



## Research

# Evaluation of Knowledge of Family Physicians on the Diagnosis and Treatment of Anaphylaxis and Adrenaline Auto-injector Use in Türkiye

## Türkiye’de Çalışan Aile Hekimlerinin Anafilaksi Tanı-tedavisi ve Adrenalin Otoenjektör Kullanımı Konusunda Bilgi Düzeylerinin Değerlendirilmesi

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### ABSTRACT

**Objective:** Anaphylaxis is a life-threatening reaction characterized by sudden symptoms affecting different organ systems, and healthcare professionals must recognize and urgently treat anaphylaxis. In this study, we aimed to evaluate the knowledge and attitudes of family physicians in Türkiye about the diagnosis and treatment of anaphylaxis, use of adrenaline auto-injector, and factors affecting these attitudes.

**Methods:** This was a cross-sectional descriptive survey study. An online questionnaire was administered to family physicians to evaluate their knowledge levels regarding the diagnosis and treatment of anaphylaxis and the use of AAI.

**Results:** The study was completed with 207 participants, mean age was 33.8±8.5 years and mean professional experience was 8.5±8.3 years. 93.7% of the participants stated that the first-line treatment of anaphylaxis was adrenaline, 85.5% the correct route of adrenaline administration was intramuscular, 79.2% the right place of adrenaline administration, 75.4% the dose of adrenaline in children, 61.8% of them answered the adrenaline dose correctly in adults. 51.2% of the participants stated that they knew about the use of AAI, and 24.6% had received training on this subject. The average number of professional years of participants who knew that the first-line treatment was adrenaline, the correct route and place of administration of adrenaline, and knew how to use auto-injectors were statistically significantly lower ( $p=0.031$ ,  $p<0.001$ ,  $p<0.001$ ,  $p=0.041$ , respectively). Family physicians who received post-graduation training on anaphylaxis; the rate of knowing that the first-line treatment of anaphylaxis was adrenaline, the correct route and place of administration of adrenaline, and the rate of knowing the use of auto-injectors were statistically significantly higher ( $p=0.013$ ,  $p=0.037$ ,  $p=0.024$ ,  $p=0.011$ , respectively).

**Conclusion:** The most significant outcome of our study is family physicians' knowledge of the diagnosis and treatment of anaphylaxis is higher when their training at medical faculty and specialist training is more recent and when they undergo post-graduation training. With post-graduation training programs, family physicians can become more competent in life-threatening anaphylaxis. However, physicians' knowledge of adrenaline auto-injector therapy is insufficient. Family physicians should be trained on the use of this essential and life-saving drug for those at risk of anaphylaxis.

**Keywords:** Anaphylaxis, family physicians, knowledge, adrenaline auto-injector

### ÖZ

**Amaç:** Anafilaksi, farklı organ sistemlerini etkileyen ani semptomlarla karakterize, yaşamı tehdit eden bir reaksiyondur. Tüm sağlık profesyonellerinin anafilaksiyi tanıması ve acil olarak tedavi etmesi gerekir. Bu çalışmada Türkiye’de çalışan aile hekimlerinin, anafilaksi tanı ve tedavisi ile adrenalin otoenjektör kullanımı konusundaki bilgi ve tutumlarını ve bu tutumları etkileyen faktörleri değerlendirmeyi amaçladık.

**Gereç ve Yöntem:** Çalışma, kesitsel tanımlayıcı tarama çalışması olarak planlandı. Aile hekimlerine, anafilaksi tanı ve tedavisi ile adrenalin otoenjektörlerinin kullanımı ile ilgili bilgi düzeylerini değerlendirmeyi amaçlayan çevrimiçi bir anket uygulandı.

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**ÖZ**

**Bulgular:** Çalışma 207 katılımcı ile tamamlandı, ortalama yaş  $33,8 \pm 8,5$  yıl ve ortalama mesleki deneyim  $8,5 \pm 8,3$  yıldır. Katılımcıların; %93,7'si anafilaksinin ilk tedavisinin adrenalin olduğunu, %85,5'i doğru adrenalin uygulama şeklinin kas içi olduğunu, %79,2'si adrenalinin doğru uygulama yerini, %75,4'ü çocuk hastalarda uygun adrenalin dozunu, %61,8'i erişkin hastalarda uygun adrenalin dozunu doğru olarak biliyordu. Katılımcılardan %51,2'si adrenalin otoenjektör kullanımını bildiğini, %24,6'sı bu konuda eğitim aldığını belirtti. İlk tedavinin adrenalin olduğunu, adrenalinin doğru uygulama yolu ve yerini bilen, otoenjektör kullanmayı bilen katılımcıların meslek yılı ortalamaları istatistiksel olarak anlamlı derecede düşüktü (sırasıyla  $p=0,031$ ,  $p<0,001$ ,  $p<0,001$ ,  $p=0,041$ ). Anafilaksi konusunda mezuniyet sonrası eğitim alan aile hekimlerinin; ilk tedavinin adrenalin olduğunu, adrenalinin doğru verilmiş yolu ve yerini bilme oranı, otoenjektör kullanımını bilme oranı istatistiksel olarak anlamlı derecede yüksekti (sırasıyla  $p=0,013$ ,  $p=0,037$ ,  $p=0,024$ ,  $p=0,011$ ).

**Sonuç:** Çalışmamızın en önemli sonucu, aile hekimlerinin tıp fakültesi ve uzmanlık eğitimlerinin daha yeni olması ve mezuniyet sonrası eğitim almaları durumunda anafilaksi tanı ve tedavisi konusundaki bilgilerinin daha yüksek olmasıdır. Bu nedenle hizmet içi eğitim programları ile hekimler hayatı tehdit eden anafilaksi konusunda daha yetkin hale gelebilir. Hekimlerin adrenalin oto-enjektör tedavisi konusundaki bilgileri yetersizdir. Anafilaksi riski taşıyanlar için bu temel ve hayat kurtarıcı ilacın kullanımı konusunda aile hekimlerine yönelik eğitim planlanmalıdır.

**Anahtar Kelimeler:** Anafilaksi, aile hekimleri, bilgi, adrenalin otoenjektörü

**INTRODUCTION**

Anaphylaxis is a life-threatening condition characterized by the acute onset of symptoms involving different organ systems, and it requires immediate medical intervention. All healthcare professionals need to recognize and treat anaphylaxis (1). With correct and rapid treatment, the risk of mortality can be minimized.

Estimated prevalence is 0.3-5.1% according to diagnostic criteria used in previous studies (2). Although the frequency of hospitalization due to food-and drug-induced anaphylaxis has increased in recent years, death from anaphylaxis remains very infrequent and stands at 0.35-1.06 deaths per million people per year, with no increase observed in the last 10 years (2,3).

The clinical signs and symptoms of anaphylaxis are highly variable, depending on the organ and system affected. Skin and mucosal symptoms occur most frequently (>90% of cases), followed by symptoms involving the respiratory and cardiovascular systems (>50% of cases) (1). The prevalence of various causes of anaphylaxis is age-dependent and varies in different geographical regions. Food, drug, and Hymenoptera venom are the most common factors of anaphylactic reactions (4,5). Anaphylaxis in children is most commonly caused by food, and bronchospasm is a common symptom. There is usually a background of atopy and asthma. In adults, venom- and drug-induced anaphylaxis are more common, and hypotension is more likely to occur (6).

In patients with previous anaphylaxis, it is essential to educate the patient and family about allergen avoidance. Adrenaline auto-injectors (AAI) should be recommended for emergency use in appropriate patients, and patients should be educated about their use (1). It is important that family physicians performing primary health care recognize and treat the signs and symptoms of anaphylaxis, a rare but life-threatening condition.

In this study, we aimed to evaluate the knowledge and attitudes of family physicians in Türkiye about the diagnosis and treatment of anaphylaxis and use of AAI and the factors affecting these attitudes.

**METHODS**

The study was conducted as a cross-sectional descriptive survey between June 2022 and August 2022. The questionnaire was prepared by a specialist family physician and pediatric allergist based on current information. The survey, consisting of 31 questions prepared online using the Google Forms application, was sent to family physicians via social media (WhatsApp) and e-mail. The first part of the survey included the purpose and content of the study and the information and consent of the researchers. Participants who provided consent answered the survey questions fully.

The contents of the questions in the survey were as follows:

1. Questions to determine demographic information, such as gender, age, and professional years.
2. Questions about whether he received post-graduation education on anaphylaxis.
3. General information about anaphylaxis (most common causes of anaphylaxis), diagnosis (clinical symptoms), and questions about experience (previous encounter with an anaphylaxis patient and treatment of an anaphylaxis patient).
4. Questions about anaphylaxis treatment (positioning of the anaphylaxis patient, first-line drug in anaphylaxis, method-place-dose of adrenaline administration).
5. Question about whether the institution where you work has the necessary drugs and equipment for anaphylaxis treatment.
6. There are questions to determine their knowledge and experience regarding the use of AAI.

**Study Population**

Family physicians actively working in Türkiye were included. The study was completed with 207 participants who participated in the survey.

**Statistical Analysis**

The data were analyzed using International Business Machines Statistical Package for the Social Sciences statistics 22.0. Kolmogorov-Smirnov test was used for the

normal distribution of data. The mean differences between two groups with variables that are not distributed normally was assessed using Mann-Whitney U test. The distribution of categorical variables between groups were analyzed using  $\chi^2$  (chi-square) test. Mean, standard deviation, median (1<sup>st</sup> and 3<sup>rd</sup>, 4<sup>th</sup>), frequency, and percentage are descriptive statistics. The threshold of statistical significance was regarded as  $p < 0.05$ .

### Ethical Issues

This study was approved by the Bezmialem Vakıf University Rectorate Non-interventional Research Ethics Committee (approval number: 2021/173, date: 19.05.2021). The study was conducted according to the principles of the Declaration of Helsinki.

## RESULTS

The study was completed with 207 participants, and 58.5% (n=121) of them were female. Their mean age was  $33.8 \pm 8.5$  years (range 24-67 years), and their mean professional experience was  $8.5 \pm 8.3$  years (range 1-43 years). The rate of postgraduate training on anaphylaxis was 40.6% (n=84). Approximately half of the participants (47.3%, n=98) encountered anaphylaxis patients, and 38.6% (n=80) took part in the treatment of anaphylaxis patients. In Family Health Centers, the availability of drugs and equipment was assessed to evaluate the capacity of treating patients with anaphylaxis (Figure 1). Adrenaline was present in 98.6% (n=204), and the least available drug was glucagon (30%, n=62).

### General Information About Anaphylaxis and Its Affecting Factors

The majority of participants correctly identified the most common cause of anaphylaxis in children and adults (food in children 76.8%, n=159, drugs in adults 79.2%, n=164). Furthermore, 30.4% of family physicians knew that all of the signs and symptoms given in the questionnaire could be during anaphylaxis (n=63). This rate was not statistically significantly associated with age, professional experience,

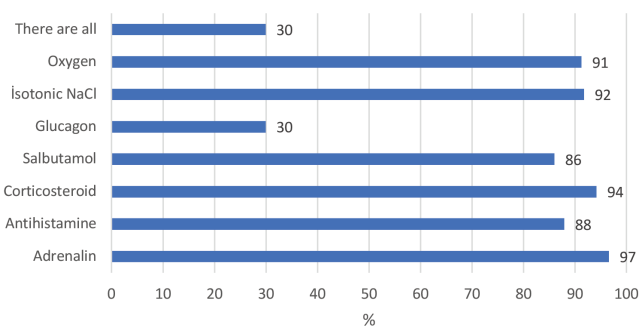


Figure 1. Available drugs and materials to be used in anaphylaxis

and post-graduate education ( $p=0.564$ ,  $p=0.426$ ,  $p=0.454$  respectively). The proportion of family physicians who were involved in the treatment of patients with anaphylaxis was significantly higher than that of those who were not involved in the treatment ( $p=0.03$ ). The signs and symptoms most associated with anaphylaxis were dyspnea (96.6%, n=200), hypotension (94.7%, n=196), and angioedema (94.2%, n=195). The ratio of family physicians to signs and symptoms in the questionnaire regarding anaphylaxis is shown in Figure 2.

### Knowledge and Factors Affecting Anaphylaxis Treatment

Participants knew correctly as correct position to be given to the patient during anaphylaxis (if there is no respiratory distress, lay the patient on his back and raise his feet at an angle of 30-45 degrees) in an 81.6% ratio. 93.7% of the participants stated that the first-line treatment of anaphylaxis was adrenaline, 85.5% the correct route of adrenaline administration was intramuscular, 79.2% the right place of administration of adrenaline, 75.4% the dose of adrenaline in children, and 61.8% of them answered the adrenaline dose correctly in adults.

The average age and professional years of the participants who knew the right route of adrenaline administration and the right place of administration of adrenaline were statistically significantly lower ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.001$ , respectively). The average number of professional years of physicians who knew that the first drug to be administered was adrenaline was statistically significantly less ( $p=0.031$ ). The results are shown in Table 1.

Family physicians who received post-graduation training on anaphylaxis; the rate of knowing that the first drug to be administered in the treatment of anaphylaxis was adrenaline, the correct route of administration of adrenaline, and the right place of administration of adrenaline were significantly higher ( $p=0.013$ ,  $p=0.037$ ,  $p=0.024$ , respectively).

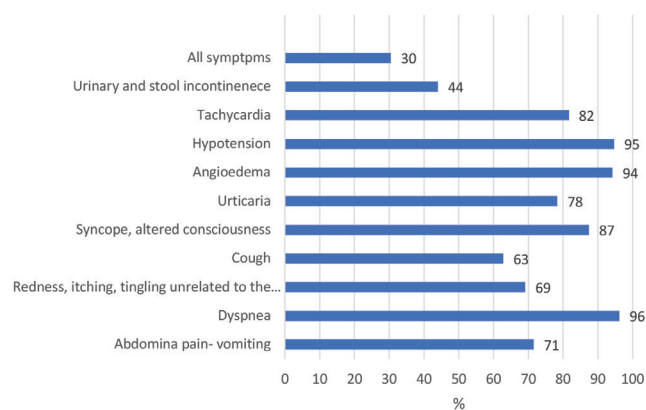


Figure 2. Rate of attributing signs and symptoms to anaphylaxis

Family physicians giving correct answers to questions about the diagnosis and treatment of anaphylaxis; the statistical relationship between age, professional year, post-graduate training in anaphylaxis, and participation in anaphylaxis treatment is presented in Table 1.

### Knowledge and Factors Affecting the Use of AAI

The mean age and professional experience of family physicians who stated that they knew how to use auto-

injectors were lower ( $p=0.006$ ,  $p=0.041$ , respectively). The rate of knowing the use of auto-injectors was significantly higher among those who received postgraduate education on anaphylaxis ( $p=0.011$ ).

The statistical relationships between family physicians' AAI usage information, age, professional experience, post-graduate training on anaphylaxis, and participation in anaphylaxis treatment are presented in Table 2.

**Table 1.** Comparison of the knowledge levels of family physicians according to age, professional experience, post-graduate education, and involvement in anaphylaxis treatment

		Knowing all the symptoms	Knowing that the first drug is adrenaline	Understanding the right route of adrenaline administration	Accurately determining the place of adrenaline administration	Knowing the dose of adrenaline in children	Knowing the dose of adrenaline in adults	Understanding how to position correctly
<b>Age years (mean <math>\pm</math> SD) Median (Q1-Q3)</b>	Know	33.8 $\pm$ 7.7 31 (28-38)	33.4 $\pm$ 8.3 30 (28-36)	32.3 $\pm$ 7.4 30 (28-34)	32.3 $\pm$ 7.1 30 (28-34)	33.6 $\pm$ 8.1 31 (28-37)	33.1 $\pm$ 8.5 30 (28-35)	33.8 $\pm$ 8.7 30 (28-37)
	Don't know	33.6 $\pm$ 8.9 30 (28-35.75)	37.3 $\pm$ 11.1 32 (30-44)	41.7 $\pm$ 10.1 39.5 (32.75-50.25)	39 $\pm$ 11.1 35 (29-49)	34 $\pm$ 9.8 30 (27-37)	34.6 $\pm$ 8.5 31 (28-40)	33.3 $\pm$ 7.3 31.5 (28-36.25)
	$p^*$	0.564	0.076	<0.001	<0.001	0.466	0.174	0.791
<b>Professional years (mean <math>\pm</math> SD) Median (Q1-Q3)</b>	Know	8.6 $\pm$ 7.3 6 (3-12)	8.3 $\pm$ 8.1 5 (3-11)	7.1 $\pm$ 7.1 5 (3-9)	7.1 $\pm$ 6.8 5 (3-9)	8.3 $\pm$ 7.7 5 (3-11)	7.9 $\pm$ 8.1 5 (3-9)	8.5 $\pm$ 8.4 5 (3-10)
	Don't know	8.4 $\pm$ 8.6 5 (3-10)	11.5 $\pm$ 9.6 9 (5-15)	16.3 $\pm$ 9.9 14 (9-23)	18.6 $\pm$ 10.8 10 (4-22)	9 $\pm$ 9.7 4 (3-11)	9.4 $\pm$ 8.4 5 (3-13)	8.1 $\pm$ 7.3 5 (3-11)
	$p^*$	0.426	0.031	<0.001	<0.001	0.554	0.185	0.891
<b>Post-graduate education n (%)</b>	Yes	28 (33.3)	83 (98.8)	77 (91.7)	73 (86.9)	60 (71.4)	54 (64.3)	71 (84.5)
	No	35 (28.5)	111 (90.2)	100 (81.3)	91 (74.0)	96 (78.0)	74 (60.2)	98 (79.7)
	$p^{**}$	0.454	0.013	0.037	0.024	0.278	0.549	0.376
<b>Previously, treating patients with anaphylaxis, n (%)</b>	Yes	34 (42.5)	75 (93.8)	68 (85.0)	64 (80)	65 (81.3)	55 (68.8)	65 (81.3)
	No	29 (22.8)	119 (93.7)	109 (85.8)	100 (78.7)	91 (71.7)	73 (57.5)	104 (81.9)
	$p^{**}$	0.003	0.989	0.869	0.828	0.119	0.104	0.908
<b>Total, n (%)</b>		63 (30.4)	194 (93.7)	177 (85.5)	164 (79.2)	156 (75.4)	128 (61.8)	169 (81.6)

\*Mann-Whitney U test, \*\*chi-square test, SD: Standard deviation

**Table 2.** Comparison of AAI usage information by age, professional year, and post-graduate education

		Understanding the use of AAI	I prescribe AAI
<b>Age years (mean <math>\pm</math> SD) Median (Q1-Q3)</b>	Yes	31.5 $\pm$ 5.8 30 (28-33)	33.4 $\pm$ 7.9 31 (28-36)
	No	36 $\pm$ 10 32 (28-43.5)	33.9 $\pm$ 9.1 30 (28-38)
	$p^*$	0.006	0.864
<b>Professional years (mean <math>\pm</math> SD) Median (Q1-Q3)</b>	Yes	6.5 $\pm$ 5.5 5 (3-8.25)	8.4 $\pm$ 7.9 5 (3-11)
	No	10.5 $\pm$ 10 6 (3-15)	8.8 $\pm$ 8.7 5 (3-10)
	$p^*$	0.041	0.782
<b>Post-graduate education, n (%)</b>	Yes	52 (61.9)	46 (54.8)
	No	54 (43.9)	69 (56.1)
	$p^{**}$	0.011	0.849
<b>Total</b>		106 (51.2)	115 (55.6)

\*Mann-Whitney U test, \*\*Chi-square test, AAI: Adrenaline auto-injector, SD: Standard deviation

## DISCUSSION

Anaphylaxis is an acute life-threatening emergency condition that requires immediate treatment to prevent further progression and complications. In our country, some medical interventions, including childhood and adult vaccination practices and intramuscular injections, are carried out at family health centers that are established for primary health care. Therefore, it is vital for family health centers to possess essential medications and equipment as well as for family physicians to be competent in the diagnosis and treatment of anaphylaxis.

### Knowledge of Family Physicians Regarding Anaphylaxis Diagnosis, Treatment and AAI

Approximately one-third of the participants in our study knew that all symptoms and clinical findings may occur during anaphylaxis. These results indicate that the multiorgan and multisystem findings of anaphylaxis are not sufficiently valuable. Under these circumstances, underdiagnosis and undertreatment may occur. Many studies have reported the underdiagnosis and undertreatment of anaphylaxis (7,8).

Nearly all family physicians in our study (93.7%) considered adrenaline as a first-line treatment for anaphylaxis. This ratio is similar to a study on family physicians in our country (9), whereas two other studies report significantly lower percentage of 50% (10,11). Research on different health professionals reported similar and lower ratios (12-19).

Most of our participants knew the correct route (85%) and location (79%) of adrenaline administration, although their knowledge of the correct dose (for pediatric dose 75% and for adult dose 61%) was inadequate. Nevertheless, the ratios in 2 other studies on family physicians in our country were lower (9,11). Similar or lower results have been reported in studies including different health professionals (12,17-23). Most of our participants were informed about the correct positioning of patients with anaphylaxis, whereas the literature results were lower (19).

The average professional experience of participants who knew adrenaline was a first-line drug in the treatment of anaphylaxis and could administer adrenaline by correct route and location was significantly lower in our study. This may be the result of more recent and up-to-date education for younger physicians. Additionally, the former recommendation of subcutaneous administration of adrenaline in the treatment of anaphylaxis may have an impact on the less accurate knowledge of senior physicians regarding the correct administration route. The research proposes that at any age, adrenaline reaches the maximal plasma concentration when administered IM rather than

SC route (24,25). Thus, adrenaline is recommended to be administered to the lateral thigh by the IM route according to current guidelines (1,26). Another study on family physicians in our country found significantly higher rates of knowledge of the correct route and site of administration of adrenaline in the group with less professional experience, whereas no significant difference was determined for the knowledge of adrenaline as first-line treatment (9). In another study including general practitioners, no difference was demonstrated according to the general practitioners no difference according to professional experience in terms of knowledge of adrenaline as a first-line treatment and its proper route of administration (10). On the contrary, in a comprehensive survey conducted on healthcare professionals in Mexico, the most correct answers were among those with professional experience over 30 years (19).

Anaphylaxis is a recurring condition, so AAI must be prescribed to those that experience anaphylaxis, and they should be trained on how to use it. Healthcare professionals who care for patients at risk of anaphylaxis should also be educated on the use of AAI. Half of the family physicians in our study stated that they knew how to use and obtain adrenaline auto-injector and would prescribe it to patients with anaphylaxis. Nevertheless, only a quarter of the participants had undergone training on the use of adrenaline auto-injector. Our survey was conducted online and was based on the statements of the physicians; their proficiency could not be evaluated. Therefore, comparisons with other studies are not applicable. Knowledge regarding the correct use of AAI was found to be inconclusive in studies conducted on healthcare professionals working in primary, secondary, or tertiary healthcare centers in our country and worldwide (27-30). The rate of prescribing adrenaline to patients who develop anaphylaxis has increased over time (31) but is still insufficient (32-35).

### Factors Affecting the Knowledge of Family Physicians About Anaphylaxis Diagnosis, Treatment, and AAI

In our survey, the rate of knowledge of adrenaline as the first-line treatment in anaphylaxis, the correct route and site of administration of adrenaline, the use of adrenaline auto-injector, and how to obtain it was higher among family physicians who had undergone training on anaphylaxis during residency and after graduation. This finding clearly indicates the need for post-graduate education programs on anaphylaxis to allow physicians to update their knowledge. Less than half of our participants had undergone postgraduate education on anaphylaxis. This



is considered inadequate. When the proficiency levels of those who underwent training and those who did not are compared, the necessity for periodic and comprehensive training for updating should be considered. In a similar study of different healthcare professionals, the ratio of family physicians to receive training on anaphylaxis was lower than that of other groups (12).

Most family physicians referred patients with anaphylaxis to pediatric or adult allergy and immunology clinics. The guidelines recommend the referral of patients with anaphylaxis to allergy and immunology specialists for confirmation of the suspected trigger, counseling on preventive measures, and use of allergen immunotherapy (i.e., bee venom) when necessary (1,26).

## CONCLUSION

The most significant outcome of our study is family physicians' knowledge of the diagnosis and treatment of anaphylaxis is higher when their training at medical faculty and residency is more recent and when they undergo post-graduate training. Therefore, in-service training programs may increase the competency of physicians in handling life-threatening anaphylaxis. The physicians' knowledge of adrenaline auto-injector treatment is inadequate. Family physicians should be trained on the use of this basic life-saving drug for those at risk of anaphylaxis.

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## ETHICS

**Ethics Committee Approval:** This study was approved by the Bezmialem Vakıf University Rectorate Non-Interventional Research Ethics Committee (approval number: 2021/173, date: 19.05.2021). The study was conducted according to the principles of the Declaration of Helsinki.

**Informed Consent:** Participants who provided consent answered the survey questions fully.

## Authorship Contributions

Surgical and Medical Practices: Concept: L.B., G.K.E., S.S.Ç., S.A., A.Ö., M.A.N., Design: L.B., G.K.E., S.S.Ç., S.A., A.Ö., M.A.N., Data Collection or Processing: L.B., M.Y., Analysis or Interpretation: L.B., A.T., Literature Search: L.B., Writing: L.B., M.Y.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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