

# Hospital Selection of Health Tourists: A Study with Ahp and Topsis Methods<sup>1</sup>

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## Abstract

Developments in transport and communication technologies have made traveling easier between countries. In addition to these developments, the search for low-cost and high-quality health services has been effective in the development of the health tourism sector. This study aims to determine the hospital preferences of health tourists with Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods in line with expert opinions. Within the scope of this study, the criteria affecting the hospital preferences of health tourists were weighted with the AHP method, and ideal hospital alternative for health tourists was selected with the TOPSIS method by using the criteria weights obtained. The opinions of seven experts, who are experts in their field at least ten years, were taken by using the 9-scale evaluation scale developed by Saaty. As a result of expert opinions; it has been determined that qualified health personnel, quality of medical care applied, modern equipment of the hospital, recommendability of the hospital and health personnel are more effective. For a preferable hospital strategy within the scope of health tourism, deficiencies of health personnel in terms of foreign language and professional experience should be eliminated, and devices that will increase the preferability of the hospital by following technological developments should be used. In addition, necessary improvements should be made by applying satisfaction surveys to health tourists.

**Keywords:** Health Tourism, Multi-Criteria Decision Making, AHP, TOPSIS.

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## Öz

Ulaşım ve iletişim teknolojilerinde yaşanan gelişmeler ülkeler arası seyahatleri daha kolay hale getirmiştir. Bu gelişmelere ek olarak düşük maliyetli ve kaliteli sağlık hizmeti arayışı sağlık turizmi sektörünün gelişmesinde etkili olmuştur. Bu çalışmanın amacı, sağlık turistlerinin hastane tercihlerini uzman görüşleri doğrultusunda AHP ve TOPSIS yöntemleri ile belirlemektir. Çalışma kapsamında Analitik Hiyerarşi Süreci (AHP) yöntemi ile sağlık turistlerinin hastane tercihlerini etkileyen kriterler ağırlıklandırılmış, elde edilen kriter ağırlıkları kullanılarak Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) yöntemi ile sağlık turistleri için en ideal hastane alternatifi seçilmiştir. Çalışmamızda Saaty tarafından geliştirilen 9 ölçekli değerlendirme skalası kullanılarak alanında en az on yıllık uzmanlığı olan yedi kişinin görüşü alınmıştır. Uzman görüşleri sonucunda; kalifiye sağlık personelinin, uygulanan tıbbi bakım kalitesinin, hastanenin sahip olduğu modern cihazların, hastane ve sağlık personelinin tavsiye edilebilirliğinin daha etkili olduğu saptanmıştır. Sağlık turizmi kapsamında tercih edilebilir bir hastane stratejisi için, yabancı dil ve mesleki deneyim açısından sağlık personelinin eksiklikleri giderilmelidir, teknolojik gelişmeler takip edilerek hastanenin tercih edilebilirliğini arttıracak cihazlar kullanılmalıdır. Ayrıca sağlık turistlerine memnuniyet anketleri uygulanarak gerekli iyileştirmeler yapılmalıdır.

**Anahtar Kelimeler:** Sağlık Turizmi, Çok Kriterli Karar Verme, AHP, TOPSIS.

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## Introduction

With the technological developments in today's world, international travel has become easier. As a result of these developments, there has been a rapid increase in tourism activities (Şahin & Tuzlukaya, 2013). Health tourism, which is one of the tourism types, has also been the type of tourism with the highest growth rate in this increase. When the data of the Turkish Statistical Institute is examined, it is seen that the number of health tourists coming to our country has increased over the years. While 163,252 health tourists came to our country in 2010, this number increased to 662,087 in 2019. Expenditures were made within the scope of health tourism; while it was 443,398 dollars in 2010, it is 1,065,105 dollars in 2019 (Tengilimoğlu, 2021).

There are many criteria and hospital alternatives in the hospital selection of health tourists. In cases where there are multiple criteria and alternatives, multi-criteria decision-making techniques are used in order to make the best decision. In this study, hospital selection of health tourists will be examined with Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods from multi-criteria decision-making (MCDM) techniques. The AHP method is one of the multi-criteria decision-making techniques developed by Thomas Saaty. TOPSIS method, one of the multi-criteria decision-making techniques, was also developed by Hwang and Yoon (Paksoy, 2017). In the TOPSIS method, the closest distance to the positive ideal solution and the farthest distance to the negative ideal solution is determined as the best alternative (Özbek, 2019).

Analytical Hierarchy Process method was used in a study that made strategy suggestions in order to increase Turkey's health tourism market share. As a result of the study, the lack of sufficient legal sanction for faulty practices, lack of coordination with agencies and insurance companies abroad, and the lack of qualified health personnel who speak foreign languages were determined as the shortcomings of our country within the scope of health tourism (Demir Uslu, et al., 2021). In a study examining medical tourism in Turkey, the

integrated SWOT and Analytical Hierarchy Process method was used. In the study, Turkey's strengths in medical tourism were determined as affordable price advantage, experienced health personnel and short waiting time. Inadequate marketing was evaluated as a weakness. The location advantage was evaluated as an opportunity. Increasing competition is considered as a threat (Görener, 2016). In another study examining the development of medical tourism in Turkey with SWOT and AHP methods, the criterion with the highest weight value was affordable price advantage (Yiğit & Demirbaş, 2020).

Within the scope of this study, using the AHP method, which is one of the multi-criteria decision-making techniques, weighting the criteria that are effective in the hospital selection of health tourists and ideal hospital selection process for health tourists with the TOPSIS method.

## Health Tourism

Health tourism is defined as individuals traveling outside of the regions where they are permanently residing to protect, improve or be treated their current health status. It is also defined as "health tourist" to individuals who travel with the aim of protecting, improving and treating their current health status. (Kaya, Yıldırım, Karsavuran & Özer, 2013).

Health tourism, where two different sectors such as health and tourism come together, is a sector with high added value. For this reason, many countries make significant investments in health tourism. Among the leading countries in health tourism such as India, Hungary, Thailand and Malaysia (Zengingönül, Emeç, İyilikçi, & Bingöl, 2012).

There are a number of factors that motivate people about health tourism. Some of these factors are as follows (Şahin & Tuzlukaya, 2013);

- Access to health services is difficult in the country of residence,
- Providing better quality and appropriate opportunities in different countries for some rare diseases,

- Health services being more expensive in the country of residence,
- The lack of a sufficient number of health facilities in the country of residence,
- Insufficient education and professional experience of physicians in the country of residence,
- Confidentiality request regarding the health services,
- Advice from an acquaintance,
- Long waiting times in the country of residence.

Health tourism is examined four sub-headings according to the treatment methods and the types of resources used in these methods. These sub-headings are; medical tourism, thermal tourism, spa and wellness tourism, geriatrics and disabled tourism (Şahin & Tuzlukaya, 2013).

### **Medical Tourism**

Medical tourism is the travel of individuals outside the countries where they are permanently residing in order to receive medical treatment (Connell, 2006). In another definition, medical tourism is expressed as the travels of individuals in order to be treated in overseas countries due to the expensive health services and long waiting times in their own countries (Tengilimoğlu & Kahraman, 2013). Unlike other types of health tourism, there is no need to use natural resources. In this type of health tourism, health personnel such as physicians, nurses and well-equipped health institutions such as hospitals and clinics are needed (Zengingönül et al., 2012).

There are a number of factors that direct people to medical tourism. Some of these factors are; the length of the waiting periods, the ease of transportation between countries, the treatments not covered by insurance or the lack of necessary health services in their own countries can be listed as the opportunity to visit different countries (Buzcu & Birdir, 2019; Ergen & Aydemir, 2020). Medical tourism includes advanced treatments that can be offered in secondary and tertiary health institutions (Ergen & Aydemir, 2020). Some of the treatments offered within the scope of medical tourism are as follows; cosmetic surgery,

cardiology, orthopedics, eye surgery, dental treatment, organ and tissue transplantation (Lunt, et al., 2011).

### **Thermal Tourism**

Thermal tourism is the benefit of the services provided in order to have a positive effect on the current health status of individuals with the contribution of environmental and climatic conditions in the regions where thermal waters are located. These services are offered under the supervision of a doctor. In addition to the services offered within the scope of thermal tourism, services such as physical therapy and rehabilitation, diet, exercise, and psychotherapy are also offered (Bostan, 2020).

The aim of thermal tourism is to apply the treatment under the control of specialist doctors in thermal waters that are determined to be medically curative. In addition, within the scope of thermal tourism, a healthy environment is created for individuals to rest, have fun and stay fit. Thermal tourism, unlike other types of tourism; the fact that tourism activities are active throughout the year, thermal tourism facilities have high occupancy rates, create an important potential for employment, high interaction with other types of tourism, offer opportunities such as entertainment and rest in addition to thermal services, thermal tourism facilities have high profitable and competitive potential. (Erdoğan & Akınoğlu, 2008).

### **Spa Wellness Tourism**

The word SPA is of Latin origin and means "health that comes with water" (Şahin & Tuzlukaya, 2013). Besides this, the word wellness refers to the physical, mental and spiritual well-being of individuals (Tengilimoğlu, 2021). The services offered within the scope of spa wellness are the treatment method applied by experts in order to rest the human body and reduce pain and suffering. During this treatment method, water and aromatic cures are used. Spa; it consists of special care using water and mud. It also expresses the physical, mental and spiritual well-being of

individuals (Yalçın, 2018). The spa is a therapy method in which rest and relaxation are experienced as a result of hot, cold or different applications of water. Based on the meaning of the concept of wellness, the services offered in this context aim to make people physically, mentally and spiritually well. The services offered for this purpose are; massages, skincare, mud baths, algae treatments (Değer, 2020).

### **Geriatrics and Disabled Tourism**

Advanced age tourism, also known as third age tourism, is a type of health tourism that includes the treatment of individuals aged 65 and over. Those who participate in touristic activities within the scope of advanced age tourism are generally retired and individuals with flexible time. For this reason, old age tourism has an off-season income-generating effect (Zengingönül et al., 2012). Disabled tourism is the participation of disabled people in tourism activities in order to be treated, to benefit from medical care services or health services such as rehabilitation. This type of tourism; rehabilitation service includes therapies, special care and excursions (Tengilimoğlu, 2021).

makes the knowledge and experience of decision-makers measurable (Paksoy, 2017). The AHP method can shorten the decision-making process as it is understandable and easy to apply (Topdemir, 2019).

In the AHP method, first of all, the purpose of the problem is determined. Then, the criteria and sub-criteria affecting the purpose are determined. Expert opinion and survey studies can be used to determine the criteria (Özbek, 2019). In order to solve the problem correctly, the criteria and alternatives must be determined completely (Çelikkilek & Özdemir, 2020).

In the AHP method, the problem is handled hierarchically. In this hierarchical structure; goals, criteria and alternatives are included (Topdemir, 2019). With the created hierarchical structure, complex problems are easier to understand (Ayçin, 2019). An example of the hierarchical structure is shown in the figure below (Saaty, 2000).

### **Multi-Criteria Decision Making Methods**

Multi-Criteria Decision-Making (MCDM) methods developed to make decisions in situations where there are multiple criteria and alternatives. The focal point of MCDM methods is to make the right decision. For this purpose, the most appropriate one among the alternatives is selected, sorted or classified (Paksoy, 2017).

#### **Analytical Hierarchy Process Method (AHP)**

Analytical Hierarchy Process (AHP), one of the MCDM problems, is a method developed by Thomas Saaty (Ayçin, 2019). The AHP method

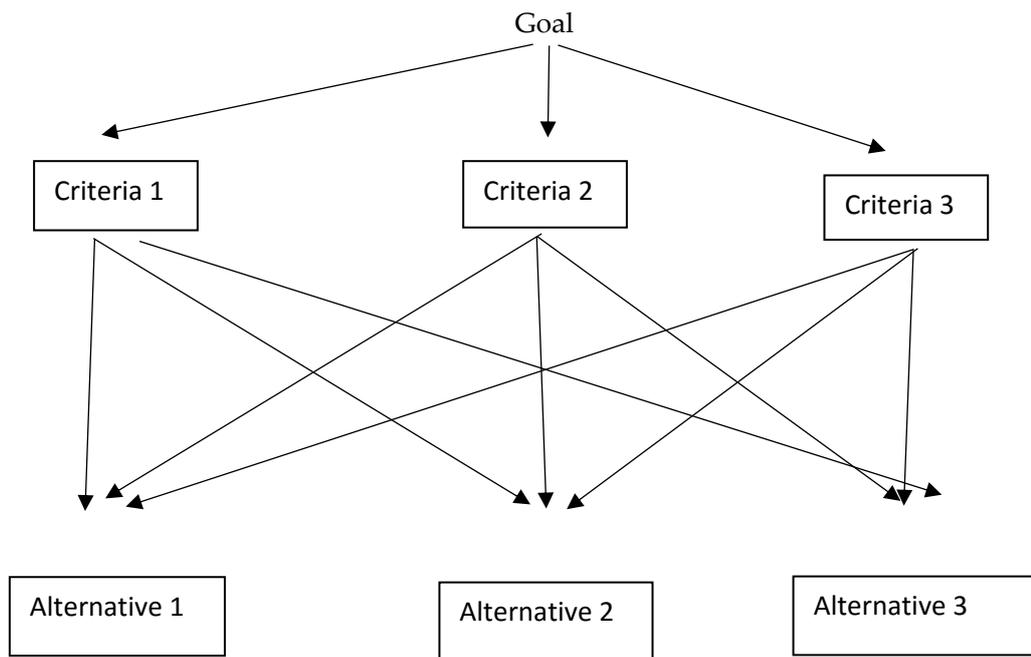


Figure 1. AHP hierarchical structure

A pairwise comparison matrix is created for each level of the hierarchical structure. With the pairwise comparison matrix, the relative importance of the factors in the hierarchical structure against each other is determined (İpek, 2019). The scale below is used when performing the pairwise comparison (Çelikbilek and Özdemir, 2020). With the help of this scale, it is determined how important the criterion *i* is compared to the criterion *j* (İpek, 2019).

Table 1. Saaty's pairwise comparison scale

Intensity of importance	Definition
1	Equally importance
3	Moderately importance
5	Strongly importance
7	Very strongly importance
9	Extremely importance
2, 4, 6, 8	Intermediate

References: (Saaty, 2000).

After the pairwise comparison matrix is created, the elements in the columns of the matrix are added and each element is divided by the column sum. In this way, the normalization process is carried out. The rows of the normalized matrix are summed and divided by the number of

elements. In this way, the priority vector is obtained (Özbek, 2019). With this process, the importance levels of the criteria and alternatives are determined (Akman, 2019).

It is necessary to check whether the pairwise comparison matrix is consistent within itself. As a result of these calculations, the consistency ratio is expected to be less than 0.1. If the consistency ratio is found to be greater than 0.1 as a result of the operations, it is understood that the comparison matrix is inconsistent. In this case, the pairwise comparison matrix should be revised (Özbek, 2019).

### TOPSIS Method

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), one of the MCDM methods, was developed by Hwang and Yoon in 1981 (Paksoy, 2017). The TOPSIS method focuses on two concepts: the positive ideal and the negative ideal solution. In this method, the optimal alternative is closest to the positive ideal solution and farthest away from the negative ideal solution (Özbek, 2019).

Defining the problem is the first stage of the TOPSIS method (Çelikbilek & Özdemir, 2020). The

second stage of the TOPSIS method is the creation of the decision matrix. In the rows of the matrix there are alternatives, and in the columns there are criteria. This matrix is the initial matrix formed by decision-makers (Özbek, 2019). For the normalization of the decision matrix, the square root of the sum of squares of each element of the criterion columns contained in the decision matrix is taken. Then each element is divided into the resulting value. Along with this process, the normalization process is performed. The normalized decision matrix values are multiplied by the importance weights of the criteria and the normalized matrix is obtained (Çelikbilek & Özdemir, 2020). Maximum and minimum values in the columns of the weighted normalized matrix; give positive ideal solution and negative ideal solution values. In order to obtain the positive ideal solution value, the maximum value of each column of the weighted decision matrix is selected (Ayçin, 2019). In the negative ideal solution, it is determined by choosing the minimum value of each column of the weighted decision matrix (Paksoy, 2017).

Each criterion in the weighted normalized matrix is subtracted from the positive ideal solution values and taken as squares. Then the obtained values were collected and their square roots were taken. Along with this process, the distance to the positive ideal solution is calculated. The same process has been repeated to calculate the distance to negative ideal points. At this stage, each criterion is subtracted from negative ideal solution values. Finally, the negative ideal distance is divided into the total distance value and the relative proximity value is obtained (Ayçin, 2019).

## Method

### The Purpose of Research

This study aims to determine the hospital preferences of health tourists in line with expert opinions by using AHP and TOPSIS methods which are multi-criteria decision-making techniques. Within the scope of this study, it is aimed to weight the criteria affecting the hospital preferences of health tourists with the AHP

method and to make an ideal hospital selection with the TOPSIS method.

### The Limitations of the Research

The data collected in research is limited to seven experts and eleven criteria that are effective in the hospital selection of health tourists.

### Data Collection Tool

In the study, the data were collected with a questionnaire obtained as a result of the literature review. The criteria affecting the hospital selection of health tourists in the survey; qualified health personnel, affordable medical treatment, touristic features, advice, modern equipment, accreditation, promotion and advertising, hospital image, language, quality of medical care, regional and cultural proximity (Belber, 2015; Işık et al., 2016; Kurumehmet, 2018; Taş et al., 2018; Tütüncü et al., 2011; Zengingönül et al., 2012). Criteria and symbols of criteria are given in 2.

*Table 2. Criteria for implementation*

Symbol	Criteria
C1	Qualified Health Personnel
C2	Affordable Medical Treatment
C3	Touristic Features
C4	Advice
C5	Modern Equipment
C6	Accreditation
C7	Promotion and Advertising
C8	Hospital Image
C9	Language
C10	Quality of Medical Care
C11	Regional and Cultural Proximity

This questionnaire for pairwise comparisons of criteria consists of 55 questions. During the preparation of the questionnaire was used Saaty 9-scale. This scale is given in Table 1. By using the values in the table, pairwise comparisons of the criteria were made within the scope of the AHP method. After the criterion weights were obtained with the AHP method, an ideal hospital selection process was carried out with the TOPSIS method. At this stage, hospital A, hospital B and hospital C, which were determined as hypothetical, were evaluated in terms of criteria. The evaluation of hospitals on the basis of criteria was made by assigning numerical values between 1-9.

## Data Collection

This study was conducted between March 2021 and April 2021 by taking the opinions of seven experts. Seven people participating in the study; their opinions were sought because they are experts in health tourism and dominate the field. Within the scope of the study, 6 experts were interviewed face-to-face and 1 expert was interviewed online. The interviews lasted approximately 25 minutes. This questionnaire, which was prepared by using the 9-scale evaluation scale developed by Saaty, is for pairwise comparisons of the criteria. During the interviews, experts were asked to compare each criterion in pairs regarding the purpose of choosing a hospital for health tourists. Within the scope of the survey, experts asked, "Is the criterion of qualified health personnel important, unimportant or equally important when compared to the criterion of affordable medical treatment?" they were expected to express their views on the questions asked. If it is considered important or unimportant, it is asked to what level it is. The obtained questionnaires were converted into numerical data with Table 1 and paired comparison matrices were obtained.

## Method and Analysis of the Research

In this study, AHP and TOPSIS methods from MCDM techniques were used to determine the hospital choice of health tourists. In the study, seven expert opinions were taken at the stage of data collection. One of the experts is a professor and six of them are employees of the International Patient Services Unit of a private hospital in Istanbul.

Pairwise comparison matrices were created in the MS Excel program of the data collected within the scope of the research. In order to combine the obtained pairwise comparison matrices into a single matrix, the geometric averages of the pairwise comparisons were taken. In our study, geometric mean was used to obtain a single decision matrix from seven different matrices obtained as a result of expert opinions. Since the

arithmetic mean is highly affected by the extreme values, the geometric mean was found suitable for this study, the arithmetic mean was not found appropriate (Krejčí & Stoklasa, 2018). The elements in the columns of the pairwise comparison matrix are summed and each element is divided by the column sum. With this process, a normalized matrix was obtained. Priority vectors were obtained by averaging the rows of the normalized matrices. A consistency test was conducted to determine whether the results obtained at this stage were consistent. As a result of these calculations, the consistency ratio is expected to be less than 0.1. After weighing the criteria with the AHP method, the TOPSIS normalization matrix was created to evaluate the 3 hypothetical hospitals. A weighted normalized matrix was created by using the normalized values. At this stage, in the columns of the weighted normalized matrix; the maximum values give the positive ideal solution values, and the minimum values give the negative ideal solution values. Then, by calculating the distance values and calculating the relative proximity, an ideal selection and ranking was made among the alternative hospitals that health tourists would prefer.

## Results

### Weighting of criteria with the AHP method

In this part of the study, hospital selection of health tourists will be determined by using AHP and TOPSIS methods from MCDM techniques. The criteria weights will be determined by the AHP method, and then the ideal hospital selection application will be carried out with the TOPSIS method. A hierarchical structure was created with 11 criteria and 3 hospital alternatives for the purpose of choosing a hospital for health tourists. The hierarchical structure is shown in Figure 2. As a result of the literature review, the criteria affecting the hospital selection of health tourists; qualified health personnel, affordable medical treatment, touristic features, advice, modern equipment, accreditation, promotion and advertisement, hospital image, language, medical care quality, regional and cultural proximity (Belber, 2015; Işık et al., 2016; Kurumehmet, 2018;

Taş et al., 2018; Tütüncü et al., 2011; Zengingönül et al., 2012). Three hospitals were selected hypothetically for the alternatives in the

hierarchical structure. Hospitals were named a Hospital A, Hospital B and Hospital C.

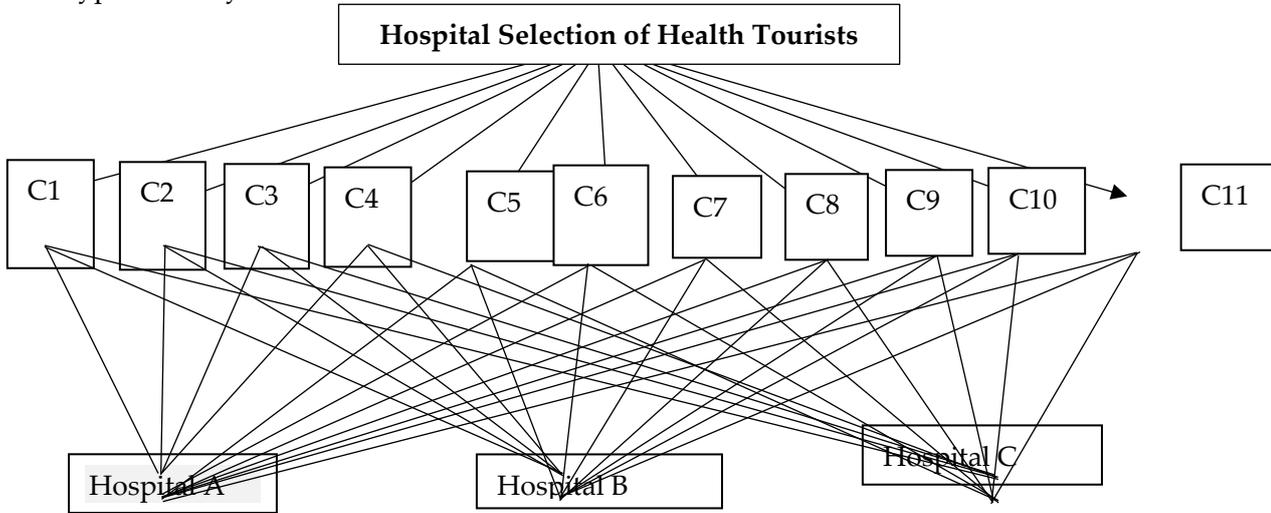


Figure 2. AHP hierarchy for health tourists hospital selection

In the study, seven expert opinions were taken in order to determine the importance levels of 11 criteria that affect the hospital choices of health tourists. At this stage, a questionnaire prepared using the 9-scale evaluation scale developed by Saaty was used. In order to combine the obtained pairwise comparison matrices into a single matrix, the geometric averages of the pairwise comparisons were taken. For each criterion, geometric averages were taken in line with the answers given by seven experts. The decision matrix obtained as a result of the geometric mean process is given below.

Table 3. Decision matrix obtained as a result of the geometric mean

Symbol	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
C1	1,00	3,97	6,27	1,87	1,99	2,09	3,78	1,74	2,89	2,09	4,64
C2	0,25	1,00	5,11	1,25	0,58	1,54	2,63	0,99	1,18	0,49	4,27
C3	0,16	0,19	1,00	0,34	0,21	0,51	0,55	0,21	0,53	0,18	0,76
C4	0,53	0,79	2,90	1,00	1,11	1,16	2,27	1,99	2,01	0,37	2,50
C5	0,50	1,72	4,81	0,90	1,00	3,00	2,45	1,87	1,94	0,63	3,69
C6	0,48	0,64	1,94	0,85	0,33	1,00	1,03	0,67	1,26	0,32	2,22
C7	0,26	0,38	1,81	0,44	0,41	0,96	1,00	0,68	1,03	0,22	2,27
C8	0,57	1,01	4,76	0,50	0,53	1,49	1,47	1,00	2,35	0,45	3,26
C9	0,34	0,84	1,87	0,84	0,51	0,79	0,96	0,42	1,00	0,48	0,86
C10	0,48	2,02	3,96	2,66	1,58	3,08	4,48	2,19	2,09	1,00	5,17
C11	0,21	0,23	1,32	0,40	0,27	0,45	0,44	0,30	1,16	0,19	1,00

For the normalization of the pairwise comparison matrix, the values in each column were first collected. After obtaining the column totals, each criterion is divided by the column total.

With this process, the normalized decision matrix is obtained. The values in the rows of the normalized matrix are summed and divided by the number of elements. With this process, the priority vector is obtained. The consistency ratio was calculated in order to determine whether the pairwise comparisons made within the scope of the study were consistent within themselves. The consistency rate was found to be 0,02. The consistency ratio was found to be less than 0.10. This result shows that the pairwise comparison matrices are consistent, that is, pairwise comparison matrices can be used for the purpose of health tourists' hospital selections. As a result, the criteria weights obtained by the AHP method and determined to be consistent were found as in table 4.

Table 4. Criteria weights obtained as a result of the AHP method

Symbol	Criteria	Criteria Weights
C1	Qualified Health Personnel	0,199487
C2	Affordable Medical Treatment	0,094625
C3	Touristic Features	0,026353
C4	Advice	0,097737
C5	Modern Equipment	0,123654
C6	Accreditation	0,061952
C7	Promotion and Advertising	0,050351
C8	Hospital Image	0,090537
C9	Language	0,055881
C10	Quality of Medical Care	0,165864
C11	Regional and Cultural Proximity	0,033557

As a result of expert opinions, the weight ranking of the criteria is as follows; qualified medical staff (0,199487), quality of medical care (0,165864), modern equipment (0,123654), advice (0,097737), affordable medical treatment (0,094625), hospital image (0,090537), accreditation (0,061952), language (0,055881), promotion and advertisement (0,050351), regional and cultural proximity (0,033557), touristic features (0,026353).

### Ideal Hospital Selection with TOPSIS Method

At this stage of the study, an ideal hospital will be selected for health tourists by using the criterion weights obtained by the AHP method. During the implementation of the TOPSIS method, first of all, the decision matrix should be created. Hospital A, hospital B and hospital C, which are determined as alternatives in the decision matrix, are evaluated in terms of criteria. Within the scope of this study, hospitals were determined as hypothetical. The evaluation of hospitals on the basis of criteria was made by assigning numerical values between 1-9. In this evaluation, hospitals were evaluated on the basis of criteria, with 1 being the lowest and 9 the highest. The decision matrix containing the evaluation of the alternatives created within the scope of the TOPSIS method according to the criteria is given below.

Table 5. TOPSIS decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Hospital A	9	3	7	8	9	9	8	9	7	9	7
Hospital B	3	9	6	2	4	9	3	3	3	6	5
Hospital C	7	5	5	6	7	9	5	6	5	7	6

To perform the normalization of the decision matrix in the TOPSIS method, each criterion is divided by the square root of the sum of the squares of the values in the column. During the weighting of the normalized decision matrix, each value in the normalized decision matrix was multiplied by the criterion weights obtained by the AHP method. The weighted normalized decision matrix obtained by multiplying each value in the normalized matrix with the criterion weights is as follows.

Table 6. Weighted normalized matrix

Hospitals	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Hospital A	0,14	0,02	0,013	0,07	0,08	0,03	0,04	0,07	0,03	0,11	0,020
Hospital B	0,04	0,07	0,011	0,01	0,04	0,03	0,01	0,02	0,01	0,07	0,014
Hospital C	0,11	0,04	0,010	0,05	0,07	0,03	0,02	0,04	0,02	0,08	0,017

The maximum value in each column of the weighted normalized matrix shows the positive ideal solution values, and the minimum value shows the negative ideal solution values. At the stage of calculating the distance to the positive ideal points, each criterion in the weighted normalized matrix was subtracted from the positive ideal solution values and their squares were taken. Then the obtained values were summed and their square roots were taken. The same process is repeated to calculate the distance to the negative ideal points. At this stage, each criterion is subtracted from the negative ideal solution values. Positive ideal and negative ideal solution values are given in the table below.

Table 7. Ideal and negative ideal solution values

	$S_i^+$	$S_i^-$
Hospital A	0,05035526	0,1396
Hospital B	0,1395619	0,05039
Hospital C	0,066634108	0,0868

Relative proximity; It is calculated with the negative ideal solution value and the positive ideal solution value obtained in the previous step. First of all, the total distance value was obtained by summing the positive ideal solution value and the negative ideal solution value. Then, the negative ideal solution value is divided by the total distance value and the relative closeness value is obtained. The ranking of hospital alternatives obtained within the scope of TOPSIS method is given in the table below.

Table 8. Relative proximity values and ranking of alternatives

	$C_i^+$	Ranking
Hospital A	0,73547732	1
Hospital B	0,26452268	3
Hospital C	0,56630374	2

In this study aimed at determining the hospital preferences of health tourists, criterion weights were determined by the AHP method. By using the criteria weights obtained, an ideal hospital selection process for health tourists was carried

out. When the relative closeness values of the alternatives are examined; Hospital A, with the largest relative closeness value of 0.7354, was the most ideal hospital choice. Hospital C ranks second with a relative closeness value of 0.5663, and hospital B with a relative proximity value of 0.2645 is in the last place. Among these three hospital alternatives, the most ideal hospital was found to be hospital A, while the farthest alternative to the ideal solution was found to be hospital B.

### Discussion and Conclusion

This study was carried out to determine the hospital preferences of health tourists using AHP and TOPSIS methods, which are among the MCDM techniques. Within the scope of this study, the criteria affecting the hospital preferences of health tourists were weighted with the AHP method, and an ideal hospital was selected with the TOPSIS method. Seven expert opinions were taken during the pairwise comparison of the criteria that are effective in the hospital selection of health tourists. As a result of expert opinions, the weight ranking of the criteria is as follows; qualified medical staff (0,199487), quality of medical care (0,165864), modern equipment (0,123654), advice (0,097737), affordable medical treatment (0,094625), hospital image (0,090537), accreditation (0,061952), language (0,055881), promotion and advertisement (0,050351), regional and cultural proximity (0,033557), touristic features (0,026353).

Criterion weights were obtained by the AHP method. Using the criteria weights obtained, an ideal hospital selection process was carried out among three hypothetical hospital alternatives with the TOPSIS method. With the TOPSIS method, the relative proximity value among the three alternative hospitals was found to be 0.7354, and the most ideal hospital in the hospital preferences of health tourists was found to be hospital A. In the second place, hospital C with 0.5663 and hospital B with 0.2645 were in the last place.

In the study conducted by Reddy (2013) to determine the reasons that are effective in the

preference of India within the scope of medical tourism, it was determined that the high quality of doctors and medical facilities were effective in the preference of India within the scope of medical tourism (Reddy, 2013). This result supports our study. In our study, qualified health personnel criteria with a weight of 0.1994 criteria and modern equipment criteria with a weight of 0.1236 criteria were determined as the effective criteria in the hospital preferences of health tourists.

In the study conducted by Izadi et al. (2014) to determine the factors that affect the preference of hospitals in Tehran within the scope of medical tourism, it was determined that the awareness and reliability of the health personnel and the factors of affordable health services affect the choice of hospital within the scope of medical tourism (Izadi, Torabian, & Farhangi, 2014). This result supports our study. In our study, qualified health personnel were the most effective criterion in the hospital selection of health tourists with a criterion weight of 0.1994, while affordable medical treatment was in the fifth place with a criterion weight of 0.0946.

In the study conducted by Mosadeghrad and Sadeghi (2021) to determine the reasons that affect Iran's preference in medical tourism, it was determined that the quality and cheapness of medical services were effective in the preference of Iran within the scope of medical tourism (Mosadeghrad & Sadeghi, 2021). This result is similar to our study. In our study, it was determined that the quality of medical care with a weight of 0.1658 criteria and affordable medical treatment criteria with a weight of 0.0946 criteria had a high effect on the hospital selection of health tourists.

In the study conducted by Bostan and Yalçın (2016) to determine the factors affecting the destination choice of health tourists, it was determined that service quality is the most important reason for preference in health tourism as a result of interviews with health personnel working in a private hospital (Bostan & Yalçın, 2016). In our study, the quality of medical care criterion ranks second with a criterion weight of 0.1658.

In a study conducted by Sevim and Sevim (2019) with 284 health tourists who applied to a private hospital in Istanbul, it was determined that quality health service delivery, modern institutions and touristic features were the most significant factors for health tourists' hospital preferences (Sevim & Sevim, 2019). In our study, while the quality of medical care criterion was in the second place with a weight of 0.1658 criteria, it was determined that the criterion of modern equipment was in the third place with a weight of 0.1236 criteria. The criterion of touristic features was found to be less important in our study with a criterion weight of 0.0263.

In a study conducted by Hasanova (2019) with 344 health tourists to determine the reasons that affect the selection of Hacettepe University Hospitals by health tourists, it was determined that the awareness of the doctors and the reliable image of the hospital were effective in the preferences of health tourists (Hasanova, 2019). In our study, the criterion of qualified health personnel was determined as the criterion with the highest importance with a weight of 0.1994. The image of the hospital was found to be less important in our study with a weight of 0.0905.

The situation of Malaysia in medical tourism was evaluated with Dematel and Fuzzy TOPSIS method. As a result, it has been determined that the most effective criteria are human and technological factors. In our study, qualified health personnel ranked first with 0.1994, while modern equipment was ranked third with 0.1236. These results are similar to our study (Nilashi, Samed, Manaf et al., 2019).

One of the effective criteria in the hospital selection of health tourists is qualified health personnel. For this reason, in order to be a hospital

that can be preferred by health tourists; trainings can be organized to eliminate the deficiencies of all health personnel in hospitals in foreign language. Trainings on health tourism can be given to health personnel. It can be ensured that healthcare personnel participate in congresses and conferences held abroad.

One of the effective criteria for health tourists in choosing a hospital is the modern equipment of the hospital. For this reason, devices that will increase the preferability of the hospital can be used by following the technological developments.

Satisfaction surveys can be applied to health tourists who have received services within the scope of health tourism. In this way, the improvements that can be made can be determined from the point of view of the health tourist. Special packages can be prepared for health tourists who come to receive services within the scope of health tourism. Thanks to these packages, health tourists can both have a holiday and receive health services. Bilateral agreements, promotions and advertisements can be made in countries with regional and cultural proximity and in countries with health tourism potential.

This study was carried out in line with 11 criteria obtained as a result of the literature review in order to determine the hospital preferences of health tourists. Expert opinion can also be taken at the stage of determining the criteria for future studies. Thus, the common views of experts and people with industry experience in health tourism will be obtained. In this way, a sectoral perspective can be gained in addition to the literature. In future studies, the city or country preference of health tourists can be investigated. In this way, the improvements to be made in the health tourism sector can be evaluated.

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