

Original Article



Level of knowledge among healthcare professionals regarding anaphylaxis

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Conflict of Interest

The authors have no financial conflicts of interest.

Author Contributions

Conceptualization: Sevgi Sipahi Cimen. Formal analysis: Sevgi Sipahi Cimen. Investigation: Sevgi Sipahi Cimen, Sena Baykara Sayili. Methodology: Sevgi Sipahi Cimen. Project administration: Sevgi Sipahi Cimen, Sena Baykara Sayili. Writing - original draft: Sevgi

ABSTRACT

Background: Anaphylaxis is defined as a severe, life-threatening systemic hypersensitivity reaction. Healthcare professionals must recognize the symptoms, apply correct treatment immediately, and provide epinephrine auto-injectors (EAI) to patients who experience anaphylaxis.

Objective: In this study, we aimed to investigate the knowledge of healthcare professionals regarding anaphylaxis.

Methods: This cross-sectional study, which was conducted between February 2022 and March 2022, included healthcare professionals working in various hospitals in Turkey. A survey consisting of 21 questions which concerned with the demographic data, personal experience and level of knowledge about anaphylaxis was applied to healthcare professionals.

Results: The study included a total of 301 participants, comprising 160 specialist physicians (53.16%), 86 resident physicians (28.57%), 31 family physicians (10.3%), and 24 allied health personnel (7.97%). Most of the healthcare professionals (93%) chose epinephrine as the first-line treatment for anaphylaxis. Two hundred ten participants (69.77%) knew the correct dose of epinephrine in the treatment of anaphylaxis, and allied healthcare professionals had least knowledge ($p = 0.009$). The participants who received anaphylaxis training and had experience with anaphylaxis had a higher knowledge about epinephrine dosing ($p < 0.001$ and $p = 0.003$, respectively). Only 49.17% of the participants knew the epinephrine doses of EAIs, and only 19% of participants had prescribed an EAI.

Conclusion: Our results showed that healthcare professionals' knowledge about epinephrine doses in the treatment of anaphylaxis was not sufficient. Furthermore, the prescribing rate of EAIs was still inadequate. There is a need for national training programs to increase and update the knowledge of healthcare professionals to reduce anaphylaxis mortality.

Keywords: Anaphylaxis; Epinephrine; Healthcare professionals; Knowledge; Physicians

INTRODUCTION

Anaphylaxis is defined as an acute, severe, and life-threatening systemic hypersensitivity reaction [1]. It has been reported that the estimated prevalence of anaphylaxis is between 1.6% and 5.1%, and it is increasing, especially in developed countries [2, 3]. Accurate

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diagnosis and early treatment are essential because anaphylaxis is a clinical condition that has a rapid onset and it may cause death [4]. Epinephrine is the first-line treatment for anaphylaxis, and delayed or incorrect administration increases the risk of fatal outcomes [5, 6]. For this reason, healthcare professionals must recognize the symptoms of anaphylaxis and apply correct treatment immediately. Anaphylaxis may recur, and unpredictable and recurrent episodes may be more severe than the previous reaction [4]. Therefore, physicians must provide epinephrine auto-injectors (EAI) to patients who experience anaphylaxis, as well as educate them on how to use them [7]. However, many studies indicate that anaphylaxis is often underrecognized by healthcare professionals, and epinephrine is not always used by physicians with the correct dose and route as the first-line treatment [3, 8-10]. Furthermore, it has been observed that EAI have not been prescribed by physicians adequately [11].

In this study, we aimed to investigate the knowledge of healthcare professionals about anaphylaxis and its management, as well as to identify gaps in anaphylaxis management.

MATERIALS AND METHODS

We conducted a descriptive, cross-sectional study between February 2022 and March 2022, including healthcare professionals working in various hospitals in Turkey. A survey was developed by a pediatric allergist via Google Forms to evaluate the knowledge levels of healthcare providers about anaphylaxis. Anaphylaxis guidelines were used to prepare the questionnaire form and define the correct responses [1, 12]. Questionnaire form links were shared with the participants through different social media platforms and email addresses. Digital informed consent was obtained from all participants before answering the questions.

Three hundred one healthcare providers consisting of physicians (specialists, residents, and family [primary care] physicians), nurses, emergency medical technicians, and the other allied healthcare professionals who accepted to participate, gave digital informed consent and answered all the questions were included in the study.

A survey consisting of 21 questions was administered. The first 8 questions were concerned with the demographic data and personal experience of the disease of the participants such as sex, age, duration of work experience, occupational group, working department and institution, and personal or family history of allergic disease. The remaining 13 questions focused on the participants' level of knowledge about anaphylaxis and its management. Among them, the first 5 questions were relevant to educational status regarding anaphylaxis, case-based experience, and also knowledge level about triggers and symptoms of anaphylaxis. In the remaining 8 questions, knowledge about the drugs used in the treatment of anaphylaxis, epinephrine dose, its route of administration, and finally knowledge about the dose and use of EAI was inquired.

Statistical analysis

The IBM SPSS Statistics ver. 21.0 (IBM Co., Armonk, NY, USA) was used for data evaluation and analysis. Categorical variables are presented as frequencies (n) and percentages (%), and numeric variables are presented as the median (interquartile range) values. The Kolmogorov-Smirnov test was used for normality analysis. The chi-square test and Fisher exact test were used to compare the distribution of categorical variables between groups. The Mann-Whitney

U test was used to compare differences between 2 independent groups when variables were not normally distributed. A value of $p < 0.05$ was accepted as statistical significance.

The study was approved by the Ethics Committee of Firat University (2021/13-43). The study was performed according to the Declaration of Helsinki.

RESULTS

The study included a total of 301 participants, comprising 160 specialist physicians (53.16%), 86 resident physicians (28.57%), 31 family physicians (10.3%), and 24 allied healthcare professionals (7.97%). The median age of the participants was 36 years, and the majority of them were female (73%, $n = 220$). Participating healthcare professionals had a median of 10 years of work experience. Family physicians had more work experience with a median of 21 years, and resident physicians had shorter work experience ($p < 0.001$). The demographic characteristics of the participants are shown in **Table 1**.

Among the participants, 217 (72%) received formal anaphylaxis training, and 194 (64.12%) had experience with a case of anaphylaxis. The rate of receiving anaphylaxis training was higher in resident physicians and was lower in family physicians ($p = 0.008$). Almost all of the participants (98.67%) stated that they knew the symptoms of anaphylaxis. In addition, 78% and 76.41% of the participants correctly answered the questions regarding the most common cause of anaphylaxis in children and adults, respectively. Concerning the participants' knowledge of anaphylaxis management, most of the healthcare professionals (93%) chose epinephrine as the first-line treatment in anaphylaxis (**Fig. 1**). Additionally, 210 of healthcare professionals (69.77%) correctly answered the question related to the dose of epinephrine in the treatment of anaphylaxis. Two hundred forty-seven participants (82%) stated that the preferred route of administration in epinephrine treatment was intramuscular injection. Most of the participants had information about EAIs; 49.17% of the participants correctly answered the question about the epinephrine doses of the EAIs that are available in our

Table 1. Demographic characteristics of healthcare professionals

Characteristic	All Participants	Specialist physicians	Resident physicians	Family physicians	Allied health personals	<i>p</i> value
Sex						0.137 [†]
Female	220 (73.10)	114 (71.25)	59 (68.60)	27 (87.10)	20 (83.33)	
Male	81 (26.90)	46 (28.75)	27 (31.40)	4 (12.90)	4 (16.67)	
Age (yr)	36 (30–42)	38 (34.3–43)	29 (27–30)	45 (31–54)	36.5 (28–42)	<0.001 [†]
Duration of work experience (yr)	10 (5–16)	13 (1–42)	4 (1–16)	21 (0.25–38)	14.5 (1–36)	<0.001 [†]
Working department						
Emergency service	29 (9.63)	7 (4.38)	15 (17.44)	7 (22.58)	0 (0)	
Outpatient clinic	62 (20.60)	33 (20.63)	13 (15.12)	8 (25.81)	8 (33.33)	
Inpatient clinic	46 (15.28)	16 (10.00)	17 (19.77)	2 (6.45)	11 (45.83)	
Outpatient & inpatient clinic	129 (42.86)	88 (55.00)	37 (43.02)	1 (3.23)	3 (12.50)	
Primary care clinic	12 (3.99)	0 (0)	0 (0)	11 (35.48)	1 (4.17)	
Private practice	23 (7.64)	16 (10.00)	4 (4.65)	2 (6.45)	1 (4.17)	
Personal history of allergic disease						0.323 [†]
Yes	97 (32.23)	50 (31.25)	24 (27.91)	14 (45.16)	9 (37.50)	
No	204 (67.77)	110 (68.75)	62 (72.09)	17 (54.84)	15 (62.50)	
Family history of allergic disease						0.549 [†]
Yes	154 (51.16)	86 (53.75)	40 (46.51)	14 (45.16)	14 (58.33)	
No	147 (48.84)	74 (46.25)	46 (53.49)	17 (54.84)	10 (41.67)	

Values are presented as number (%) or median (range).

[†]Chi-square test. *Kruskall-Wallis test.

country. Although 64% of participants had experience with a case of anaphylaxis, only 19% of participants prescribed an EAI. Those who prescribed EAIs at the highest rate were specialist physicians. The personal experience of disease, and level of knowledge of healthcare professionals regarding anaphylaxis is shown in **Table 2**.

When the knowledge levels of anaphylaxis management were compared according to the professional groups, it was observed that resident physicians' rates of correct answers to the question related to the first-choice drug in the treatment of anaphylaxis were higher compared with other physicians and allied healthcare professionals ($p < 0.001$) (**Table 2**). When the answers given by the physicians were compared, it was found that the rates of correct answers were found to be lower in family physicians than in specialists and residents ($p = 0.027$) (data not shown). Also, resident physicians had better knowledge (60.47%) about epinephrine doses of EAIs than the family physicians (25.81%) and allied health personnel (25%), respectively ($p = 0.001$) (**Table 2**).

Table 2. Personal experience and level of knowledge of healthcare professionals regarding anaphylaxis

Answers to questions	All Participants	Specialist physicians	Resident physicians	Family physicians	Allied health personals	p value
Have receive training on anaphylaxis	217 (72.09)	118 (73.75)	69 (80.23)	16 (51.61)	14 (58.33)	0.008 [†]
Time elapsed after training						<0.001 [‡]
≤2 years	88 (34.78)	24 (17.65)	52 (66.67)	7 (35.00)	5 (26.32)	
3–5 years	38 (15.02)	21 (15.44)	12 (15.38)	2 (10.00)	3 (15.79)	
>5 years	127 (50.2)	91 (66.91)	14 (17.95)	11 (55.00)	11 (57.89)	
Have experience with a case of anaphylaxis	193 (64.12)	101 (63.13)	63 (73.26)	16 (51.61)	13 (54.17)	0.097 [†]
Know the symptoms of anaphylaxis	297 (98.67)	159 (99.38)	84 (97.67)	31 (100)	23 (95.83)	0.219 [‡]
Know the most common trigger of anaphylaxis in children	235 (78.07)	130 (81.25)	68 (79.07)	23 (74.19)	14 (58.33)	0.081 [†]
Know the most common trigger of anaphylaxis in adults	230 (76.41)	116 (72.50)	65 (75.58)	28 (90.32)	21 (87.50)	0.099 [‡]
Know the first-line treatment of anaphylaxis	280 (93.02)	150 (93.75)	85 (98.84)	27 (87.10)	18 (75.00)	<0.001 [‡]
Know the correct epinephrine dose in anaphylaxis treatment	210 (69.77)	114 (71.25)	66 (76.74)	20 (64.52)	11 (45.83)	0.009 [†]
Know the correct administration route of epinephrine	247 (82.06)	127 (79.38)	84 (97.67)	20 (64.52)	16 (66.67)	<0.001 [‡]
Have information about EAI	224 (74.42)	119 (74.38)	74 (86.05)	20 (64.52)	11 (45.83)	<0.001 [†]
Have prescribe an EAI	58 (19.27)	40 (25.00)	16 (18.60)	2 (6.45)	0 (0)	<0.001 [‡]
Know the epinephrine dose in EAIs	148 (49.17)	82 (51.25)	52 (60.47)	8 (25.81)	6 (25.00)	0.001 [†]
May describe to patients how to use of EAI	156 (51.83)	81 (50.63)	55 (63.95)	13 (41.94)	7 (29.17)	0.010 [†]

Values are presented as number (%).

EAI, epinephrine auto-injector.

[†]Chi-square test. [‡]Fishers exact test.

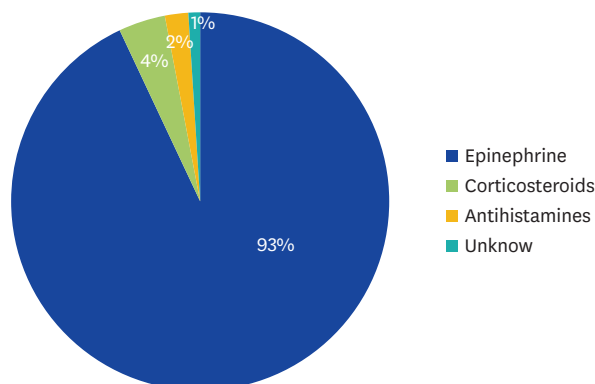


Fig. 1. Medications considered by participants as first-line treatment of anaphylaxis.

Most of the healthcare professionals (93%) chose epinephrine as the first-line treatment in anaphylaxis. Of the remaining participants, 4% preferred corticosteroids; 2% chose antihistamines. Also, 1% of the participants stated that they did not know the first-line treatment of anaphylaxis.

There was a statistically significant difference between physicians and allied health personnel in correct responses to questions related to epinephrine doses for the treatment of anaphylaxis ($p = 0.009$). Allied health personnel had less knowledge about the correct epinephrine doses. However, there was no statistical difference between the physicians according to whether they were specialists (Table 2). Regarding the knowledge level toward the administration route of epinephrine that should be preferred, it was found that resident physicians' rates of correct answers were significantly higher compared with other physician groups and allied health personnel ($p < 0.001$). The rate of correct responses to questions about epinephrine doses and route of administration by physicians and allied health personnel is shown in Fig. 2.

The participants who received anaphylaxis training and had experience with a case of anaphylaxis had a higher rate of correct answers to questions about epinephrine doses ($p < 0.001$ and $p = 0.003$, respectively). Also, it was observed that participants who received anaphylaxis training and had experience with a case of anaphylaxis had a higher rate of correct answers to questions about EAI doses ($p < 0.001$ and $p = 0.002$, respectively). In addition, participants with older age and longer work experience had a higher rate of incorrect answers to questions about the route of administration of epinephrine ($p < 0.001$). The characteristics of participants according to answers to the question about epinephrine dose and route of administration in the treatment of anaphylaxis are shown in Table 3 and Table 4, respectively.

DISCUSSION

Anaphylactic reactions can progress quickly and result in death. Hence, recognizing the symptoms of anaphylaxis and administering early epinephrine treatment with the correct dose and route is crucial. Even though clinical practice guidelines for anaphylaxis management exist, evidence shows that both acute and long-term anaphylaxis management is inadequate in healthcare facilities including emergency and primary care units [13, 14].

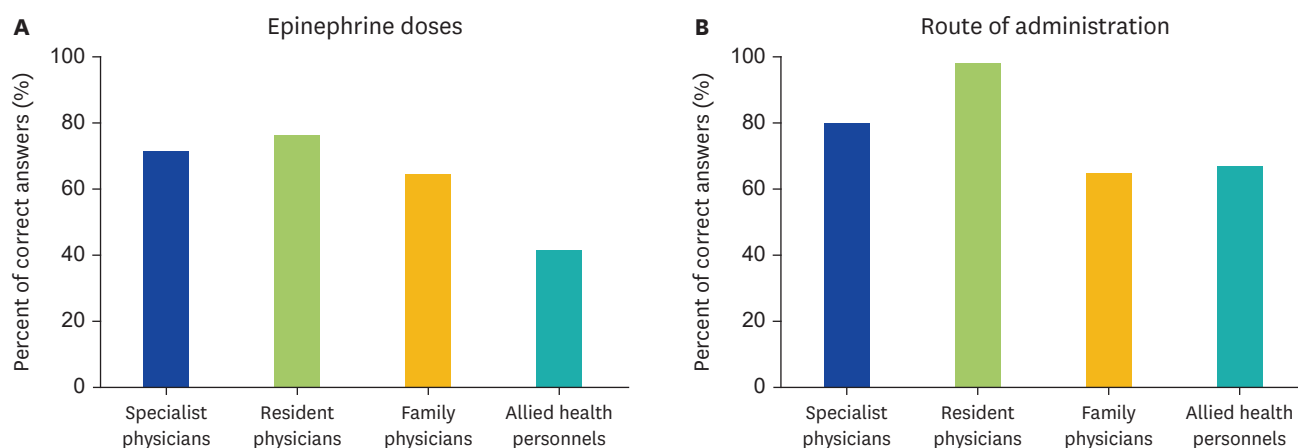


Fig. 2. Percents of correct answers to questions about epinephrine doses (A) and route of administration (B) by healthcare professionals. The resident physicians' had higher rates of correct answers to the question about epinephrine doses (A) and administration route (B) compared with other physicians and allied health personnels.

Table 3. Characteristics of participants according to answers to question about epinephrine dose

Characteristic	Participants who answered correctly (n=210)	Participants who answered incorrectly (n=91)	p value
Sex			0.001 [†]
Female	142 (67.62)	78 (85.71)	
Male	68 (32.38)	13 (14.29)	
Age (yr)	35.5 (30–42)	36 (30–42)	0.618 [§]
Duration of work experience (yr)	10 (4–16)	12 (5–17)	0.116 [§]
Professional group			0.009 [†]
Specialist physicians	114 (54.29)	46 (50.55)	
Resident physicians	66 (31.43)	20 (21.98)	
Family physicians	20 (9.52)	11 (12.09)	
Allied health personals	10 (4.76)	14 (15.38)	
Personal history of allergic disease			0.473 [†]
Yes	65 (30.95)	32 (35.16)	
No	145 (69.05)	59 (64.84)	
Family history of allergic disease			0.252 [†]
Yes	112 (53.33)	42 (46.15)	
No	98 (46.67)	49 (53.85)	
Have receive training on anaphylaxis	165 (78.57)	52 (57.14)	<0.001 [†]
Time elapsed after training			0.103 [†]
≤2 years	69 (37.1)	19 (28.36)	
3–5 years	31 (16.67)	7 (10.45)	
>5 years	86 (46.24)	41 (61.19)	
Have experience with a case of anaphylaxis	146 (69.52)	47 (51.65)	0.003 [†]
Know the symptoms of anaphylaxis	210 (100)	87 (95.60)	0.008 [‡]
Know the most common trigger of anaphylaxis in children	166 (79.05)	69 (75.82)	0.535 [†]
Know the most common trigger of anaphylaxis in adults	162 (77.14)	68 (74.73)	0.65 [†]
Know the first-line treatment of anaphylaxis	206 (98.10)	74 (81.32)	<0.001 [‡]
Know the correct administration route of epinephrine	187 (89.05)	60 (65.93)	<0.001 [†]
Have prescribe an EAI	50 (23.81)	8 (8.79)	0.002 [†]
Know the epinephrine dose in EAI	125 (59.52)	31 (34.07)	0.001 [†]

Values are presented as number (%) or median (range).

EAI, epinephrine auto-injector.

[†]Chi-square test. [‡]Fishers exact test. [§]Mann-Whitney *U* test.

In a systematic review regarding the gaps in anaphylaxis management, it was revealed that there was a lack of knowledge in anaphylaxis management and follow-up care among physicians [15]. Identifying these gaps is particularly important given the increasing prevalence of anaphylaxis. In this regard, we evaluated the gaps in anaphylaxis knowledge and its management in our country.

Our study, including healthcare professionals from different healthcare institutions, showed that there was a lack of knowledge among healthcare professionals regarding the acute treatment of anaphylaxis such as the dose of epinephrine, and long-term therapy such as EAI doses, and prescribing rates. This lack of knowledge was similar to previous studies conducted in Turkey and different countries [16–20].

It has been observed that the education programs on the recognition and treatment of anaphylaxis have increased the level of knowledge of healthcare professionals and, accordingly, decreased fatalities due to anaphylaxis [21, 22]. Similarly, we determined that our participants who received anaphylaxis training had a higher rate (78.57%) of knowing the correct epinephrine dose. In addition, the rate of preferring epinephrine as the first-line treatment was found to be significantly lower among family physicians, who had the lowest rate of receiving anaphylaxis training among the physicians.

Table 4. Characteristics of participants according to answers to question about epinephrine route of administration

Characteristic	Participants who answered correctly (n=247)	Participants who answered incorrectly (n=54)	p value
Sex			0.011 [†]
Female	173 (70.04)	47 (87.04)	
Male	74 (29.96)	7 (12.96)	
Age (yr)	34 (29–40)	42 (36.75–51.25)	<0.001 [§]
Duration of work experience (yr)	9 (4–14)	17.5 (12–24.25)	<0.001 [§]
Professional group			<0.001 [†]
Specialist physicians	127 (51.44)	33 (61.11)	
Resident physicians	84 (34.01)	2 (3.70)	
Family physicians	20 (8.10)	11 (20.37)	
Allied health personals	16 (6.48)	8 (14.81)	
Personal history of allergic disease			0.897 [†]
Yes	80 (32.39)	17 (31.48)	
No	167 (67.61)	37 (68.52)	
Family history of allergic disease			0.625 [†]
Yes	128 (51.82)	26 (48.15)	
No	119 (48.18)	28 (51.85)	
Have receive training on anaphylaxis	187 (75.71)	30 (55.56)	0.003 [†]
Time elapsed after training			<0.001 [†]
≤2 years	82 (37.79)	6 (16.67)	
3–5 years	37 (17.05)	1 (2.78)	
>5 years	98 (45.16)	29 (80.56)	
Have experience with a case of anaphylaxis	172 (69.64)	21 (38.89)	<0.001 [†]
Know the symptoms of anaphylaxis	244 (98.79)	53 (98.15)	0.549 [†]
Know the most common trigger of anaphylaxis in children	198 (80.16)	37 (68.52)	0.061 [†]
Know the most common trigger of anaphylaxis in adults	187 (75.71)	43 (79.63)	0.539 [†]
Know the first-line treatment of anaphylaxis	236 (95.55)	44 (81.48)	0.001 [†]
Know the correct epinephrine dose in anaphylaxis treatment	187 (75.71)	23 (42.59)	<0.001 [†]
Have prescribe an EAI	56 (22.67)	2 (3.70)	0.001 [†]
Know the epinephrine dose in EAI	138 (55.87)	10 (18.52)	<0.001 [†]

Values are presented as number (%) or median (range).

EAI, epinephrine auto-injector.

[†]Chi-square test. [‡]Fishers exact test. [§]Mann-Whitney *U* test.

Current international guidelines for anaphylaxis recommend the use of epinephrine as first-line therapy for anaphylaxis management [1]. In previous studies evaluating knowledge levels of anaphylaxis, the rate of using epinephrine as the first-line therapy among participants was found between 90%–93% [23, 24]. Similarly, in our study group, 93% of the participants chose epinephrine as the first-line treatment for anaphylaxis. Also, we found that this rate was highest in resident physicians and lowest in family physicians. We think that this result may be related to the fact that family physicians have less experience in cases of anaphylaxis and a lower rate of receiving anaphylaxis training. Two different studies conducted in Turkey and the United States of America reported similar results [16, 25]. In contrast to our findings, in a previous study by Baççioğlu et al. [26] from Turkey, it was reported that less than half of the participants used epinephrine as a first-line treatment. This result may be related to the fact that nurses constituted the majority of the study population and less than half of the participants had direct experience of anaphylaxis.

The majority (93%) of our participants chose epinephrine as the first-line treatment, but only 69.77% of the healthcare professionals knew the correct dose. Although this rate was the lowest among allied healthcare professionals, no statistical difference was found among physicians. Plumb et al. [27] illustrated that although all of the participants in their study preferred epinephrine as the first treatment option, only 30% of them knew the dose correctly. Lee et al. [28] reported similar results, indicating that epinephrine administration

was insufficient in actual practice. Therefore, training programs should be arranged to include allied healthcare professionals. Also, in contrast with a recent study conducted in Egypt [29], we determined that receiving anaphylaxis training and having experience with a case of anaphylaxis impacted the rate of knowing the epinephrine dose.

Lack of knowledge about the correct administration route of epinephrine was also a determined gap in previous studies [30-33]. Contrary to these findings, the administration route of epinephrine was answered correctly by 82% of our responders. The rate of knowing the preferred administration route was found to be significantly highest in resident physicians. In addition, participants who were older and with longer work experience had a lower level of knowledge about intramuscular epinephrine administration. These results can be explained by the fact that resident physicians constituted the younger age group in our study, and they have the highest rate of receiving anaphylaxis education. Even though current guidelines recommend intramuscular epinephrine treatment, before 2006, subcutaneous epinephrine treatment had been recommended [13, 34]. In this context, it can be concluded that the older participants with longer work experience have not updated their knowledge of the epinephrine administration route in accordance with the current literature. Similar observations were made in recent studies in our country conducted by Tuncel et al. [17] and in Tehran by Fakheri and Movahedi et al. [35].

It is also important that EAI should be provided to patients for potential unpredictable recurrent reactions [13]. In the literature, different studies indicated that the rate of EAI prescriptions was low across healthcare professionals [11, 30, 32, 36, 37]. Along the same line, we found that the percentage of participants prescribing EAI was low, even though EAI is available in our country. This result may be related to insufficient training of health workers regarding EAI. Also, we observed that the specialist physicians were significantly more likely to prescribe EAI than residents and family physicians. Similarly, Mehr et al. [36] found that resident physicians prescribed EAI less frequently than more senior personnel. Moreover, in a previous study conducted in Turkey that evaluated the level of knowledge of family physicians on anaphylaxis, the authors reported that only 7.4% of family physicians prescribed EAI. This may be related to the fact that patients are mostly referred to specialist physicians.

It is also important to prescribe the correct dose of an EAI to prevent a poor prognosis in patients with recurrent episodes of anaphylaxis. In previous studies, it was reported that few physicians knew the correct doses of EAI [31, 38-41]. In line with the literature, we observed that 49.17% of our participants knew the epinephrine doses of the EAI available in our country. Also, participants who received anaphylaxis training and had experience with a case of anaphylaxis had a higher rate of knowledge about EAI doses. These results showed that education and experience with anaphylaxis were effective in knowing the EAI dose correctly.

This is an important study including physicians and allied health personnel in terms of revealing the deficiencies in the knowledge level of anaphylaxis. However, this study has some limitations. First, this study did not analyze the specialization distribution of physicians. This may be a factor, that the level of knowledge of specialists is lower than among residents. Secondly, because this study was conducted online, it could not be delivered to all physicians. Therefore, it cannot be generalized to the country.

In conclusion, our results showed that healthcare professionals' knowledge about epinephrine doses in the acute treatment of anaphylaxis was not sufficient, also regarding

EAI doses. Furthermore, the prescribing rate of EAIs was still inadequate. The level of knowledge about anaphylaxis treatment such as the use of epinephrine as first-line treatment was found to be lower in family physicians who had longer work experience and had less formal anaphylaxis training. There is a need for national training programs to increase and update the knowledge of healthcare professionals, especially those with longer work experience and family physicians, to reduce anaphylaxis-related mortality. The results of this study will be useful to provide a basis for educational programs to close the gaps in the concept of anaphylaxis.

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