 68.8% of participants correctly identified adrenaline as the first-line treatment for anaphylaxis, and 72.2% correctly selected the intramuscular route for administration. Additionally, 92.4% of participants correctly responded that there is no absolute contraindication to the use of adrenaline. However, 27.3% of respondents stated that adrenaline may not be necessary in mild cases, which is incorrect. This finding is clinically important because hesitation to use adrenaline in apparently mild presentations may delay treatment and increase the risk of progression to more severe reactions. In our practice-related questions, when asked what should be done if there is no response to the first dose of adrenaline, 49.8% of physicians correctly selected initiation of intravenous fluid resuscitation, whereas 42.4% chose corticosteroids and 5.9% chose antihistamines. In our study, 57.3% of participants correctly identified the recommended adult dose of adrenaline (0.5 mg) (17). Although the accuracy rates regarding anaphylaxis treatment appear similar across different studies, variations in sample size, inclusion of non-physician participants such as pharmacists, dentists, or nurses in some studies, and differences in the scope and frequency of local guidelines and in-service training programs may account for discrepancies in reported outcomes. Personalized anaphylaxis management plans should be an integral component of the long-term follow-up and care of patients who have experienced an episode of anaphylaxis, even if only once (7). In resource-limited settings, the lack of availability or affordability of adrenaline auto-injectors (AAIs), as well as the failure to refer patients with anaphylaxis to allergy/immunology specialists, may significantly compromise post-discharge management (18). Prescribing the correct dose of an AAI is crucial to prevent poor outcomes, particularly in patients who experience recurrent anaphylactic episodes (10). According to the EAACI guideline, absolute indications for prescribing an AAI(1); nclude: a history of anaphylaxis triggered by foods, latex, or aeroallergens; exercise-induced anaphylaxis; idiopathic anaphylaxis; coexisting uncontrolled or moderate-to-severe asthma in patients with food allergy; Hymenoptera venom allergy accompanied by systemic reactions or high risk of re-exposure; during and after venom immunotherapy; presence of risk factors for recurrence; multiple systemic reactions;

Bozok Tıp Derg 2026;16(2):224-234
Bozok Med J 2026;16(2):224-234

and underlying systemic mastocytosis in adults with any prior systemic reaction. For all these reasons, patients who have experienced anaphylaxis should be referred to an allergy/immunology specialist for long-term follow-up and AAI prescription. In Türkiye, AAIs are available in different doses for adults and children and are reimbursed by the national social security system. For all these reasons, individuals who have experienced anaphylaxis should be referred to an allergy/immunology specialist for long-term follow-up and prescription of an adrenaline auto-injector (AAI). In Türkiye, AAIs are available in different doses for adult and pediatric patients and are reimbursed by the national social security system. In our study, 249 participants (60.7%) correctly indicated that an AAI should be prescribed after an episode of anaphylaxis, and 251 participants (61.2%) reported that they routinely perform all three recommended discharge steps: prescribing an auto-injector, referring the patient to an allergy specialist, and providing written instructions. In a study conducted in a pediatric emergency department in Spain, 69.4% of physicians reported that they would refer patients with anaphylaxis to an Allergy and Immunology specialist (19). In another study, this rate was reported as high as 92.3% (12). n our study, the proportion of participants who stated that they only referred the patient was 37.8%; however, 61.2% of physicians reported performing all recommended discharge steps, including referral to an allergy specialist, prescribing an auto-injector, and providing written instructions.

In our study, a strong and statistically significant relationship was identified between years of professional experience and correct responses to questions related to anaphylaxis management. Physicians with fewer years of experience demonstrated significantly higher accuracy rates. We attribute this finding to the recency of training, suggesting that foundational knowledge may be better retained shortly after graduation. Additionally, participants who had encountered more than five anaphylaxis cases in the past year had significantly higher mean knowledge scores than those who had not encountered any cases. Likewise, participants who had received anaphylaxis training within the last ≤2 years demonstrated higher accuracy rates compared with those whose training occurred more than two years ago. Contrary to our findings, another study reported that formal anaphylaxis training had no significant impact on knowledge or clinical practice related to anaphylaxis. In that study, although the proportion of correct responses regarding epinephrine selection and diagnostic approach was high in both trained and untrained groups, the difference did not reach statistical significance (9). In another study evaluating 1,023 survey responses, item-based analysis revealed that physicians with more than 30 years of experience provided a higher proportion of correct answers. This finding contrasts with the results of our study; however, that study included not only physicians but also nurses, dentists, and medical students, which likely affected sample homogeneity. In the same Brazilian study, it was also reported that the shorter the time since graduation, the higher the level of knowledge, which aligns more closely with our findings (12). Another study found that participants who had received anaphylaxis training and had greater exposure to anaphylaxis cases demonstrated significantly higher accuracy in identifying correct epinephrine administration doses and AAI dosing compared with other participants. In the same study, physicians who were older or had longer years of professional experience had higher rates of incorrect responses regarding the appropriate route of epinephrine administration (10). In a study conducted in pediatric practice, physicians with less than five years of experience encountered anaphylaxis cases significantly less frequently, and knowledge of clinical diagnostic criteria-such as signs and symptoms-was significantly associated with clinical experience. Moreover, the number of participants with more than 10 years of experience was significantly higher, and this group demonstrated greater accuracy regarding diagnostic clinical criteria (20). In our analysis, statistically significant differences were observed between: (i) years of professional experience and accuracy of responses related to anaphylaxis management, (ii) receiving prior anaphylaxis training and correct response rates, (iii) time elapsed since training and correct response rates, and (iv) frequency of encountering anaphylaxis cases and total knowledge scores ($p< 0.001$ for all). The strongest determinant was the inverse relationship between years of experience

and knowledge level. Although receiving training and having received it more recently were associated with increased knowledge scores, these effects were comparatively weaker. Overall, our findings indicate that regular, up-to-date, and repeated training on anaphylaxis management is essential to maintain physician knowledge. One possible explanation for the lower accuracy observed among more experienced physicians is greater reliance on established routine practice patterns rather than updated guideline-based recommendations. In addition, knowledge acquired during earlier stages of medical training may decline over time if not reinforced by regular continuing medical education.

When evaluated collectively, the inverse trend observed in our study suggests that physicians with longer professional experience may rely more on routine practice patterns or may not update their knowledge according to current guideline recommendations. Additionally, discrepancies between our results and those reported in the literature may be attributed to differences in sample size, heterogeneity of participant characteristics, and variability in access to educational opportunities, all of which may influence anaphylaxis management.

This study has several limitations. First, the physicians included in the survey represented heterogeneous specialties, levels of training, and working environments, which may have influenced the outcomes. Differences in years of professional experience may also have affected the results. The online and self-reported nature of the survey may have introduced response and recall bias. Second, as participation was voluntary, physicians with a higher interest or awareness of anaphylaxis may have been more likely to respond. Additionally, although participants were instructed to answer based on their own knowledge, the possibility that some respondents may have consulted external resources while completing the questionnaire cannot be fully excluded. Finally, because the questionnaire included knowledge-based items, case-based clinical scenarios, and attitude-related statements, the decision-making process may have been challenging for some participants.

CONCLUSION

With a relatively large sample size, we believe that our study contributes to the current literature by evaluating physicians' knowledge and management of anaphylaxis. Overall, we identified a high level of awareness and a substantial need for further education on anaphylaxis among physicians. Certain uncertainties remain, particularly regarding diagnostic criteria and the management of mild cases. Our findings show that while physicians possess adequate knowledge regarding first-line interventions, significant deficiencies exist in post-discharge management and institutional training opportunities. The accuracy rates for knowledge-based questions ranged from 13.7% to 92.4%, indicating that physicians have strong knowledge in some components of anaphylaxis management and limited knowledge in others.

These results reinforce that physicians across all specialties must maintain up-to-date knowledge on the diagnosis and treatment of anaphylaxis. Regular, structured, and guideline based educational programs tailored to national resources and local clinical settings are essential to ensure optimal patient care and to sustain knowledge over time.

Acknowledgment

The authors declared that this study has received no financial support and no conflict of interest between.

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