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Health Services and Patient Satisfaction in IRAN during the COVID-19 Pandemic: A Methodology Based on Analytic Hierarchy Process and Artificial Neural Network

Seyed Mohammad Khansari [1], Farzin Arbabi [2], Mir Hadi Moazen Jamshidi [3,*], Maryam Soleimani [4] and Pejman Ebrahimi [5]

[1] Department of Economics, Faculty of Administrative Sciences and Economics, Shahid Ashrafi Esfahani University, Isfahan 4999981799, Iran; sm_khansari@yahoo.com
[2] Department of Economics, Central Tehran Branch, Islamic Azad University, Tehran 1955847781, Iran; f.arbabi@iauctb.ac.ir
[3] Department of Management, Payame Noor University, Tehran P.O. Box 19395-3697, Iran
[4] Department of Management, Economics and Accounting, Payame Noor University, Tehran 1599959515, Iran; m.soleimani@pnu.ac.ir
[5] Doctoral School of Economic and Regional Sciences, Hungarian University of Agriculture and Life Sciences (MATE), 2100 Gödöllő, Hungary; ebrahimi.pejman@stud.uni-mate.hu
* Correspondence: Jamshidi.hadi@pnu.ac.ir

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Abstract: The aim of this study is to identify and classify the most important factors affecting patient satisfaction in the COVID-19 pandemic crisis considering economic effects. This is an analytical study using the analytic hierarchy process (AHP) method and ANN-MLP (Artificial neural network based on multilayer perceptron model as a supervised learning algorithm) as an innovative methodology. The questionnaire was completed by 72 healthcare experts (N = 72). The inter-class correlation (ICC) coefficient value was confirmed in terms of consistency to determine sampling reliability. The findings show that interpersonal care and organizational characteristics have the greatest and least influence, respectively. Furthermore, the observations confirm that the highest and lowest effective sub-criteria, respectively, are patient safety climate and accessibility. Based on the study's objective and general context, it can be claimed that private hospitals outperformed public hospitals in terms of patient satisfaction during the COVID-19 pandemic. Focusing on performance sensitivity analysis shows that, among the proposed criteria to achieve the study objective, the physical environment criterion had the highest difference in private and public hospitals, followed by the interpersonal care criterion. Furthermore, we used a multilayer perceptron algorithm to assess the accuracy of the model and distinguish private and public hospitals as a novelty approach. Overfitting results in finding an MLP model which is reliable, and the accuracy of the model is acceptable.

Keywords: patient satisfaction; COVID-19 pandemic; interpersonal care; technical care; analytic hierarchy process (AHP); artificial neural network (ANN); multilayer perceptron algorithm (MLP); supervised learning; economic aspects

1. Introduction

The coronavirus disease 2019 (COVID-19) was declared a global pandemic (Anuszkiewicz et al. 2022) in 2020 after the virus spread rapidly in most countries (Salamzadeh and Dana 2021). The COVID-19 pandemic has caused unprecedented rapid changes in our society, economy, and health care system (Graves et al. 2022). Clearly, the dire COVID-19 situation has a significant economic and financial impact, with GDP and hours worked falling by 20% (de la Fuente-Mella et al. 2021). Regarding to health economics, the lost productivity costs owing to absenteeism costs are an important element of the health care costs (Faramarzi et al. 2021). During the COVID-19 crisis, the economic downturn has struck people from the

lower socioeconomic stratum (Gopalan and Misra 2020). The COVID-19 pandemic is a human socioeconomic crisis that has led to many problems (Verma and Gustafsson 2020) and numerous challenges for hospitals and medical centers. Due to the COVID-19 pandemic, the healthcare sector is one of the most affected, and the general public is undoubtedly the most affected (Alzahrani et al. 2022). An important aspect for healthcare managers is patient management (Otani et al. 2011), which is of paramount importance in conditions of the COVID-19 crisis. Patient satisfaction is one of critical indicators for assessing healthcare service quality (Batbaatar et al. 2017) and an important issue for hospitals (Sadeh 2017) that can affect their persistence (Otani et al. 2010). Effective use of patient satisfaction can also provide them with a competitive advantage (Oppel et al. 2017; Russell et al. 2015). Patient satisfaction is an important issue intertwined with strategic decisions in the health and wellbeing domain (Andaleeb 2001). Therefore, it is important and noteworthy for health care providers to determine the factors related to this issue (Otani et al. 2003) because it allows us to identify valuable cases for patients (Zineldin 2006). Assessment of patient satisfaction can help identify aspects of health services that require improvements (Carlucci et al. 2013). Prioritization of factors affecting patient satisfaction in the conditions of COVID-19 crisis will cause hospital managers to focus on the most basic needs of patients and will help to effectively manage health services in these situations.

On 18 February 2020, the Iranian government formally acknowledged COVID-19's presence in Iran and put the country under suppression and lockdown (Yoosefi Lebni et al. 2021). The real case count is likely far greater than estimated, as it is challenging to confirm the cases due to the inadequate test kits for PCR diagnosis and the personnel working at hospitals (Shahriarirad et al. 2020).

Iran's public health system has not been developed in accordance with the needs of the country's population despite the country's ongoing changes (Solatianaghizi et al. 2017; Gholampour et al. 2020). The health system in Iran suffers from many problems that have led to decreased satisfaction of service providers and patients (Abbaszadeh et al. 2013) in addition to economic sanctions that have further reduced the health service quality in this country (Aloosh et al. 2019). The lack of medical facilities during the COVID-19 crisis has encountered the system with more serious problems than normal situations. The unfavorable economic conditions in Iran and the inefficiency of hospitals in providing health services to people make it impossible to make a comprehensive improvement in the Iranian healthcare system. Therefore, identification of crucial factors affecting patient satisfaction can specify strategic and important areas in the health system for hospital managers and policy makers.

As indicated by a review of previous studies, no study on the prioritization of critical factors affecting patient satisfaction in the conditions of the COVID-19 crisis is available. Definitely, there are some economic aspects related to the dire COVID-19 situation. Identification of the most important factors influencing patient satisfaction in the COVID-19 pandemic will provide important results for the management of the crisis. Additionally, identifying and prioritizing the factors affecting patient satisfaction in the context of the COVID-19 crisis can identify strategic factors in the provision of health services and help managers in this field in Iran and other similar regions in strategic planning, especially in crisis situations. In addition, comparing the most important factors affecting patient satisfaction in COVID-19 crisis situations between public and private hospitals can provide practical suggestions to health policy makers in developing appropriate strategies to improve health services to patients. The present study seeks to prioritize factors affecting patient satisfaction using the AHP method, thereby pursuing three important objectives:

1. Identification and classification of the most important factors affecting patient satisfaction in the COVID-19 pandemic crisis; 2. Prioritization of factors based on the AHP method; and 3. Accuracy of the model based on expert opinions regarding overfitting and cross validation.

In Section 2, the literature review is presented. In Section 3, the research methodology is illustrated in six separate subsections. In Section 4, the data analysis and results are

reported completely. In Section 5, the application of ANN-MLP to predict the accuracy of the model is presented. Finally, in Sections 6 and 7, discussion, conclusions and suggestions for future researchers are presented.

2. Literature Review

The effectiveness of healthcare systems can be measured by how satisfied patients are (Alosaimi et al. 2022). A review of the literature reveals that factors affecting patient satisfaction have been examined in a plethora of previous studies in the framework of factors related to service quality (Batbaatar et al. 2017), patient demographic characteristics (Alberto Sánchez et al. 2014; Danielsen et al. 2010; Footman et al. 2013), and demographic characteristics of health care providers such as gender and age (Hall et al. 1994). In previous studies, the most powerful determinant of patient satisfaction is stated to be the perception of health service quality characteristics (Batbaatar et al. 2017). This study focuses on the most important factors affecting patient satisfaction that have been emphasized in most studies. Technical care is one of the most important factors that has been confirmed to have an effect on patient satisfaction (Birhanu et al. 2010; Hemadeh et al. 2019; Tokunaga and Imanaka 2002). Technical care refers to the competence, experience, and ability of health professionals in disease diagnosis (Naidu 2009).

Another factor affecting patient satisfaction is interpersonal care, which is considered for physicians, nurses (Batbaatar et al. 2017), and personnel (Andaleeb 2001). Interpersonal communication with patients has been measured with different criteria, including politeness and attention (Akyüz and Ayyildiz 2012), empathy (Badri et al. 2009), responsiveness (Andaleeb 2001), friendly behavior (Chahal and Mehta 2013; Saad Andaleeb 1998), kindness (Schoenfelder et al. 2011), humaneness (Scotti 2005), emotional support, and respect for patient preferences (Alosaimi et al. 2022; Jenkinson et al. 2002). According to the results of research (Stanhope et al. 2022), regardless of whether care was given in-person or remotely, provider–patient interaction, including listening and warmth, was the main factor in the perceived quality of care.

Physical environment is another factor affecting patient satisfaction. The effects of various aspects of environmental conditions, including the cleanliness of hospital environment and the silence of the patient room (Ghosh 2014; Otani et al. 2011), illuminance, lighting design, and light distribution (Cui et al. 2018), on patient satisfaction have been demonstrated in previous studies.

Another factor affecting patient satisfaction is the access variable that includes three dimensions of accessibility, availability, and affordability (Batbaatar et al. 2017). Accessibility encompasses aspects of the treatment, such as shorter waiting times (Zopf et al. 2012) and simpler admission and discharge processes (Otani et al. 2003). Past research has emphasized the importance of providing effective telehealth services for patient satisfaction (Miziara et al. 2022; Montoya et al. 2022; Skime et al. 2022). Availability consists of such indicators as adequate numbers of nurses, physicians, and equipment (Batbaatar et al. 2017). There is less than one nurse present for every hospital bed due to the COVID-19 pandemic, which has increased the nursing shortage to 0.7–0.8 (Varasteh et al. 2021). Oppel et al. (2017) reported that a lower rate of problems in terms of physician shortages was significantly associated with higher levels of patient satisfaction (Batbaatar et al. 2017). Affordability is another dimension of accessibility that is related to such issues as insurance coverage and treatment costs. Hospital treatment costs were found to negatively affect patient satisfaction (Saad Andaleeb 1998). Lack of insurance coverage is also one of the factors affecting low patient satisfaction (Xiao and Barber 2008).

Patient satisfaction is also affected by organizational characteristics, one of which is hospital reputation, affecting overall patient satisfaction according to Tokunaga et al. (2000). Hospital reputation was introduced as one of the most important determinants of patient satisfaction (Imanaka et al. 1993). Another organizational feature is a patient safety climate in the hospital, which includes such criteria as communication openness, feedback and communication about errors, and teamwork across units, and its positive relationship with

patient satisfaction was confirmed in previous research (Mazurenko et al. 2016; Mazurenko et al. 2019; Sorra et al. 2012). Table 1 Shows factors affecting patient satisfaction in the COVID-19 pandemic crisis.

Table 1. Factors affecting patient satisfaction in the COVID-19 pandemic crisis.

Categories	Factors	References
Technical Care	Perceived competency of health professionals	(Andaleeb 2001; Cheng et al. 2003; Hall and Dornan 1988; Saad Andaleeb 1998)
Interpersonal care		(Alasad and Ahmad 2003; Alosaimi et al. 2022; Chahal and Mehta 2013; Otani et al. 2003; Rehman and Ali 2016; Stanhope et al. 2022)
Physical environment		(Cui et al. 2018; Ghosh 2014; Ozkoc and Pazarlioglu 2011)
Access	Accessibility	(Montoya et al. 2022; Otani et al. 2003; Zopf et al. 2012)
	Availability	(Batbaatar et al. 2017; Oppel et al. 2017)
	Affordability	(Saad Andaleeb 1998; Xiao and Barber 2008)
Organizational characteristics	Reputation	(Imanaka et al. 1993; Tokunaga et al. 2000)
	Patient safety climate	(Mazurenko et al. 2016; Mazurenko et al. 2019; Sorra et al. 2012)

3. Methodology

3.1. Analytic Hierarchy Process (AHP)

The AHP method, introduced by Saaty (1980), is widely used as a multi-criteria decision-making method in a range of decisions and applications (Improta et al. 2019; Zekhnini et al. 2020; Saaty 1980). This approach has advantages because it is simple to use and can incorporate the opinions of numerous experts and decision makers (Wong and Li 2008; Baffoe 2019). If there is bias in the agreement reached by the assessment experts, it can be further supported by the theoretical underpinnings of quantification in AHP (Lin and Wu 2008). The AHP method is regarded both qualitatively and quantitatively as being able to usefully evaluate the alternatives of multifaceted, numerous criteria that include biased judging. It is also a particularly symmetrical method capable of simplifying complex issues, such as project screening, by converting them into hierarchical structures.

AHP is used in several stages (Improta et al. 2019; Zekhnini et al. 2020, Baffoe 2019; Lin and Wu 2008; Albayrak and Erensal 2004; Nasiri et al. 2020; Tu et al. 2020). (1) Creation of a hierarchy model, (2) creation of a pairwise comparison matrix, (3) calculation of priority and eigen value, and (4) verification of the pairwise comparison's consistency.

3.2. Development of the Hierarchy Model

A conceptual model for a decision problem must be created before any data are collected. When entities can be categorized into distinct groups and the entities of one group have an impact on the entities of other groups, the system is said to be a hierarchy (Saaty 1980). A hierarchical structure must be established for assessing hospital and asset capacities in order to prioritize effective factors by AHP in order to pursue patient satisfaction in the COVID-19 scenario. Figure 1 illustrates how the main aspect of the AHP's qualitative constituent drives the entire global objective's criteria. The critical standards that hospitals must adhere to in order to ensure patient satisfaction were determined by using related published work as a guide. First off, the choice of the assessment framework level was made strategically with the goal of "prioritizing factors affecting patient satisfaction in the COVID-19 pandemic condition." Five criteria make up the newly introduced selection model: technical care; interpersonal care; access; physical environment; and organizational

traits. Private and public hospitals are the two alternatives to the hierarchical model. Measurable sub-criteria in the third level of the evaluation framework, such as perceived competency, accessibility, availability, affordability, reputation, and patient safety climate, determine which of these is best.

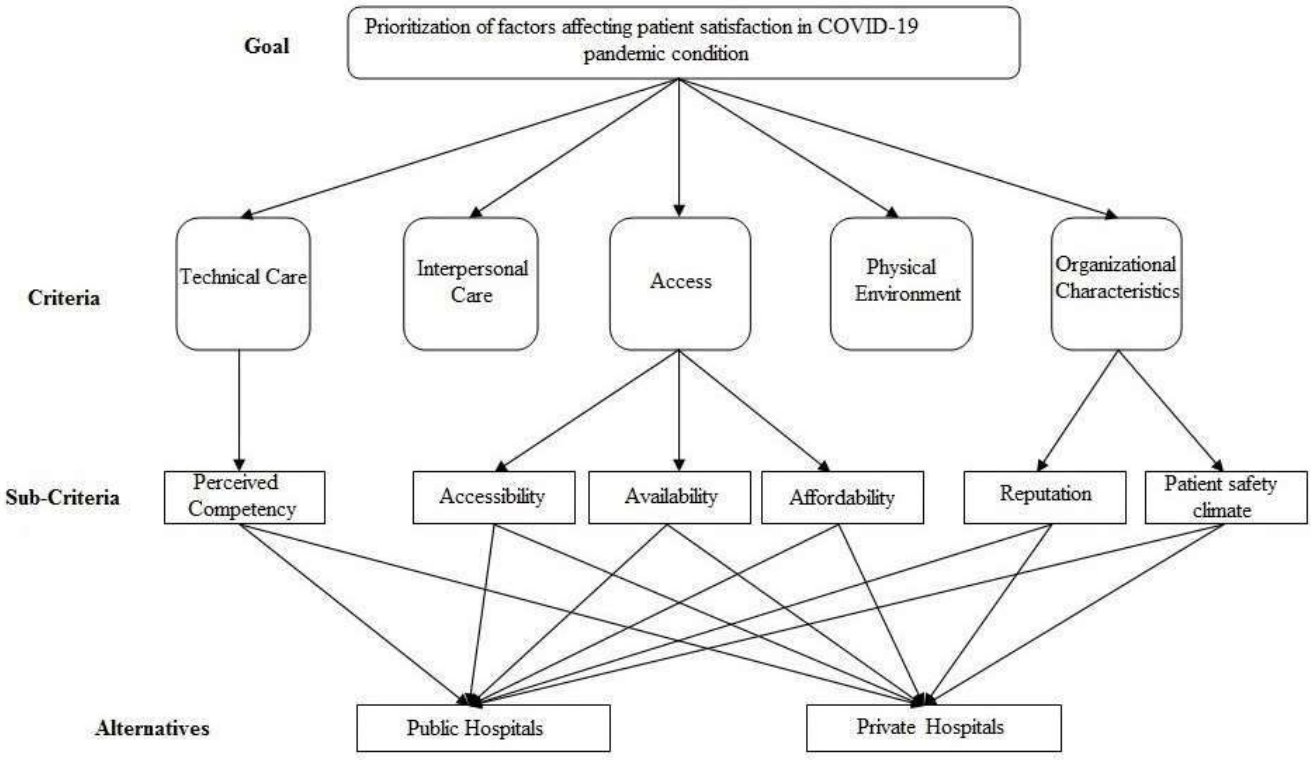

Figure 1. Top-level criteria and indicators of each criterion.

3.3. Pairwise Comparison Matrix and the Priority Weights within the Hierarchy

When building a matrix for pairwise comparisons with a relative importance scale, the major diagonal entries of the pair-wise comparison matrix are all set to 1, as an attribute compared to itself is always assigned to value 1. 2, 4, 6, and 8 represent a compromise between 3, 5, 7, and 9, while 3, 5, 7, and 9 denote moderate importance, strong importance, "very important," and "absolutely important", respectively (Saaty 1980; Chen and Wang 2010).

The pairwise comparison matrix must then be normalized. By dividing each number by the sum of the numbers in that column, each criterion in each column of the matrix is normalized. The arithmetic mean of each row is then calculated to determine the relative weights of the various criteria. To do this, the sum of each matrix row's numbers is divided by the total number of numbers in that row. Together, the calculated relative weights of the options and the criteria are multiplied. The results of multiplying the criteria and options are arranged in ascending order of value, with the options receiving the highest prime concern (Nasiri et al. 2020).

3.4. Consistency Index and Consistency Ratio

AHP can measure the consistency of the comparison using the Consistency Index, CI, Random Consistency Index, RI, and Consistency Ratio, CR; see Equations (1) and (2) for more information. The accepted consistency ratio, CR, is <10% (CR < 0.1), indicating that the subjective judgment is acceptable, while perfect consistency is denoted by a zero value of CI (CI = 0) (Aminbakhsh et al. 2013; Petruni et al. 2019).

$$CI = (\lambda max - n)/(n - 1) \quad (1)$$

where CI is the consistency index; λmax is the maximum eigenvalue; and n is the size of the measured matrix.

$$CR = CI/RI \quad (2)$$

where CR is the consistency ratio; CI is the consistency index; and RI is the random consistency index.

3.5. Artificial Neural Network (Multi-Layer Perceptron Model)

Machine learning algorithms, divided two major categories, supervised and unsupervised, have become important tools for clustering and classification (Ebrahimi et al. 2022a, 2022b). ANN is a supervised machine learning algorithm. Machine learning algorithms are used in many mathematical problems and complex models. This model operates based on the definition of weights and the type of activation functions. Based on the number of neurons and the number of hidden layers, the accuracy of the model can be examined. Advantages of MLP models are that they are suitable to learn non-linear models and learn models in real time. However, there are some drawbacks, such as an MLP model requires tuning a number of hyper parameters such as the number of hidden neurons, layers, and iterations, and is sensitive to scaling (Roshandel-Arbatani et al. 2019).

3.6. Data Collection

The two examinations used in the current study were general and AHP surveys. The former was initially used to determine the deemed crucial selection criteria and choose specialists with the appropriate credentials and experience for entry into the AHP survey. Prior to the general survey, a preliminary investigation was carried out to gauge the suitability of the introduced criteria summary gleaned from earlier publications and to assess the questionnaire's readability before it was given out. By conducting the AHP survey and giving significant weightings to the perceived criteria, the general survey results were honed and refined.

Analyzing data and concurrently interpreting the results are just two of the many aspects of investigations which suffer from a small sample size. The AHP has advantages over other MCDM techniques, primarily because it can produce comprehensive results that are statistically robust without a large sample size with statistical significance (Darko et al. 2019).

The study population consisted of nurses and managers (N = 72) working in nine hospitals (five private and four public) with an affiliation to Iran. A BSc in nursing, a Master's, or Ph.D. in a medical discipline, and a minimum of ten years of work experience were required for consideration.

The inter-class correlation (ICC) coefficient value was confirmed in terms of consistency (Bouzari et al. 2021; Fekete-Farkas et al. 2021; Ebrahimi et al. 2020) to determine the reliability of sampling.

4. Data Analysis and Findings

Following the collection of questionnaires in the current study, the data were analyzed using descriptive statistics, specifically frequency, proportion, and percentage, using SPSS 21.0 software. The AHP method was also used to analyze data using Expert Choice 10.0 software.

The majority of respondents (88.9 percent) were between the ages of 40 and 65, with females making up the majority (62.5 percent), and the majority of respondents (58.3 percent) held a BSc in nursing.

The calculations showed that all questionnaire responses met the consistency ratio requirement of CR = CI/RI of <0.1, allowing the decision maker to accept the pairwise comparison matrices (Figure 2). Figure 2 and Table 2 show, respectively, the total weights and the total weights of the criteria and sub-criteria, along with their ranks. Interpersonal care (0.272), technical care (0.259), access (0.212), physical environment (0.162), and organizational characteristics make up the order in which the criteria's weights are given (0.095). The results show that, when it comes to ranking the factors that affect patient satisfaction

in the COVID-19 pandemic, interpersonal care and organizational characteristics have the upper and lower influences, respectively. The patient safety climate (0.667), availability (0.400), affordability (0.400), reputation (0.333), and accessibility are also ranked according to the weights of the sub-criteria (0.200). The findings support the assertion that accessibility and the patient safety climate rank as the highest and lowest effective sub-criteria, respectively. As perceived competence is only a sub-criterion for technical care, and the software is unable to estimate its rank, it is not taken into account in rankings. The software assumes that a single sub-criterion has a weight of 1.

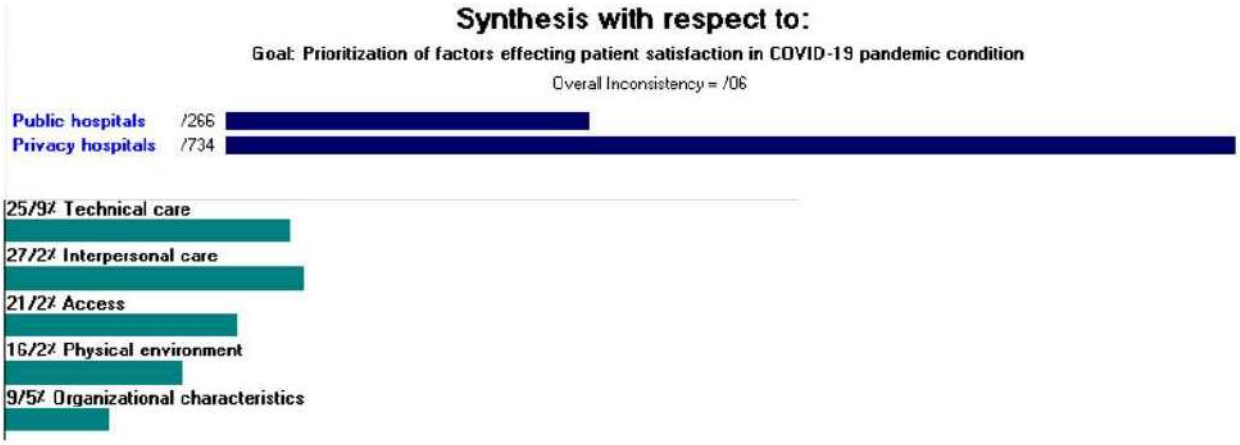

Figure 2. The AHP weights of criteria.

Table 2. The AHP weight and ranking of criteria and sub-criteria.

Criteria	Weights	Ranking	Sub-Criteria	Weights	Ranking
Technical care	0.259	2	Perceived competency	1.000	
Interpersonal care	0.272	1			
Access	0.212	3	Accessibility	0.200	5
			Availability	0.400	2
			Affordability	0.400	2
Physical environment	0.162	4			
Organizational characteristics	0.095	5	Reputation	0.333	4
			Patient safety climate	0.667	1

Additionally, Figure 3 indicates that private hospitals have generally received a much higher score than public hospitals according to the proposed criteria. Based on the study objective, it can be claimed that private hospitals achieved a much higher ranking in obtaining patient satisfaction in the COVID-19 pandemic than public hospitals. Focusing on performance sensitivity, Figure 4 also shows that, among the proposed criteria to achieve the study objective, the physical environment criterion had the highest difference in private and public hospitals, followed by the interpersonal care criterion. The Access criterion was the same for both private and public hospitals.

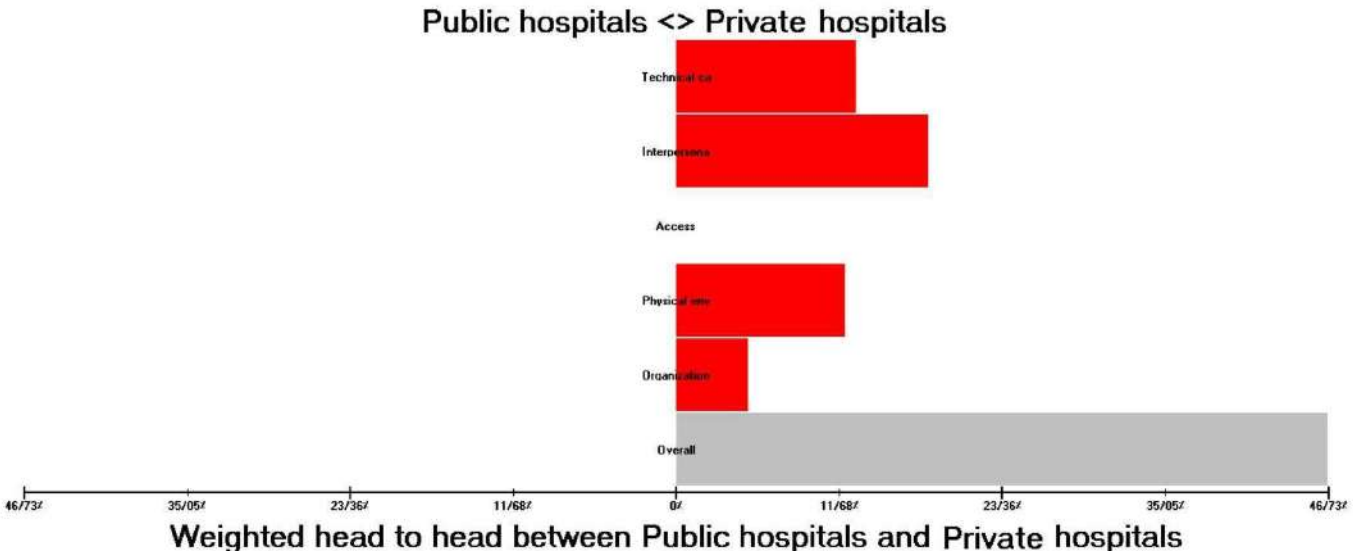

Figure 3. Weighted head-to-head between public and private hospitals.

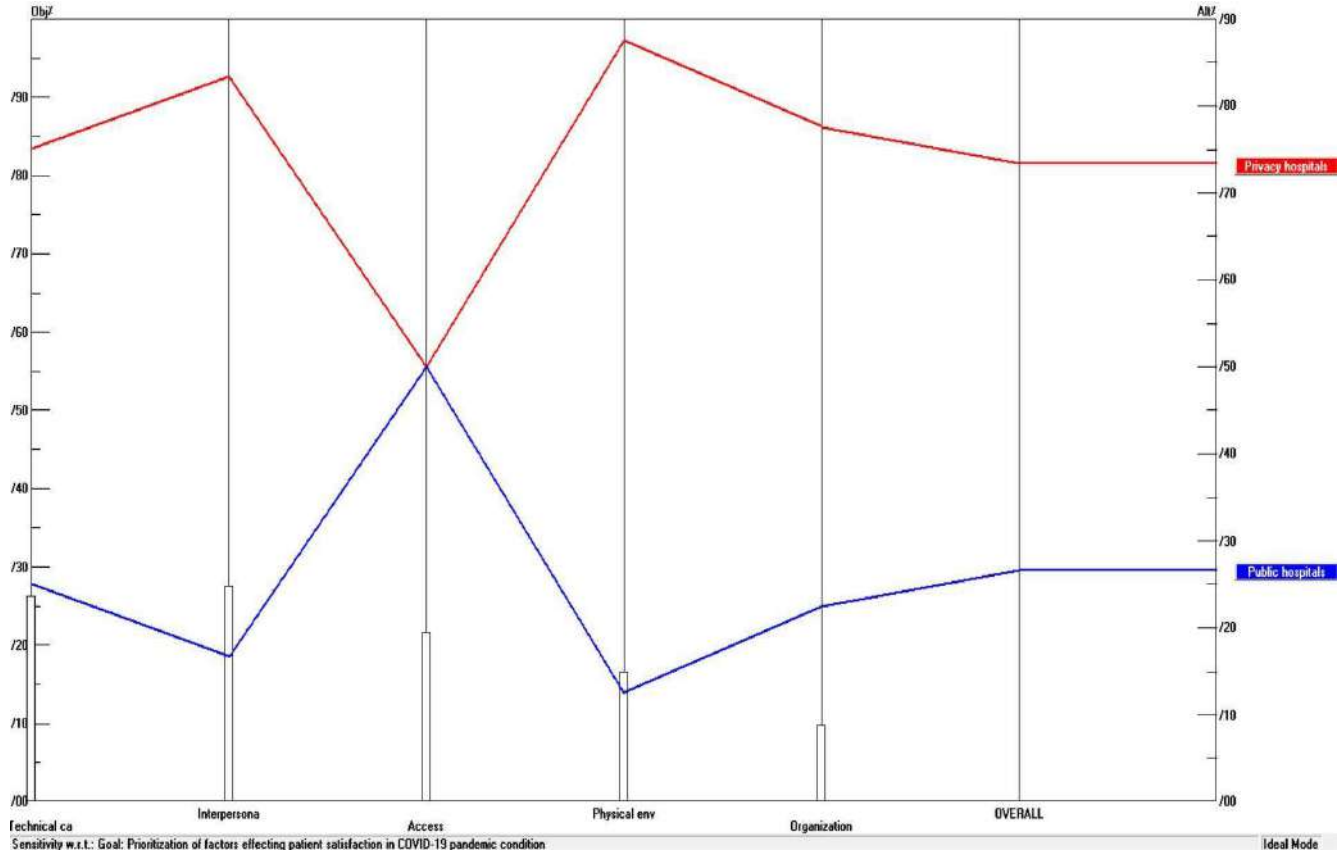

Figure 4. Performance sensitivity analysis.

5. Application of ANN-MLP to Predict Accuracy of the Model

In this research, the MLP algorithm has been used to check the accuracy and prediction of the model. Experts have been examined in terms of demographic characteristics such as age, experience, and education. Overall, experts have been classified in two different groups based on tendency to private or public health services during the dire COVID-19 situation. The accuracy of the model was evaluated in two intervals and in a number

of different perceptrons, which yielded similar results. Additionally, the value of mean square error (MSE) is less than 0.1. The results of overfitting indicate the proper fit of the model. Figures 5 and 6 show the accuracy of the models in terms of test and train data. The accuracy of the model is more than 80%, which is an acceptable amount.

In the first step, we import all required libraries to make MLPClassifier model (Code A):

Code A: # Libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.neural_network import MLPClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.model_selection import cross_val_score
from sklearn.metrics import mean_squared_error
```

In the second step, we import all data (Code B):

Code B: #Import data

```
data = pd.read_excel("Data.xlsx")
x = data.drop(columns = ["independent variables"])
y = data["Dependent variable"]
print(x)
print("\n", y)
```

For the next step, we divided data into two parts: training and testing data. We usually consider 70% of data for training and 30% of data for testing. We can see the output of the model with every new x (based on demographic variable). In fact, the model can predict expert opinion regarding private or public hospitals. Meanwhile, the accuracy of the model in different conditions can be tested (Code C).

Code C: # Train, Test, model accuracy and prediction

```
x_train, x_test, y_train, y_test = train_test_split(
   x, y, test_size = 0.3, random_state = 30)
print(x_train.shape)
print(x_test.shape)
test_accuracy = []
train_accuracy = []
HLS = [] # hidden lyer size

for i in range(1, 20):
   for j in range(5, 25):
      model = MLPClassifier(hidden_layer_sizes = (i, j), activation = 'relu', solver = 'adam')
      model.fit(x_train, y_train)
      y_predict = model.predict(x_test) # predict model with every new x
      score = accuracy_score(y_test, y_predict)
      print(f"Score is: {score}")

      test_accuracy.append(model.score(x_test, y_test))
      train_accuracy.append(model.score(x_train, y_train))
      HLS.append([i, j])
```

Based on Code D, we can provide accuracy plots regarding testing or training data.

Code D: # Plots

```
plt.plot(test_accuracy, label = "Test")
plt.plot(train_accuracy, label = "Train")
plt.xticks(range(0, len(HLS)), HLS, rotation = 90)
plt.xlabel("Hidden layer size")
plt.ylabel("Accuracy")
plt.legend()
plt.show()
```

The final step is related to overfitting and cross validation (Code E).

Code E: # Overfitting and cross validation

```
reg = MLPClassifier()
cv_score = cross_val_score(reg, x, y, cv = 5)
mse = np.mean(cv_score)
print("cross validation mse is: ", mse)
clf = MLPClassifier(hidden_layer_sizes = (
   i, j), activation = 'relu', solver = 'adam')
scores = cross_val_score(clf, x, y, cv = 5)
print(f"Score is: {scores}")
```

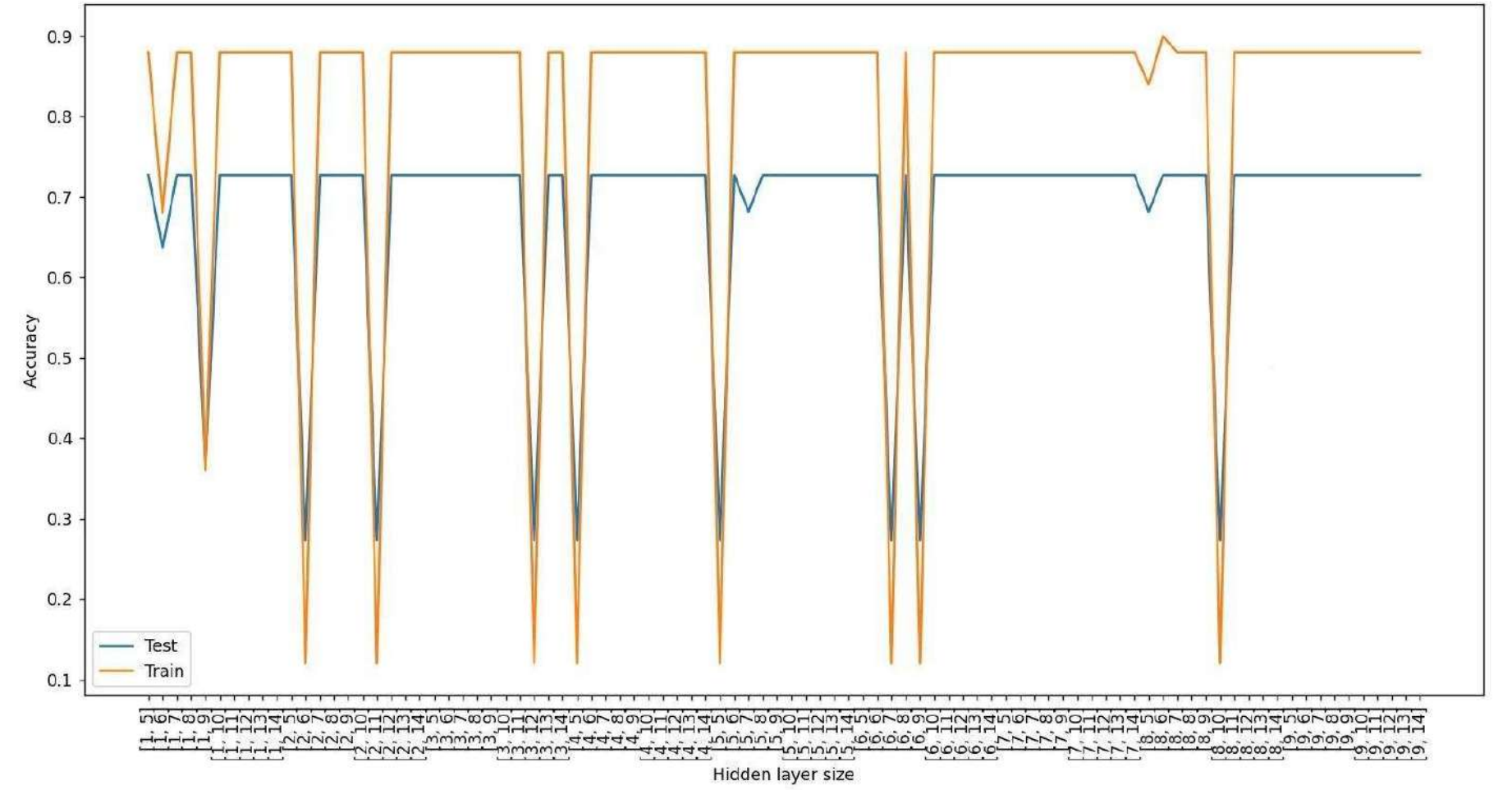

Figure 5. Accuracy of the MLP model (I = (1, 10), j = (5, 15)). Note: MSE= 0.083; Scores (Cross validation with cv = 5) = [0.8, 0.8, 0.857, 0.857, 0.857].

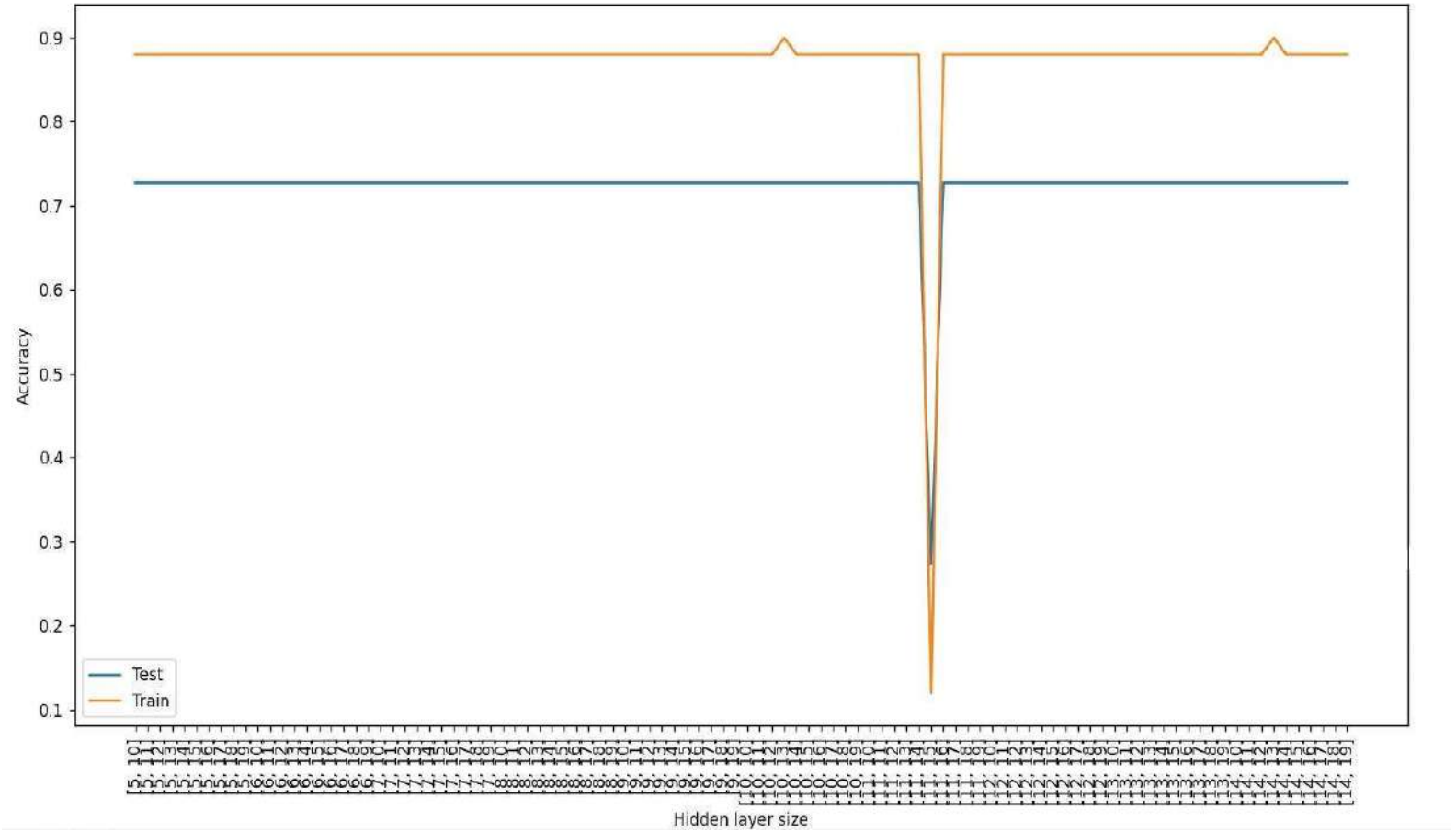

Figure 6. Accuracy of the MLP model (I = (5, 15), j = (10, 20)). Note: MSE = 0.083; Scores (Cross validation with cv = 5) = [0.8, 0.8, 0.857, 0.857, 0.857].

6. Discussion

The present study mainly focused on the prioritization of factors affecting patient satisfaction in the COVID-19 pandemic. The research results demonstrate noteworthy points about the criteria and sub-criteria of the hierarchy model. Among the proposed criteria, the most important criterion was interpersonal care, with a greater weight than the other criteria. Previous research (Chahal and Mehta 2013; Rehman and Ali 2016; Schoenfelder et al. 2011) also emphasized the importance of interpersonal care for patient satisfaction. Additionally, an important point worthy of consideration by health managers in Iran is that this criterion is the second one that has made a significant difference in public and private hospitals according to the performance sensitivity analysis. In fact, the results indicated that interpersonal care is not of desirable quality and has been neglected in public hospitals. In contrast, private hospitals have paid special attention to interpersonal care in the COVID-19 pandemic conditions. This criterion, along with the physical environment criterion, has caused the greatest difference in public and private hospitals. It can, therefore, be concluded that private hospitals in Iran have gained a significant difference in terms of patient satisfaction compared with public hospitals by prioritizing physical environment and interpersonal care during the COVID-19 pandemic.

Another point of consideration was the importance and high weight of the patient safety climate sub-criterion in comparison to the other sub-criteria. The importance of patient safety climate for patient satisfaction has also been emphasized in the literature (Mazurenko et al. 2016; Mazurenko et al. 2019; Sorra et al. 2012). A point that redoubles the importance of this sub-criterion is that it represents organizational characteristics, personality, and the order of the hospital. According to performance sensitivity analysis, a significant difference observed between public and private hospitals in this criterion largely indicates the weakness of the system governing public hospitals.

The results of this research clearly show the weakness and unsatisfactory performance of public hospitals in Iran in attracting patient satisfaction during the COVID-19 pandemic. It should be noted, though, that in the COVID-19 pandemic, a much higher percentage of patients were admitted to public hospitals than private hospitals according to the statistics of the Ministry of Health of Iran, and this high volume of admissions and lack of adequate facilities might have caused such a functional weakness. Indeed, public hospitals in Iran suffer from a lack of resources, and the problem of healthcare budget has always been one of the main problems of the health system in Iran in recent years. Additionally, many clients and patients who are intermediate or poor groups of society had no choice but to choose and refer to public hospitals in the COVID-19 pandemic due to the high costs of private hospitals. Manenti (2011) emphasized the inability of the public sector to provide the health needs of people, the poor quality of public hospital services, the physician shortage per patient, and the shortage of nurses. Abbaszadeh et al. (2013) also highlighted the challenges of the health system in Iran, including decreased efficiency of the staff.

As announced by health officials in Iran, the possible increase in the burden of COVID-19 disease in the second wave and its coincidence with the outbreak of influenza, fatigue and exhaustion of hospital staff during the multi-month outbreak of COVID-19, along with elevated costs and a sharp decline in the revenue of public hospitals have all exposed these organizations to bankruptcy, which necessitates the immediate support of hospitals and medical centers by relevant authorities. The financial problems of public hospitals are among the factors that can clearly influence patient satisfaction by affecting medical staff, an important point that can be considered by the large-scale health management in Iran from a managerial point of view. For example, lack of medical facilities, long working hours for medical staff, non-payment of salaries and compensations of medical staff, and lack of beds in the ICU are all factors affecting medical staff and thus patient satisfaction. Downsizing was another important issue that faced public hospitals with many problems due to the economic problems of public hospitals during the COVID-19 pandemic. This imposes intensive burden on public hospital staff by increasing working hours, and obviously significantly reduces the work efficiency of medical staff. The lack of proper planning and

management is evident regarding the performance of hospitals in Iran and, perhaps more widely, in the field of health, which also affects patient satisfaction and medical staff on a larger scale, leading to more dissatisfaction with provided services in the long run.

7. Conclusions

The present study tried to prioritize the factors affecting patient satisfaction during the COVID-19 period using the AHP method. Undoubtedly, patient satisfaction is an important factor affecting the health economy. In the next step, to study the accuracy of the proposed model, the machine learning algorithm was used using Python programming, which shows the acceptable results of the model's accuracy.

COVID-19 condition has certainly had many psychological and economic effects. Meanwhile, patients' dissatisfaction with health services can have more negative economic effects on the health sector.

One of the points that should be highlighted in this study is the prominent role of public hospitals in the onset of the COVID-19 pandemic. In fact, the important role of public hospitals in the beginning of the fight against COVID-19 should not be easily disregarded, despite the results of this study indicating patient satisfaction in private compared with public hospitals. In fact, the facilities of private hospitals are considerable in comparison to public hospitals in Iran for economic reasons and perhaps poor management in the latter. For readers of this article, it may be interesting to note that only public hospitals provided services to clients in the beginning of the COVID-19 pandemic, and private hospitals refused to admit patients. This clearly reveals the weakness of management in the health system and monitoring the performance of hospitals in Iran. From another viewpoint, the large number of clients referred to public hospitals and the lack of adequate facilities have brought about patient dissatisfaction, which should by no means underestimate the services and efforts of medical staff in public hospitals. Indeed, medical staff in public hospitals of Iran have always been at the forefront of the struggle and have tried to satisfy patients with minimum facilities.

Irrespective of mentioned notes, clustering based on a machine learning approach revealed that experts have more tendency to emphasize the quality of private hospitals in comparison with public hospitals. Based on their experience and education level, advantages of private hospitals in Iran must be weighed against some shortcomings.

Regardless of the aforementioned explanation, the management of private hospitals provided better planning and organization than public hospitals after solving the problem of patient admission in private hospitals during the COVID-19 pandemic. Allocation of separate wards for COVID-19 patients, paying special attention to interpersonal care and physical environment, and undoubtedly the supply of suitable facilities to fight this disease have been the most important reasons for patient satisfaction with private hospitals during the COVID-19 pandemic.

Future researchers can use other machine learning algorithms to assess the accuracy of the model. They also can compare different algorithms. Meanwhile, other criteria related to performance of hospital can be added to model, and tests can be run in different levels.

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References

Abbaszadeh, Abbas, Manijeh Eskandari, and Fariba Borhani. 2013. Changing the care process: A new concept in Iranian rural health care. *Asian Nursing Research* 7: 38–43. [CrossRef]

Akyüz, Ahmet Mutlu, and Hasan Ayyildiz. 2012. A Structural Equation Model Test of Patient Satisfaction in the Health Service Organizations in Trabzon City. Available online: https://www.researchgate.net/publication/265261173_A_STRUCTURAL_EQUATION_MODEL_TEST_OF_PATIENT_SATISFACTION_IN_THE_HEALTH_SERVICE_ORGANIZATIONS_IN_TRABZON_CITY (accessed on 27 May 2022).

Alasad, Jafar A., and Muayyad M. Ahmad. 2003. Patients' satisfaction with nursing care in Jordan. *International Journal of health Care Quality Assurance* 16: 279–85. [CrossRef]

Albayrak, Esra, and Yasemin Claire Erensal. 2004. Using analytic hierarchy process (AHP) to improve human performance: An application of multiple criteria decision making problem. *Journal of Intelligent Manufacturing* 15: 491–503. [CrossRef]

Alberto Sánchez, Carlos, Francisco Javier Prado-Galbarro, Sonia García-Pérez, and Antonio Sarría Santamera. 2014. Factors associated with patient satisfaction with primary care in Europe: Results from the EUprimecare project. *Quality in Primary Care* 22: 147–55.

Aloosh, M., A. Salavati, and A. Aloosh. 2019. Economic sanctions threaten population health: The case of Iran. *Public Health* 169: 10–13. [CrossRef]

Alosaimi, Fahad D., Futoon S. Alsaleh, Luluh Y. Alsughayer, Lamees A. Altamimi, Ibrahim A. Alfurayh, Nashwa M. Abdel-Aziz, and Khalid A. Alsaleh. 2022. Psychosocial and Clinical Predictors of Patient Satisfaction with Cancer Care. *Saudi Pharmaceutical Journal* 30: 414–20. [CrossRef]

Alzahrani, Ahmed Ibrahim, Hosam Al-Samarraie, Atef Eldenfria, Joana Eva Dodoo, and Nasser Alalwan. 2022. Users' intention to continue using mHealth services: A DEMATEL approach during the COVID-19 pandemic. *Technology in Society* 68: 101862. [CrossRef]

Aminbakhsh, Saman, Murat Gunduz, and Rifat Sonmez. 2013. Safety risk assessment using analytic hierarchy process (AHP) during planning and budgeting of construction projects. *Journal of Safety Research* 46: 99–105. [CrossRef]

Andaleeb, Syed Saad. 2001. Service quality perceptions and patient satisfaction: A study of hospitals in a developing country. *Social Science & Medicine* 52: 1359–70.

Anuszkiewicz, Karolina, Piotr Stogowski, Marta Zawadzka, Przemysław Waszak, Ewa Sokolewicz, Natalia Aleksandra Dułak, Kamil Dzwilewski, Karolina Jażdżewska, Kamila Karbowiak, Daria Karlińska, and et al. 2022. COVID-19 pandemic influence on epilepsy course in pediatric patients. *Epilepsy & Behavior* 129: 108581.

Badri, Masood A., Samaa Attia, and Abdulla M. Ustadi. 2009. Healthcare quality and moderators of patient satisfaction: Testing for causality. *International Journal of Health Care Quality Assurance* 22: 382–410. [CrossRef]

Baffoe, Gideon. 2019. Exploring the utility of Analytic Hierarchy Process (AHP) in ranking livelihood activities for effective and sustainable rural development interventions in developing countries. *Evaluation and Program Planning* 72: 197–204. [CrossRef]

Batbaatar, Enkhjargal, Javkhlanbayar Dorjdagva, Ariunbat Luvsannyam, Matteo Mario Savino, and Pietro Amenta. 2017. Determinants of patient satisfaction: A systematic review. *Perspectives in Public Health* 137: 89–101. [CrossRef]

Birhanu, Zewdie, Tsion Assefa, Mirkuzie Woldie, and Sudhakar Morankar. 2010. Determinants of satisfaction with health care provider interactions at health centres in central Ethiopia: A cross sectional study. *BMC Health Services Research* 10: 78. [CrossRef]

Bouzari, Parisa, Aidin Salamzadeh, Maryam Soleimani, and Pejman Ebrahimi. 2021. Online Social Networks and Women's Entrepreneurship: A Comparative Study between Iran and Hungary. *Journal of Women's Entrepreneurship and Education (JWEE)* 3/4: 61–75.

Carlucci, Daniela, Paolo Renna, and Giovanni Schiuma. 2013. Evaluating service quality dimensions as antecedents to outpatient satisfaction using back propagation neural network. *Health Care Management Science* 16: 37–44. [CrossRef]

Chahal, Hardeep, and Shivani Mehta. 2013. Modeling patient satisfaction construct in the Indian health care context. *International Journal of Pharmaceutical and Healthcare Marketing* 7: 75–92. [CrossRef]

Chen, Ming-Kuen, and Shih-Ching Wang. 2010. The critical factors of success for information service industry in developing international market: Using analytic hierarchy process (AHP) approach. *Expert Systems with Applications* 37: 694–704. [CrossRef]

Cheng, Shou-Hsia, Ming-Chin Yang, and Tung-Liang Chiang. 2003. Patient satisfaction with and recommendation of a hospital: Effects of interpersonal and technical aspects of hospital care. *International Journal for Quality in Health Care* 15: 345–55. [CrossRef]

Cui, Z., L. Hao, and J. Xu. 2018. Lighting of a cardiac intensive care unit: Emotional and visual effects on patients and nurses. *Lighting Research & Technology* 50: 701–15.

Danielsen, Kirsten, Oyvind A. Bjertnaes, Andrew Garratt, Oddvar Forland, Hilde Hestad Iversen, and Steinar Hunskaar. 2010. The association between demographic factors, user reported experiences and user satisfaction: Results from three casualty clinics in Norway. *BMC Family Practice* 11: 73. [CrossRef]

Darko, Amos, Albert Ping Chuen Chan, Ernest Effah Ameyaw, Emmanuel Kingsford Owusu, Erika Pärn, and David John Edwards. 2019. Review of application of analytic hierarchy process (AHP) in construction. *International Journal of Construction Management* 19: 436–52. [CrossRef]

de la Fuente-Mella, Hanns, Rolando Rubilar, Karime Chahuán-Jiménez, and Victor Leiva. 2021. Modeling COVID-19 cases statistically and evaluating their effect on the economy of countries. *Mathematics* 9: 1558. [CrossRef]

Ebrahimi, Pejman, Aidin Salamzadeh, Maryam Soleimani, Seyed Mohammad Khansari, Hadi Zarea, and Maria Fekete-Farkas. 2022a. Startups and Consumer Purchase Behavior: Application of Support Vector Machine Algorithm. *Big Data and Cognitive Computing* 6: 34. [CrossRef]

Ebrahimi, Pejman, Marjan Basirat, Ali Yousefi, Md Nekmahmud, Abbas Gholampour, and Maria Fekete-Farkas. 2022b. Social Networks Marketing and Consumer Purchase Behavior: The Combination of SEM and Unsupervised Machine Learning Approaches. *Big Data and Cognitive Computing* 6: 35. [CrossRef]

Ebrahimi, Pejman, Sebastian Kot, and Maria Fekete-Farkas. 2020. Platform entrepreneurship: An interpretative structural modeling. *Nordic Journal of Media Management* 1: 385–400.

Faramarzi, Ahmad, Javad Javan-Noughabi, Seyed Saeed Tabatabaee, Ali Asghar Najafpoor, and Aziz Rezapour. 2021. The lost productivity cost of absenteeism due to COVID-19 in health care workers in Iran: A case study in the hospitals of Mashhad University of Medical Sciences. *BMC Health Services Research* 21: 1169. [CrossRef]

Fekete-Farkas, Maria, Abbas Gholampour, Parisa Bouzari, Hadi Jarghooiyan, and Pejman Ebrahimi. 2021. How gender and age can affect consumer purchase behavior? Evidence from A microeconomic perspective from Hungary. *AD-Minister* 39: 25–46. [CrossRef]

Footman, Katharine, Bayard Roberts, Anne Mills, Erica Richardson, and Martin McKee. 2013. Public satisfaction as a measure of health system performance: A study of nine countries in the former Soviet Union. *Health Policy* 112: 62–69. [CrossRef]

Gholampour, Abbas, Mir Hadi Moazen Jamshidi, Alireza Habibi, Narges Motamedi Dehkordi, and Pejman Ebrahimi. 2020. The Impact of Hospital Information System on Nurses' Satisfaction in Iranian Public Hospitals: The Moderating Role of Computer Literacy. *Journal of Information Technology Management* 12: 141–59.

Ghosh, Manimay. 2014. Measuring patient satisfaction: An empirical study in India. *Leadership in Health Services* 27: 240–54. [CrossRef]

Gopalan, Hema S., and Anoop Misra. 2020. COVID-19 pandemic and challenges for socio-economic issues, healthcare and National Health Programs in India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* 14: 757–59.

Graves, Claire E., Neha Goyal, Anna Levin, Miriam A. Nuño, Jina Kim, Michael J. Campbell, Wen T. Sen, Jessica E. Gosnell, Sanziana A. Roman, Julie A. Sosa, and et al. 2022. Anxiety During the COVID-19 Pandemic: A Web-Based Survey of Thyroid Cancer Survivors. *Endocrine Practice* 28: 405–13. [CrossRef] [PubMed]

Hall, Judith A., and Michael C. Dornan. 1988. What patients like about their medical care and how often they are asked: A meta-analysis of the satisfaction literature. *Social Science & Medicine* 27: 935–39.

Hall, Judith A., Julie T. Irish, Debra L. Roter, Carol M. Ehrlich, and Lucy H. Miller. 1994. Satisfaction, gender, and communication in medical visits. *Medical Care* 32: 1216–31. [CrossRef]

Hemadeh, Randa, Rawan Hammoud, Ola Kdouh, Tarek Jaber, and Lea Ammar. 2019. Patient satisfaction with primary healthcare services in Lebanon. *The International Journal of Health Planning and Management* 34: e423–e435. [CrossRef]

Imanaka, Y., S. Araki, K. Murata, and K. Nobutomo. 1993. Determinants of patient satisfaction and intention to continue service utilization: Analysis of a survey of outpatients at general hospital. *[Nihon Koshu Eisei Zasshi] Japanese Journal of Public Health* 40: 624–35.

Improta, Giovanni, Antonietta Perrone, Mario Alessandro Russo, and Maria Triassi. 2019. Health technology assessment (HTA) of optoelectronic biosensors for oncology by analytic hierarchy process (AHP) and Likert scale. *BMC Medical Research Methodology* 19: 140. [CrossRef]

Jenkinson, Crispin, Angela Coulter, S. Bruster, N. Richards, and T. Chandola. 2002. Patients' experiences and satisfaction with health care: Results of a questionnaire study of specific aspects of care. *Qual Saf Health Care* 11: 335–39. [CrossRef]

Lin, Chin-Tsai, and Cheng-Shiung Wu. 2008. Selecting a marketing strategy for private hotels in Taiwan using the analytic hierarchy process. *The Service Industries Journal* 28: 1077–91. [CrossRef]

Manenti, Ambrogio. 2011. Health situation in Iran. *Medical Journal of Islamic Republic of Iran* 25: 1–7.

Mazurenko, Olena, Jason Richter, Abby Swanson-Kazley, and Eric Ford. 2016. Examination of the relationship between management and clinician agreement on communication openness, teamwork, and patient satisfaction in the US hospitals. *Journal of Hospital Administration* 5: 20–27. [CrossRef]

Mazurenko, Olena, Jason Richter, Abby Swanson Kazley, and Eric Ford. 2019. Examination of the relationship between management and clinician perception of patient safety climate and patient satisfaction. *Health Care Management Review* 44: 79–89. [CrossRef]

Miziara, Roberta Amparado, Jonathan Yugo Maesaka, Danielle Ramos Martin Matsumoto, Laura Penteado, Ariane Andrade dos Santos Anacleto, Tarso Augusto Duenhas Accorsi, Karine De Amicis Lima, and Eduardo Cordioli. 2022. Teleoncology Orientation of Low-Income Breast Cancer Patients during the COVID-19 Pandemic: Feasibility and Patient Satisfaction. *Revista Brasileira de Ginecologia e Obstetrícia* 43: 840–46. [CrossRef]

Montoya, Madeline I., Cary S. Kogan, Tahilia J. Rebello, Karolina Sadowska, José A. Garcia-Pacheco, Brigitte Khoury, Maya Kulygina, Chihiro Matsumoto, Rebeca Robles, and Jingjing Huang. 2022. An international survey examining the impact of the COVID-19 pandemic on telehealth use among mental health professionals. *Journal of Psychiatric Research* 148: 188–96. [CrossRef]

Naidu, Aditi. 2009. Factors affecting patient satisfaction and healthcare quality. *International Journal of health Care Quality Assurance* 22: 366–81. [CrossRef]

Nasiri, Taha, Mohammadkarim Bahadori, Ramin Ravangard, and Mohammad Meskarpour_Amiri. 2020. Factors Affecting the Failure to Report Medical Errors by Nurses Using the Analytical Hierarchy Process (AHP). *Hospital Topics* 98: 135–44. [CrossRef]

Oppel, Eva-Maria, Vera Winter, and Jonas Schreyögg. 2017. Evaluating the link between human resource management decisions and patient satisfaction with quality of care. *Health Care Management Review* 42: 53–64. [CrossRef]
Otani, Koichiro, Patrick A. Herrmann, and Richard S. Kurz. 2010. Patient satisfaction integration process: Are there any racial differences? *Health Care Management Review* 35: 116–23. [CrossRef]
Otani, Koichiro, Patrick A. Herrmann, and Richard S. Kurz. 2011. Improving patient satisfaction in hospital care settings. *Health Services Management Research* 24: 163–69. [CrossRef]
Otani, Koichiro, Richard S. Kurz, Thomas E. Burroughs, and Brian Waterman. 2003. Reconsidering models of patient satisfaction and behavioral intentions. *Health Care Management Review* 28: 7–20. [CrossRef] [PubMed]
Ozkoc, H. Hatice, and M. Vedat Pazarlioglu. 2011. Patient satisfaction of in-patients treated in a university hospital in Turkey. *Scientific Research and Essays* 6: 5555–62.
Petruni, Alberto, Evanthia Giagloglou, Ewan Douglas, Jie Geng, Maria Chiara Leva, and Micaela Demichela. 2019. Applying Analytic Hierarchy Process (AHP) to choose a human factors technique: Choosing the suitable Human Reliability Analysis technique for the automotive industry. *Safety Science* 119: 229–39. [CrossRef]
Rehman, Salma Abdul, and Parveen Azam Ali. 2016. A review of factors affecting patient satisfaction with nurse led triage in emergency departments. *International Emergency Nursing* 29: 38–44. [CrossRef]
Roshandel-Arbatani, Taher, Hiroko Kawamorita, Saeid Ghanbary, and Pejman Ebrahimi. 2019. Modelling media entrepreneurship in social media: SEM and MLP-ANN Approach. *AD-Minister* 34: 35–57.
Russell, Roberta S., Dana M. Johnson, and Sheneeta W. White. 2015. Patient perceptions of quality: Analyzing patient satisfaction surveys. *International Journal of Operations & Production Management* 35: 1158–81.
Saad Andaleeb, Syed. 1998. Determinants of customer satisfaction with hospitals: A managerial model. *International Journal of Health Care Quality Assurance* 11: 181–87. [CrossRef]
Saaty, Tomas. 1980. *The Analysis Hierarchy Process*. New York: McGraw-Hill.
Sadeh, Ehsan. 2017. Interrelationships among quality enablers, service quality, patients' satisfaction and loyalty in hospitals. *The TQM Journal* 29: 101–17. [CrossRef]
Salamzadeh, Aidin, and Leo Paul Dana. 2021. The coronavirus (COVID-19) pandemic: Challenges among Iranian startups. *Journal of Small Business & Entrepreneurship* 33: 489–512.
Schoenfelder, Tonio, Joerg Klewer, and Joachim Kugler. 2011. Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany. *International Journal for Quality in Health Care* 23: 503–9. [CrossRef]
Scotti, Dennis J. 2005. Satisfaction with medical care among elderly patients: A review of research findings with implications for management practice and future inquiry. *Journal of Hospital Marketing & Public Relations* 15: 3–32.
Shahriarirad, Reza, Zohre Khodamoradi, Amirhossein Erfani, Hamidreza Hosseinpour, Keivan Ranjbar, Yasaman Emami, Alireza Mirahmadizadeh, Mehrzad Lotfi, Babak Shirazi Yeganeh, and Abolfazl Dorrani Nejad. 2020. Epidemiological and clinical features of 2019 novel coronavirus diseases (COVID-19) in the South of Iran. *BMC Infectious Diseases* 20: 427. [CrossRef] [PubMed]
Skime, Michelle K., Ajeng J. Puspitasari, Melanie T. Gentry, Dagoberto Heredia Jr., Craig N. Sawchuk, Wendy R. Moore, Monica J. Taylor-Desir, and Kathryn M. Schak. 2022. Patient Satisfaction and Recommendations for Delivering a Group-Based Intensive Outpatient Program via Telemental Health During the COVID-19 Pandemic: Cross-sectional Cohort Study. *JMIR Mental Health* 9: e30204. [CrossRef] [PubMed]
Solatianaghizi, Ramezan, Pejman Ebrahimi, T. Bazghaleh, and Zahra Norouzi. 2017. The effect of job attitude and affective commitment on OCB of nurses. *Pharmacophore* 8: 1–11.
Sorra, Joann, Kabir Khanna, Naomi Dyer, Russ Mardon, and Theresa Famolaro. 2012. Exploring relationships between patient safety culture and patients' assessments of hospital care. *Journal of Patient Safety* 8: 131–39. [CrossRef]
Stanhope, Kaitlyn K., Kendra Piper, Peggy Goedken, Tatyana Johnson, Naima T. Joseph, Angeline Ti, Franklyn Geary, and Sheree L. Boulet. 2022. Quality and satisfaction with care following changes to the structure of obstetric care during the COVID-19 pandemic in a safety-net hospital in Georgia: Results from a mixed-methods study. *Journal of the National Medical Association* 114: 94–103. [CrossRef]
Tokunaga, Junya, and Yuichi Imanaka. 2002. Influence of length of stay on patient satisfaction with hospital care in Japan. *International Journal for Quality in Health Care* 14: 493–502. [CrossRef]
Tokunaga, Junya, Yuichi Imanaka, and Koichi Nobutomo. 2000. Effects of patient demands on satisfaction with Japanese hospital care. *International Journal for Quality in Health Care* 12: 395–401. [CrossRef]
Tu, Chuc Anh, Ehsan Rasoulinezhad, and Tapan Sarker. 2020. Investigating solutions for the development of a green bond market: Evidence from analytic hierarchy process. *Finance Research Letters* 34: 101457. [CrossRef]
Varasteh, Saeideh, Maryam Esmaeili, and Monir Mazaheri. 2021. Factors affecting Iranian nurses' intention to leave or stay in the profession during the COVID-19 pandemic. *International Nursing Review* 69: 139–49. [CrossRef]
Verma, Surabhi, and Anders Gustafsson. 2020. Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. *Journal of Business Research* 118: 253–61. [CrossRef] [PubMed]
Wong, Johnny K. W., and Heng Li. 2008. Application of the analytic hierarchy process (AHP) in multi-criteria analysis of the selection of intelligent building systems. *Building and Environment* 43: 108–25. [CrossRef]
Xiao, Hong, and Janet P. Barber. 2008. The effect of perceived health status on patient satisfaction. *Value in Health* 11: 719–25. [CrossRef] [PubMed]

Yoosefi Lebni, Javad, Jaffar Abbas, Farideh Moradi, Mohammad Reza Salahshoor, Fakhreddin Chaboksavar, Seyed Fahim Irandoost, Nazila Nezhaddadgar, and Arash Ziapour. 2021. How the COVID-19 pandemic effected economic, social, political, and cultural factors: A lesson from Iran. *International Journal of Social Psychiatry* 67: 298–300. [CrossRef]

Zekhnini, Kamar, Anass Cherrafi, Imane Bouhaddou, and Youssef Benghabrit. 2020. Analytic Hierarchy Process (AHP) for Supply Chain 4.0 Risks Management. In *Proceedings of International Conference on Artificial Intelligence & Industrial Applications*. Cham: Springer, pp. 89–102.

Zineldin, Mosad. 2006. The quality of health care and patient satisfaction: An exploratory investigation of the 5Qs model at some Egyptian and Jordanian medical clinics. *International Journal of Health Care Quality Assurance* 19: 60–92. [CrossRef]

Zopf, David, Andrew W. Joseph, and Marc C. Thorne. 2012. Patient and family satisfaction in a pediatric otolaryngology clinic. *International Journal of Pediatric Otorhinolaryngology* 76: 1339–42. [CrossRef]