



# Life and Medical Sciences

## Knowledge, Attitudes, and Behaviors of Family Physicians Towards Hyperbaric Oxygen Therapy

### Aile Hekimlerinin Hiperbarik Oksijen Tedavisi ile İlgili Bilgi, Tutum ve Davranışları

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#### Abstract

In our study, we aimed to investigate the knowledge, attitude, and behavior of physicians toward hyperbaric oxygen therapy (HBOT). Our study is a cross-sectional study. We included a total of 251 physicians, consisting of Family Medical Specialists, residents of Family Medicine Residency program, contracted residents of Family Medicine Residency program (residents who work actively in primary health units and matched with Family Medicine residency program) and General Practitioners (non-specialized family physicians) working in Ankara, between the dates 01.04.2021 and 26.11.2021. A questionnaire consisting of a total of 51 questions was given to the participants on the internet in order to determine the level of knowledge, attitude and behavior towards HBOT. 251 people, 162 women and 89 men, participated in the study. Of the participants in the study, 137 were residents of the Family Medicine residency program, 57 General practitioners, and 57 Family Medical Specialists. It was observed that 60.2% of the physicians responded with a "no" to the question, "Do you know the indications of HBOT?". 55% of the physicians did not know about the cost of HBOT therapy. The rate of knowledge of the indication of carbon monoxide poisoning was significantly higher among the physicians who had an HBOT center in their institution ( $p<0.05$ ). It was observed that 98% of the participants did not know the treatment pressure applied during HBOT, and 97.2% did not know the technique of oxygen administration. While investigating the knowledge, attitudes, and behaviors towards HBOT, we observed that our physicians had some deficiencies, even though they had partial knowledge about it. In our study, we saw that our physicians are aware of their lack of knowledge about HBOT and are open to training on this subject. We think that in order to eliminate this deficiency, a course related to this field can be added to either university curricula or specialist training curricula.

**Keywords:** Family Practice, Hyperbaric Oxygenation, Attitude, Knowledge, Behavior.

#### Özet

Çalışmamızda hekimlerin Hiperbarik Oksijen Tedavisi (HBOT) ile ilgili bilgi, tutum ve davranışlarını araştırmayı amaçladık. Çalışmamız kesitsel bir anket çalışmasıdır. Çalışmamıza 01.04.2021 ve 26.11.2021 tarihleri arasında Ankara'da görev yapmakta olan aile hekimliği uzmanları, aile hekimliği uzmanlığı asistanları,

sözleşmeli aile hekimliği uzmanlığı asistanlarından ve pratisyen aile hekimlerinden oluşan toplam 251 hekimi dahil ettik. Katılımcılara, HBOT ile ilgili bilgi, tutum ve davranış düzeylerini belirlemeye yönelik toplam 51 sorudan oluşan bir anket internet ortamında uygulanmıştır. Çalışmaya 162'si kadın, 89'u erkek olmak üzere toplam 251 kişi katılmıştır. Çalışmaya katılanların 137'si aile hekimliği uzmanlığı asistanı, 57'si pratisyen aile hekimi ve 57'si aile hekimliği uzmanıdır. HBOT tedavisinin endikasyonlarını biliyor musunuz sorusuna hekimlerin %60.2'si hayır yanıtını verdi. Hekimlerin %55'i HBOT'nin maliyeti hakkında bilgiye sahip değildi. Çalıştıkları kurumda HBOT merkezi bulunan hekimlerin karbonmonoksit zehirlenmesi endikasyonunu bilme oranı anlamlı şekilde daha yüksekti ( $p<0.05$ ). Katılımcıların %98'inin HBOT esnasında uygulanan tedavi basıncını, %97.2'sinin ise oksijenin verilmiş yolunu bilmedikleri görüldü. HBOT ilgili bilgi, tutum ve davranışlarını araştırırken hekimlerimizin bu konuda kısmen bilgileri olsa da eksiklerinin olduğu gördük. Çalışmamızda hekimlerimizin HBOT ile ilgili bilgi eksiklerinin farkında oldukları ve hekimlerimizin bu konuda eğitime açık olduklarını gördük. Bu eksikliğin giderilmesi için ya üniversite müfredatlarına ya da uzmanlık eğitimi müfredatına bu alanla ilgili bir ders eklenebileceğini düşünmekteyiz.

**Anahtar Kelimeler:** Aile Hekimliği, Hiperbarik Oksijenasyon, Tutum, Bilgi, Davranış.

## Introduction

The roots of hyperbaric therapy applications date back to the 17<sup>th</sup> century. A closed chamber with no contact with the outside called "Domicilium," made by the English scientist Henshaw in 1662, is accepted as the first pressure chamber in history [1]. In our country, hyperbaric oxygen therapy (HBOT) was first used by the Navy to treat decompression sickness. With the protocol signed in 1976, the Marine and Underwater Medicine department was opened at Istanbul University, Istanbul Faculty of Medicine and started to serve as a department since 1989. HBOT has been used in treating many diseases besides decompression sickness in Gulhane Military Medical College and Istanbul University, Istanbul Faculty of Medicine since the 1980s. With the Postgraduate Medical Education Regulation adopted in 2002, the name of Marine and Underwater Medicine was replaced with Underwater Medicine and Hyperbaric Medicine Department. With the spread of HBOT centers since the 1990s, this treatment method has become more familiar, and more people had the opportunity to avail it. HBOT is used in many cities in our country [2]. HBOT is a treatment method applied as intermittent or continuous breathing of 100% O<sub>2</sub> with a mask, helmet, or endotracheal tube at pressures higher than 1 Atmospheres Absolute Pressure (ATA) in a closed pressure chamber. The duration and pressure of HBOT show changes according to extensions and damage. The application duration and pressure of HBOT vary according to the patients and diseases.

In addition, topical O<sub>2</sub> applications where body parts are exposed to 100% O<sub>2</sub> or 100% O<sub>2</sub> inhalation at 1 ATA (normobaric oxygen) are not defined as HBOT. It has been stated that a minimum pressure of 1.4 ATA or higher should be applied when used for clinical purposes [3,4].

HBOT can be applied in multi-person pressure rooms where more than one patient can be treated simultaneously, as well as in single-person pressure rooms where only one patient can be treated individually [5]. In single-person pressure rooms, the patient breathes 100% O<sub>2</sub> with a mask or directly from the ambient air if the environment is pressurized with 100% O<sub>2</sub>. Patients intermittently inhale 100% O<sub>2</sub> from a mask, a special helmet, or an endotracheal tube in multi-person pressure rooms after the environment is pressurized with atmospheric air [5,6].

In our country, the indications of HBOT in many diseases, accepted by the Ministry of Health, include decompression sickness, air or gas embolism, acute carbon monoxide intoxication, sudden idiopathic hearing loss, sudden vision loss, soft tissue infections, skin flap/grafts suspected of rejection, chronic refractory osteomyelitis, avascular necrosis of head of the femur, crush injury and delayed wound healing [7,8,9,10].

Since primary care is one of the easiest health services to reach, diseases requiring HBOT may be encountered in Family Medicine at the beginning or during the disease [11], this makes it necessary to know about the HBOT and its indications to guide and refer the patient correctly

in primary care. In the literature review, no study was found in which family physicians' knowledge, attitudes, and behaviors about HBOT were evaluated in all aspects. In this study, we aim to evaluate the knowledge, attitudes, and behaviors of family physicians who will work in primary care towards the HBOT. We want to shed light on the activities aiming to eliminate any deficiencies and increase the awareness of HBOT among the primary care physicians.

## Material and Method

Our research is a cross-sectional observational study to evaluate Family Physicians' knowledge, opinion, and attitudes about HBOT. In our study, data were collected with the help of a survey prepared on the Internet platform. Physicians working in primary health units, community health centers, and hospitals were included in the study with sequential sampling, and they were asked to fill out a questionnaire prepared on the Internet. The questionnaire form consisting of 51 questions in total is shared.

The study was approved by the Ethics Committee of Gülhane Training and Research Hospital with the decision dated 09.03.2021 and numbered 2224. Informed consent was obtained from the volunteers participating in our study.

Statistical analyzes were performed with the help of the SPSS version 23.0 program. The conformity of the variables to the normal distribution was examined by histogram graphs and Kolmogorov-Smirnov/Shapiro-Wilk test. Mean, median, and standard deviation values were used when presenting descriptive analyzes for quantitative variables. Frequency and percentage values of the variables were used when presenting categorical variables, and Chi-Square Test or Fisher's Exact Test was used when comparing them. The reliability of the survey questions was evaluated with Cronbach's Alpha statistic. Cases with a P-value less than 0.05 were considered statistically significant results.

## Results

A total of 251 family physicians participated in our study. In addition to demographic characteristics, some questions about the HBOT mechanism of action, its application methods,

indications, and contraindications were asked to the individuals who participated in the survey. Reliability statistics of the answers to these questions were made. Accordingly, the Cronbach Alpha coefficient of the scale consisting of 30 two-answer questions (items) was 0.782; The Cronbach Alpha coefficient of the scale, which consists of 39 questions (items) with three answers, was found to be 0.821. The demographic characteristics of the family physicians participating in the study are presented in [Table 1](#). The experiences and awareness of the participants about HBOT are given in [Table 2](#).

The answers to the questions evaluating the knowledge level of the physicians participating in the study about HBOT are examined in [Table 3](#). The answers of the physicians about how oxygen can be given to the patient during the HBOT session are presented in [Figure 1](#).

When the physicians participating in our study were asked to suggest that they have sufficient knowledge about HBOT practices for their area of expertise, 73.7% (n=185) of the physicians stated that it was not sufficient.

Some diseases were told to the participants, and they were asked to indicate whether there was an indication of HBOT in these diseases or not ([Table 4](#)).

The answers given to the suggestions about the mechanism of action, indications, contraindications, and complications of HBOT are presented in [Table 5](#).

It was observed that most physicians thought HBOT treatment was an effective treatment method (65.7%, n=165) and (53.8%, n=135) thought HBOT was reliable ([Figure 2](#)). On the other hand, it was noted that most physicians (55%, n=138) did not know the cost of HBOT. 60.2% (n=151) of the physicians responded with a "no" to the question, "Do you know the indications of HBOT?".

It was observed that only 29.5% (n=74) of the physicians participating in our study had referred patients for HBOT before. When these physicians were questioned for which diseases, they referred patients to HBOT, it was noted that the most common indication was for non-healing wounds ([Figure 3](#)).

When we asked the physicians whether they wanted a general information course on HBOT in their Education Program, 87.6% (n=220) of the physicians agreed, 10.4% (n=26) did not know, and 2.0% (n=5) disagreed.

The relationship between the participation rates of the physicians participating in the HBOT - Related Lesson/Seminar/Talk with their attitudes and behaviors towards HBOT was examined. It was observed that family physicians attending the seminar referred more patients for HBOT which was statistically significant (p<0.05). In addition, there was a significant relationship between participation in the seminar and the belief that HBOT is an effective and safe treatment method

(Respectively p<0.05, p<0.05). The referral rate of patients for HBOT was not statistically significant in physicians who did or didn't do scuba diving before (p=0.366). It was observed that the referral rates for HBOT were significantly lower at the institution without an HBOT center where they worked (p<0.01).

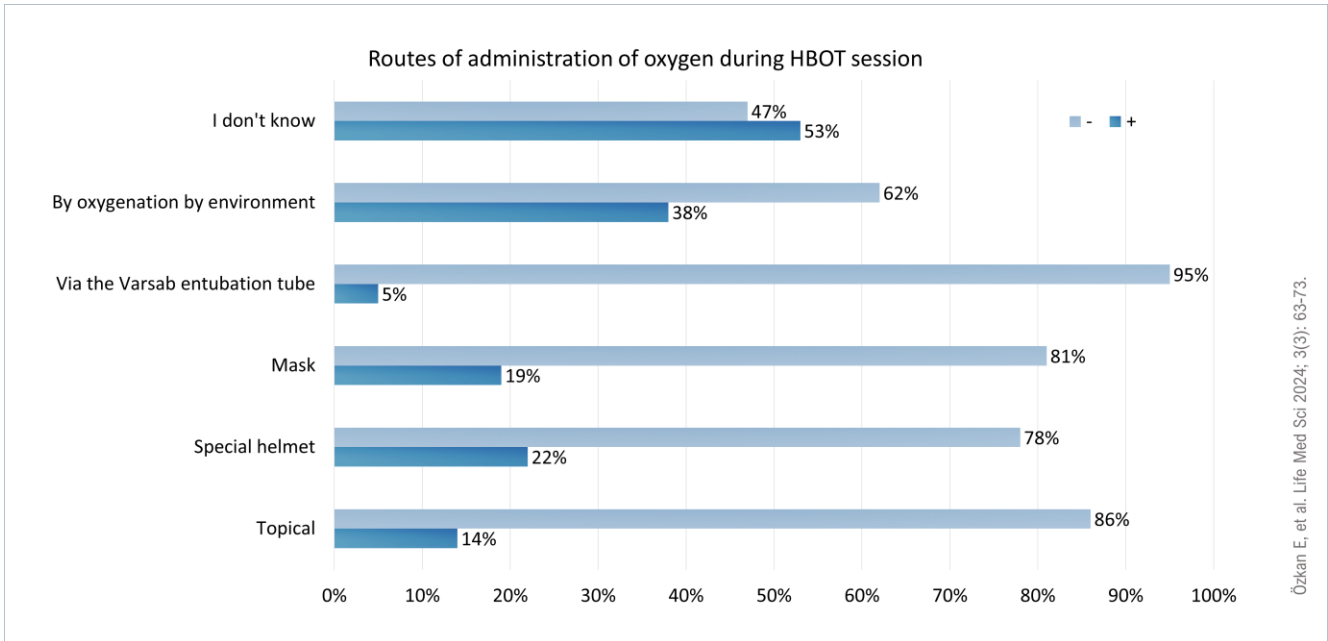
No significant results were found when the belief that 'HBOT is a reliable treatment method' was compared between those with and without an HBOT center at the institution where they work in (p>0.315). It was observed that those who had an HBOT center in their institution had a significantly higher belief that HBOT was effective (p<0.05) (Figure 4).

**Table 1.** Demographic characteristics of the participants.

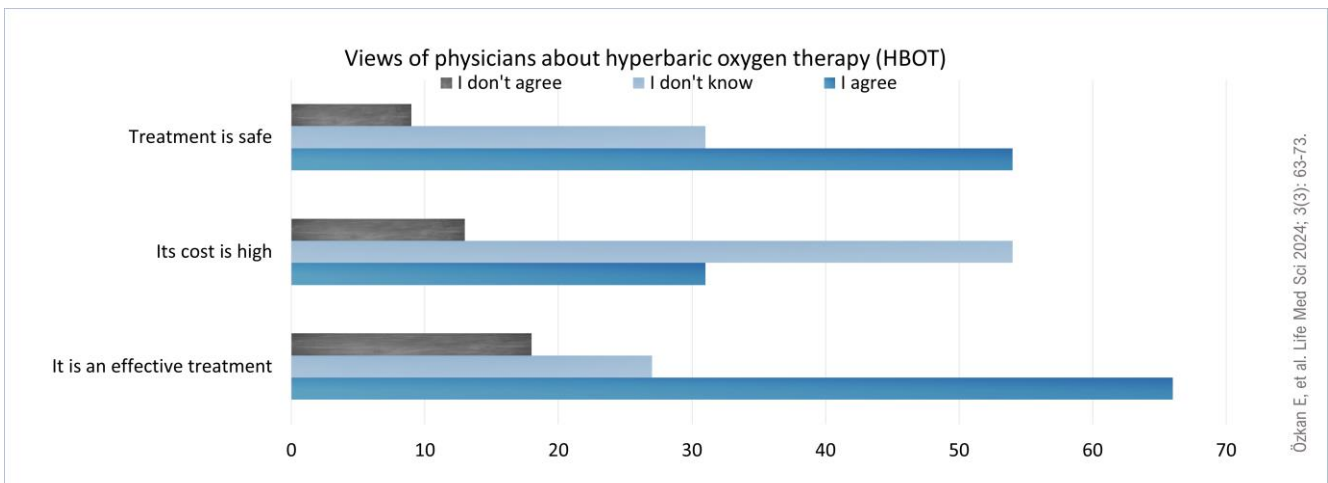
		n (%) or median± standard deviation
Gender	Female	162 (64.5)
	Male	89 (35.5)
Age and working time	Age (years)	32.91±6.76
	Graduation from a Medical School (Year)	2012±6.72
	Residency Year (Years)	2.2±1.26
	Years as a Specialist (Years)	4.62±6.06
	Years of Service as a Doctor (Years)	8.11±6.61
Profession type	Family medicine Resident	83 (33.1)
	Contracted F. Med Resident	54 (21.5)
	General Practitioner	57 (22.7)
	Family Medical Specialist	57 (22.7)
Organizations they work in	Training and Research Hospital	94 (37.5)
	Public Hospital	12 (4.8)
	Primary Health Unit	136 (54.2)
	Private Health Care service	9 (3.6)
	Total	251 (100)

**Table 2.** Analysis of participants' experience and awareness of hyperbaric oxygen therapy (HBOT).

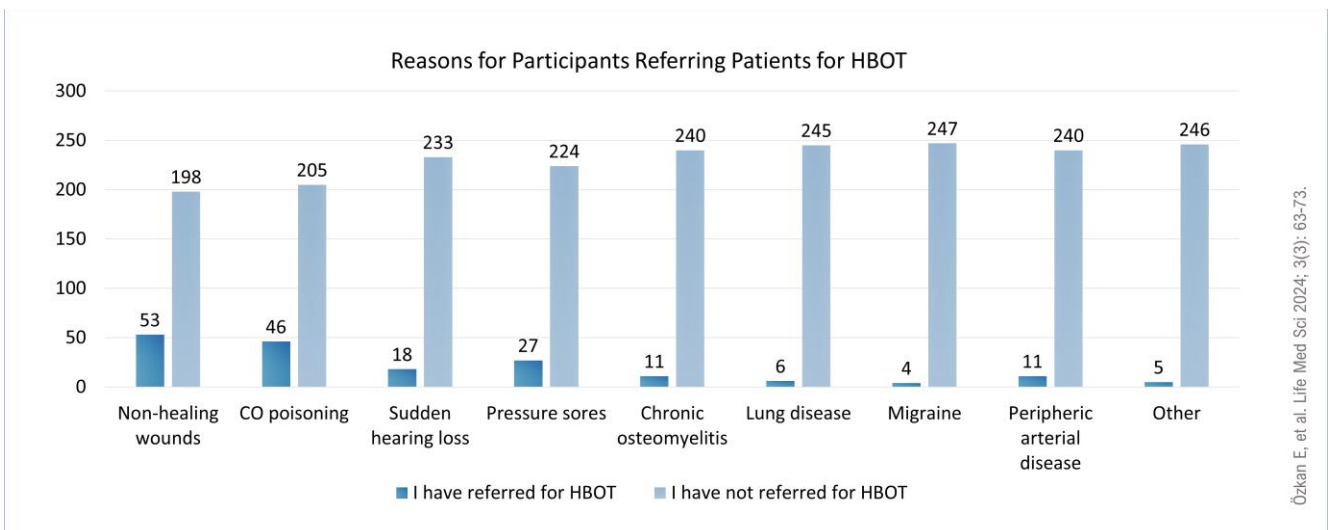
	Yes n (%)	No n (%)
Q 1. Have you attended a lecture/seminar/talk on hyperbaric oxygen therapy (HBOT)?	48 (19.1)	203 (80.9)
Q 2. Have you been to underwater medicine and hyperbaric medicine clinic before?	31 (12.4)	220 (87.6)
Q 3. Does your institution have a HBOT center?	51 (20.3)	200 (79.7)
Q 4. Is there an HBOT center in your city?	204 (81.3)	47 (18.7)
Q 5. Is there a HBOT center at the hospital where you are trained?	121 (48.2)	130 (51.8)
Q 6. Have you ever done scuba diving?	21 (8.4)	230 (91.6)



**Figure 1.** Routes of administration of O<sub>2</sub> in hyperbaric oxygen therapy (HBOT), 97.2% (n=244) of the participants did not know the true technique of oxygen administration.



**Figure 2.** Views of physicians about hyperbaric oxygen therapy (HBOT).

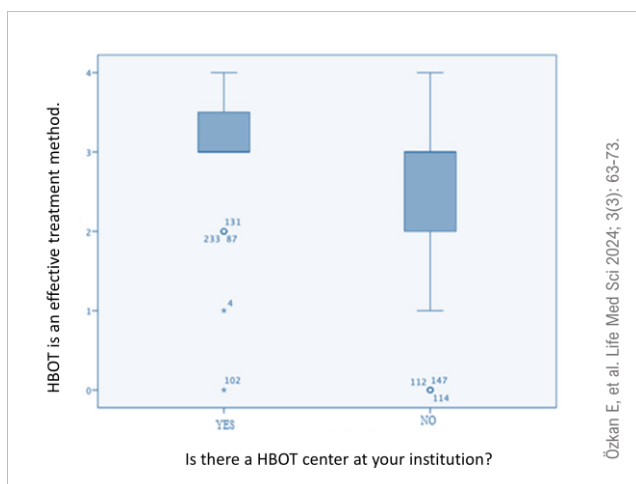


**Figure 3.** Reasons for participants referring patients for hyperbaric oxygen therapy (HBOT).

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**Figure 4.** The belief of the physicians about hyperbaric oxygen therapy’s (HBOT) effectiveness having a hyperbaric oxygen therapy center at their institution.

**Table 3.** Answers to informative questions about hyperbaric oxygen therapy (HBOT) session.

	True answers n(%)	False answers n(%)
Q12. What is the pressure applied in a routine HBOT session in a multi-person pressure room? (ATA: Absolute Atmospheres) (Correct Answer: 2-2,5ATA)	5 (2.0)	246 (98)
Q13. How long does a routine HBOT session take in a multi-person compression chamber? (Correct Answer: 120 minutes)	7 (2.8)	244 (97.2)
Q15. What is the frequency of HBOT application for a non-emergency indication? (Correct Answer: Once a day)	1 (0.4)	250 (99.6)
Q16. The treatment process of a patient who is taken to the HBOT program due to a non-healing wound is completed within 1 week. ( Correct Answer: No)	49 (19.5)	222 (80.5)

**Table 4.** Questions evaluating the knowledge level of hyperbaric oxygen therapy (HBOT) indications.

Indications	Yes n (%)	No n (%)
1 Carbon monoxide poisoning	208 (82.9)	43 (17.1)
2 Non-healing wounds due to diabetes	228 (90.8)	23 (9.2)
3 Gas embolism	152 (60.6)	99 (39.4)
4 Anaerobic or mixed anaero-aerobic bacterial infections	152 (60.6)	99 (39.4)
5 Multiple sclerosis	26 (10.4)	225 (89.6)
6 Delayed wound healing	205 (8.7)	46 (18.3)
7 Autism	18 (7.2)	223 (88.8)
8 Chronic refractory osteomyelitis	106 (42.2)	145 (57.8)
9 Parkinson disease	12 (4.8)	239 (95.2)
10 Decompression disease (the bends)	166 (66.1)	85 (33.9)
11 Radiaton related lesions of the soft tissues and bones	74 (29.5)	177 (70.5)
12 Cerebral palsy	20 (8.0)	231 (92.0)
13 Hypertension	16 (6.4)	235 (93.6)
14 Acute idiopathic hearing loss	83 (33.1)	168 (66.9)
15 Grafts/flaps suspected of rejection	114 (45.4)	137 (54.6)
16 Osteoarthritis	20 (8.0)	231 (92.0)
17 Alopecia areata	22 (8.8)	229 (91.2)
18 None of the above	2 (0.8)	249 (99.2)

**Table 5.** Responses to recommendations on the mechanism of action, indications, contraindications and complications of hyperbaric oxygen therapy (HBOT).

		n (%)	n (%)
Q18. HBOT has antiedematous, anti-infective, anti-inflammatory effects, and it accelerates wound healing.	I don't agree	2	0.8
	I don't know	12	17.1
	I agree	206	82.1
Q19. HBOT increases the oxygenation and healing of the damaged tissue by increasing the dissolved PaO <sub>2</sub> in the blood.	I don't agree	1	0.4
	I don't know	33	13.1
	I agree	217	86.5
Q20. In the pressure rooms where HBOT is applied, the clothes of the patients should be cotton in case of fire; wool or synthetic clothing is not accepted.	I don't agree	4	1.6
	I don't know	148	59.0
	I agree	99	39.4
Q21. In the pressure rooms where HBOT is applied, it is free to read books and use tablet phones so that the patients do not get bored.	I don't agree	93	37.1
	I don't know	136	54.2
	I agree	22	8.8
Q22. Chest X-ray must be seen before HBOT.	I don't agree	15	6
	I don't know	124	49.4
	I agree	112	44.6
Q23. HBOT is preferred as a supportive treatment together with other treatment methods in diabetic foot infections.	I don't agree	2	0.8
	I don't know	32	12.7
	I agree	217	86.5
Q24. HBOT reduces major lower extremity amputations in diabetic wounds.	I don't agree	0	0
	I don't know	33	13.1
	I agree	218	86.9
Q25. HBOT is useful for non-healing wounds.	I don't agree	2	0.8
	I don't know	24	9.6
	I agree	225	89.6
Q26. HBOT is beneficial in the healing of pressure sores that may occur in bedridden patients.	I don't agree	1	0.4
	I don't know	32	12.7
	I agree	218	86.9
Q27. HBOT is contraindicated in clostridial myonecrosis (gas gangrene) as it increases toxin production.	I don't agree	39	15.5
	I don't know	179	71.3
	I agree	33	13.1
Q28. HBOT is a vasodilating treatment method in peripheral arterial disease.	I don't agree	15	6
	I don't know	149	59.4
	I agree	87	34.7
Q29. HBOT is useful in carbon monoxide (CO) poisoning.	I don't agree	2	0.8
	I don't know	37	14.7
	I agree	212	84.5
Q30. In CO poisonings, HBOT should definitely be applied regardless of the carboxyhemoglobin level.	I don't agree	73	29.1
	I don't know	122	48.6
	I agree	56	22.3
Q31. HBOT is contraindicated in pregnant women who have had CO poisoning.	I don't agree	40	15.9
	I don't know	181	72.1
	I agree	30	12
Q32. Carboxyhemoglobin half-life is reduced by HBOT administration in CO poisonings; thus, the carboxyhemoglobin level drops quite rapidly.	I don't agree	13	5.2
	I don't know	116	46.2
	I agree	122	48.6
Q33. HBOT increases the probability of recovery in patients with sudden vision loss (central retinal occlusion), especially when administered within the first 24 hours.	I don't agree	2	0.8
	I don't know	148	59.0
	I agree	101	40.2

**Table 5 (continue).** Responses to recommendations on the mechanism of action, indications, contraindications and complications of hyperbaric oxygen therapy (HBOT).

		n (%)	n (%)
Q34. HBOT is used in chronic refractory osteomyelitis.	I don't agree	2	0.8
	I don't know	121	48.2
	I agree	128	51
Q35. HBOT is beneficial when applied in the first 24 hours for sudden hearing loss. It has no effect on healing when applied later.	I don't agree	24	9.6
	I don't know	184	73.3
	I agree	43	17.1
Q36. HBOT is useful in preventing tissue loss with ischemic process in crush injuries.	I don't agree	1	0.4
	I don't know	95	37.8
	I agree	155	61.8
Q37. In early-stage avascular osteonecrosis, it will be beneficial in terms of prognosis of the patient when weight relief tools (crutch, ...) and HBOT are applied together.	I don't agree	2	0.8
	I don't know	92	36.7
	I agree	157	62.5
Q38. Within 24 Hours after diving, in decompression sickness that usually present with joint pains (shoulder, knee, ... etc.), patient should receive %100 Oxygen immediately, and consulted for HBOT.	I don't agree	6	2.4
	I don't know	91	36.3
	I agree	154	61.4
Q39. Arterial gas embolism should be suspected in a patient who develops a sudden loss of consciousness while removing the central venous catheter. HBOT is never administered in these patients.	I don't agree	28	11.2
	I don't know	195	77.7
	I agree	28	11.2
Q40. HBOT is not recommended for patients with an advanced congestive heart failure (EF less than 35%).	I don't agree	2	0.8
	I don't know	185	73.7
	I agree	64	25.5
Q41. It is inconvenient to apply HBOT in the presence of an active pneumothorax in the patient.	I don't agree	7	2.8
	I don't know	107	42.6
	I agree	137	54.6
Q42. In the presence of high fever, HBOT is not recommended because it lowers the seizure threshold.	I don't agree	12	4.8
	I don't know	174	69.3
	I agree	65	25.9
Q43. During HBOT, hypoglycemia may develop as a side effect.	I don't agree	11	4.4
	I don't know	205	81.7
	I agree	35	13.9
Q44. The most common side effect of HBOT is middle ear barotrauma.	I don't agree	1	0.4
	I don't know	159	63.3
	I agree	91	36.3
Q45. Epilepsy is not among the complications of HBOT.	I don't agree	21	8.4
	I don't know	195	77.7
	I agree	35	13.9
Q46. Before HBOT, patients with a pacemaker must be initially approved to work under pressure; otherwise, the operation of the pacemaker may be impaired during HBO therapy.	I don't agree	2	0.8
	I don't know	157	62.5
	I agree	92	36.7
Q47. Claustrophobia is a relative contraindication for HBOT.	I don't agree	6	2.4
	I don't know	80	31.9
	I agree	165	65.7
Q48. Presence of a psychiatric disease is a relative contraindication for HBOT.	I don't agree	12	4.8
	I don't know	104	41.4
	I agree	135	53.8
Q49. Fire may brake if safety rules are not followed during HBOT.	I don't agree	2	0.8
	I don't know	74	29.5
	I agree	175	69.7
Q50. The cause of decompression sickness in divers is the formation of gas bubbles in the blood and other tissues caused by the pressure change during diving and ascent. Decompression sickness is one of the emergency indications for HBOT.	I don't agree	0	0
	I don't know	72	28.7
	I agree	179	71.3



## Discussion

This study aimed to evaluate the knowledge, attitudes, and behaviors of family physicians who will be working in primary health care. As a result of our study, it was observed that the majority of the physicians (73.7%) did not have sufficient knowledge about HBOT, and the majority (70.5%) did not refer patients for HBOT. In addition, it was noted that 65.7% of the physicians participating in our study stated that HBOT is an effective treatment method, and 53.8% stated that it is a reliable treatment method. It was observed that the rate of participation in the course related to HBOT was also low (19.1%).

It was observed that most of the physicians participating in our study did not attend a lecture, seminar, or talk about HBOT before, were not present in any HBOT medical clinic, and there was no HBOT center in the institution in which they worked. In addition, although our study sample was taken from Ankara, it is noteworthy that some of the physicians (18.7%) were not informed about the existence of HBOT centers in the city.

On the other hand, only 8.4% of the physicians participating in our study had done scuba diving. The physicians who did scuba diving might have referred more patients for HBOT. In our study, no statistically significant result was found when we compared the condition of scuba diving with the rate of patient referral ( $p > 0.05$ ). However, in a study conducted by Magri et al. on a physician group in Malta, it was observed that scuba diving physicians refer more patients for HBOT [12].

When we asked the physicians participating in our study about the pressure applied in a therapy session, the duration of the therapy session, the frequency of its application, and the treatment process, most gave the wrong answer. We think that the fact that the majority of them had not been to an HBOT center before and the low participation in a lecture about HBOT could explain these results. In addition, when HBOT indications were questioned, a high percentage of correct answers were given that is CO poisoning and diabetes-related chronic wounds were among the HBOT indications; It has been observed that

it is mostly unknown that chronic refractory osteomyelitis, late radiation injury, and sudden hearing loss are also indications for HBOT. Our results were similar to those of Magri and his friends' study on physicians [12].

In fact, the most effective treatment method for Carbon monoxide poisoning is HBOT, and when the climate conditions of Ankara are considered, it is quite common, this indication is well known among the physicians. Likewise, we think that diabetes mellitus, one of the common diseases in society, and its relationship to non-healing wounds are related to the fact that these patients apply present to the primary care physicians more often. We think that its indications for diseases such as chronic refractory osteomyelitis, sudden hearing loss, and late radiation injury are less known because patients presenting to primary health care with these diseases are fewer, and these patients present more often to secondary and tertiary health care units instead.

On the other hand, the referral rate of patients for HBOT (29.5%) by the physicians participating in the study was relatively low. In parallel with the results above, it was observed that the physicians who referred patients mostly referred patients for non-healing wounds and CO poisoning. The lack of knowledge among the physicians participating in our study on this subject can be eliminated with an informative lecture included in the training programs. When we questioned whether they had sufficient knowledge about this field during their duration of specialization, the opinion of the majority of our physicians (73.7%) was that they did not have sufficient knowledge. This situation can be explained by the inability to obtain knowledge about HBOT from the medical school curriculum or the absence of an informative lecture about HBOT in the residency program. When our physicians' opinions about HBOT were questioned, the common opinion was that HBOT was effective (65.7%), the cost was unknown (55%), and it was a safe treatment method (53.8%). The fact that they thought it was an effective and safe treatment method made us think that they could refer patients for HBOT, but they could as well be hesitant about their referral because they did not

know about the cost of the treatment. In the study of Evans et al., like our study, it was concluded that primary care physicians do not have sufficient knowledge about cost-effectiveness [13]. The study of Magri et al. on a physician group in Malta obtained a similar result with our study [12]. When we look at the efficacy-cost of HBOT, it has been shown to reduce the cost of treatment in the indicated diseases [14].

In our study, it was observed that family physicians who attended the Lecture/Seminar/Talk on HBOT had a significantly higher belief that HBOT is an effective and safe treatment method and referred more patients for HBOT, which was statistically significant. (Respectively  $p < 0.05$ ,  $p < 0.05$ ). This shows us that education can be transformed into attitudes and behaviors. It has shown the role of the informative lecture in increasing the awareness of HBOT among family physicians and, as a result, in guiding the patient correctly and providing effective treatment in primary health care. It was observed that the rates of patient referral for HBOT were significantly lower in those who did not have an HBOT center at their institution ( $p < 0.01$ ). This shows us that the awareness of physicians with an HBOT center at their workplace is higher. Similarly, it was observed that those who had an HBOT center in their institution had a significantly higher belief that HBOT was effective ( $p < 0.05$ ). This suggests that it may be related to the fact that they can follow the treatment processes and results of the patients they referred for treatment.

Among the limitations of our study is that our study was conducted only in Ankara. In addition, there is no validity and reliability-tested scale measuring the level of knowledge about HBOT. On the other hand, our study is the first to measure knowledge, attitude, and behavior toward HBOT among family physicians. The reliability analysis of the survey questions we applied in the study is relatively high. The questions of our study can be used in other sample groups and will be a source for other studies. Finally, our study has created awareness about HBOT among our physicians, and many physicians have given positive feedback about receiving information on this subject. At the end of the survey, an informative form about HBOT was sent to all our participating physicians; this study is intended to be an educational session and raise awareness.

## Conclusion

In this study investigating the knowledge, attitudes, and behaviors towards HBOT, we saw that our physicians had some knowledge on this subject, but also some deficiencies. This lack of knowledge is also reflected in attitudes and behaviors, and as a result, they abstain from referring patients for HBOT. On the other hand, we have seen that our physicians are aware of their lack of knowledge about HBOT and that our physicians want to attend lectures on this subject. It is important to add a lecture on HBOT to either the medical school curriculum or the residency program to fill this gap.

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