A Classifying and Ranking Selection of Healthcare Tourism Services

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ABSTRACT

The study is conducted in order to classify and ranking selection of healthcare tourism services by using integration of Kano model and Fuzzy Analytic Hierarchy Process (FAHP). The selection of healthcare tourism services is the determinant factors towards patients' satisfaction. FAHP is one of the quality improvement methods to improve the health tourism. However, FAHP cannot identify the patients' satisfaction. The Kano Model provided a way to better understanding of patients' satisfaction through the Kano Quality Attribute categories. Thus, the integration between Kano Model and FAHP is proposed in this study. The study is to identify the determinant factors towards patients' satisfaction requirements in healthcare tourism services. Next, the study measured patients' satisfaction using Kano and classified them into Five Groups: Must-be; Attractive; One-Dimensional; Indifferent; and Reverse. Finally, the study ranked the determinant factors towards patients' satisfaction requirements by using FAHP to prioritize the most important patients' satisfaction requirement. The findings will help the healthcare decision maker to design and improve the health tourism to enhance patients' satisfaction in the healthcare tourism services based on the most important patients' satisfaction requirement.

Keywords: *Fuzzy Analytic Hierarchy Process, Healthcare Tourism Service, Kano Model, Patient's Satisfaction*

1. INTRODUCTION

Many countries have doubled their efforts to enhance the health tourism production in the eyes of the world. Investments are made for technologies and medicines, accreditations are given out to qualified hospitals, health experts and infrastructure is being improvised in order to fit for the health tourism. Based on [1], the countries in Asia such as India, Thailand, Singapore, Malaysia, Philippines and South Korea have several hospitals in the world as well as up to date technologies and medical experts to offer excellence medical services.

Even though today Asians nations are leading the pack, [2] stated that a few Latin countries such as Romania, Costa Rica, Peru, Venezuela, Chile, Guatemala, Ecuador, Cuba, Bolivia, Haiti, Dominican Republic, Honduras, Paraguay, El Salvador, Nicaragua, Panama, Puerto Rico, Uruguay, Guadeloupe, Martinique, French Guiana, Saint Martin and Saint Barthelemy have also taken a toll to be on top of the leading board in the industry. This industry has both supply and demands factor that stimulate its growth.

1.1 Health Tourism in Malaysia

For over a decade, Malaysia is a leading nation in the world for health tourism and has been making a huge stride in the industry [3]. However, Malaysia besides Singapore and Thailand has the best records in Asia from the 60 years of efforts in health tourism [4]. Then, [5] have shown that after the debt crisis that hit South East Asia countries in 1997 and caused the performance of health tourism to plummet, Malaysia started to promote health tourism heavily.

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Since then, the Malaysia government started to introduce health tourism in 1998 as to branch out both of its healthcare and tourism sectors. From the promotion of health tourism, one of the mechanisms that both the Malaysia government and the private sector took was to attract the neighbouring countries such as Indonesia and Brunei and also as well as countries from other parts of the world, for an instance, the Middle-Eastern countries such as Iran, Saudi Arabia, Turkey, Egypt, and United Arab Emirates [6].

Health tourism in Malaysia has been promoting heavily through the campaigns up to 80% compared to the developed nations such as Singapore and Thailand [7]. Thus, it is possible that the initiative above has become the goal for Malaysia as the number one choice in health tourism destination [8]. According to [9], Malaysia becomes the number one choice in health tourism destination because most studies stated that Malaysia has low medical cost and modern infrastructure facilities compare to other countries. Besides that, health tourism in Malaysia is facilitated and monitored by Ministry of Health and that why Malaysia standout as a health tourist destination compared to other countries [10].

1.2 The determinants factors in healthcare tourism services

The research is to determine the impact of the determinants factor towards patients' satisfaction in healthcare tourism services and classifying and ranking selection of healthcare tourism services by integrating with Kano Model and Fuzzy Analytic Hierarchy Process (FAHP). The factors that apply in this research are cost, perceived value and service quality that impacts with patients' satisfaction in healthcare tourism services. A range of research methodology was applying to attain the research objective of the study. The concept of Kano Model is integrating with Fuzzy Analytic Hierarchy Process (FAHP) to provide a systematic approach to classify and rank patients' satisfaction for better improvement strategies selection to enhance healthcare tourism services.

There are several factors that impacts patients' satisfaction and they stated that satisfaction with healthcare tourism services can result from different aspects. Three factors of patients' satisfaction were selected in this study in order to classifying and ranking the relationship between three factors of patients' satisfaction with healthcare tourism services. The three factors of patients' satisfaction in the healthcare tourism services are cost, perceived value and service quality. Cost is considered to be one of the most essential aspects of health tourism [11]. It has been further suggested by [12] and [13] when planning for health-related tourism, the cost is an important consideration. In an agreement with this notion, [14] insisted that cost is one of the primary factors that drive satisfaction toward healthcare tourism services.

On the other hand, it becomes difficult for healthcare organizations to satisfy tourists without providing high quality service [15] [16] and value [17] [18]. Thus, service quality offered to patients and their perception regarding perceived value is also very important concerns for patients' satisfaction. When it comes to healthcare tourism service, cost, perceived value and service quality are of utmost importance. In order to gain a comprehensive understanding about patients' satisfaction with healthcare tourism services, it is important to consider these respective aspects.

1.3 Integration of Kano Model and Fuzzy Analytic Hierarchy Process (FAHP)

Professor Noriaki Kano is the person who developed a Kano model. It is based on Herzberg's Two Factor Theory which is well known for categorize and prioritize patient requirements for a product and how they affect patient's satisfaction [19]. The Kano model categorizes the quality attributes into five categories which including attractive (A), one-dimensional (O), must-be (M), indifferent (I), and reverse (R).

Otherwise, FAHP uses the concepts of fuzzy set theory and hierarchical structure analysis for the selection of the most appropriate alternative among a set of useful alternatives. The earliest FAHP method was proposed by [20] in which the fuzzy numbers with triangular membership functions express the fuzzy comparing judgment. Besides that, [21] new method was proposed with the use of triangular fuzzy numbers and extent analysis method for the pairwise comparison scale of FAHP. This method also applies the triangular fuzzy numbers and extent analysis method for the synthetic extent values of the pairwise comparisons.

Healthcare services are needed to systematically analyze elements of service for effective strategy formulation as they become increasingly critical. In the healthcare sector, [22] suggested the integrated model with Kano and fuzzy AHP to obtain strategies for the healthcare industry. From the previous studies, no research has been found that integrates Kano model and FAHP to classify and ranking quality attributes in the healthcare industry such that patients' voice is represented. Thus, this study is a combination of two methods which are Kano Model and FAHP in order to improve the study of determinants factors of patients' satisfaction in healthcare tourism services.

2. METHODS

2.1 Kano Model

Kano model guides healthcare providers of service to focus on two dimensions to gain the best satisfaction and predict future trends of patient needs regarding the assumption of inequality of attributes effects on patient satisfaction [23]. There are two dimensions which are needs fulfillment, which evaluates the degree of patient requirement fulfillment and also patient satisfaction, which subjective response to fulfillment of the quality attributes.

These dimensions can be drawn on a graph with two axes, as x-axis and y-axis. The x-axis represents fulfillment, while the y-axis represents patient satisfaction. It can describe requirement fulfillment and patient satisfaction relationship based on the attributes category. That is, attractive attributes make patients more satisfied and never make them unsatisfied. One-dimensional attributes make patients satisfied or unsatisfied depending on how they are fulfilled. Must-be attributes fulfillment prevent patients from being unsatisfied. Indifferent attributes where the patients are not interest whether the presence or absence of the features has no effect on patient satisfaction. Reverse attributes are where the patient does not want in but may prefer the same. These dimensions can be shown in Figure 1 below.
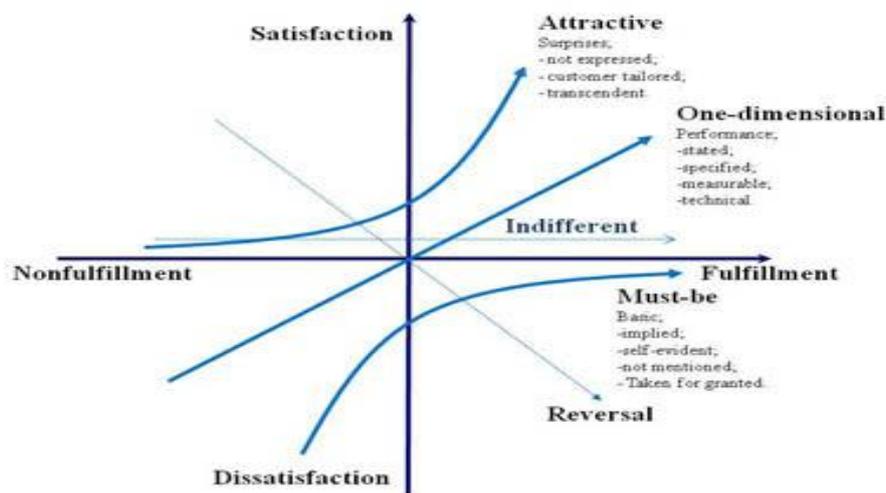
Figure 1. Kano model of patient satisfaction.

2.1.1 Kano Model Category

Kano model was used to assess the impact of quality attribute and its degree of sufficiency towards the consumer expectation [24]. There are five qualities in Kano model which represent the relationship between the patient satisfaction and value of the attribute. The five qualities are including attractive attributes, one-dimensional attributes, must-be attributes, indifferent attributes and reverse attributes, as shown in Table 1 below.

Table 1 Dimensions of Kano model

Must-be Attributes (M)	The absent or unmet of the product or service features would result in high patient dissatisfaction and a patient would lack of interest in obtaining the product. However, there is no improvement in patient satisfaction if in the futures are presences or fulfilled since they are taken for granted.
One-Dimensional Attributes (O)	The present of the attributes would lead to an improvement in patient satisfaction while result in dissatisfaction if the feature is absent. There is direct relationship between level of fulfillment and patient satisfaction. This kind of requirement would contribute to patient loyalty improvement.
Attractive Attributes (A)	Attributes that would result in high impact towards the patient satisfaction and the fulfillment of the feature would result in high patient satisfaction. The attributes are unexpected by the patients, the not fulfillment of the attributes would not result in dissatisfaction.
Indifferent Attributes (I)	Attributes where the patients are not interest. The presence or absence of the features has no effect on patient satisfaction.
Reserve Attributes (R)	Attributes where the patient does not want in but may prefer the same.

2.1.2 Satisfaction and Dissatisfaction Coefficients Formula

After identifying the patient value through the Kano evaluation table, the quantitative value of the patient satisfaction and dissatisfaction is further study by the patient satisfaction coefficient which proposed by [25].

The Satisfaction Index (SS) stated the degree of satisfaction of patient towards a product or service if the product or service meet the requirement while the Dissatisfaction Index (SD) stated that the degree of dissatisfaction of the patient towards the product and services if the product or services does not meet the requirement [26].

The patient satisfactions coefficients are determined by Satisfaction Index (SS) as the positive CS-coefficient (CS+) while Dissatisfaction Index (SD) as the negative CS-coefficient (CS-). The equation for positive CS-coefficient (CS+) and negative CS-coefficient (CS-) are as shown as below:

$$CS_{(+)} = \frac{A+O}{A+O+M+I} \qquad (1)$$

$$CS_{(-)} = \frac{M+O}{A+M+O+I} \qquad (2)$$

Where, M, O, A and I are the number of times an attribute is considered in a must-be, one-dimensional, attractive and indifferent attributes, respectively.

2.1.3 The Absolute Largest Weights Formula

The absolute largest the positive CS-coefficient (CS+) and negative CS-coefficient (CS-) weights to rank Kano attributes assuming that achieving patient's satisfaction and preventing patient's dissatisfaction are equally important [27]. That is the largest importance weights of CS+ and CS- are considered as the attribute's weights according to the following equation below. This method considers only one side of satisfaction or dissatisfaction which the one with the largest weights.

$$w_i = \max (S_i, D_i) \qquad (3)$$

Where, w_i is attribute's weight, and

$$S_i = \frac{CS_{(+)_i}}{\sum_{i=1}^{m} CS_{(+)_i}} \qquad (4)$$

$$D_i = \frac{CS_{(-)_i}}{\sum_{i=1}^{m} CS_{(-)_i}} \qquad (5)$$

S_i is satisfaction attributes' weights while D_i is dissatisfaction attributes' weights.

2.2 Fuzzy Analytic Hierarchy Process (FAHP)

Fuzzy Analytic Hierarchy Process (FAHP) is come up with linguistic variable values to allow healthcare decision makers express their uncertain judgments and preferences rather than crisp values that are used in conventional Analytic Hierarchy Process (AHP). These linguistic variable values are converted into fuzzy membership functions which appear for fuzziness and uncertainty. The steps of formulating FAHP models are the same as in conventional AHP with the only difference being in using fuzzy membership values rather than crisp values for comparative purposes. Table 2 represents the linguistic values and their triangular fuzzy numbers (TFNs) [28] and it used in FAHP these numbers can be changed and evaluated to fit with the healthcare decision maker's fuzziness. Triangular fuzzy numbers corresponding to linguistic variables are represented in Figure 2.

Table 2 Triangular fuzzy number of linguistic variable

Linguistic values	TFNs	Reciprocal TFNs

Equally important	(1,1,2)	(0.5,1,1)
Moderately important	(2,3,4)	(0.250,0.333,0.500)
Important	(4,5,6)	(0.167,0.200,0.250)
Very important	(6,7,8)	(0.125,0.143,0.167)
Absolutely important	(8,9,9)	(0.111,0.111,0.125)
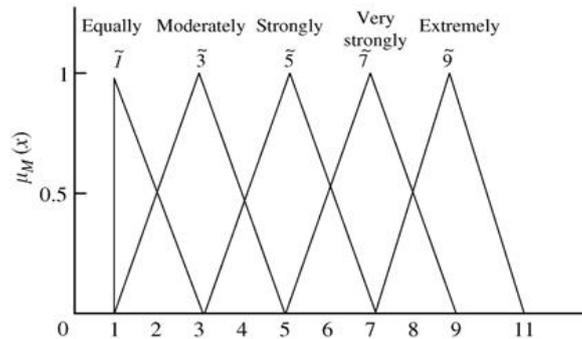
Figure 2. Triangular fuzzy numbers corresponding to linguistic variables.

2.2.1 Fuzzy Set Theory

According to [29], triangular fuzzy membership functions are usually used to represent fuzzy numbers and are very famous in fuzzy application. They are also easy to use and calculate to show that can be an effective way for constructing decision problems where the information available is subjective and uncertain. Triangular fuzzy numbers (TFNs) normally run over the range of real values in scale between [0,1]. However, any scale also can be used depend on the researchers' fuzziness and vagueness, and usually range between [1,9] in FAHP applications [30] [31].

To convert a fuzzy triangle number which in the lower, middle and upper (l,m,u) to a crisp value, many methods can be used such as fuzzy extend analysis, center-of-area defuzzification and α-cut methods. Fuzzy extend analysis is the easy way to compute and correctly determines priorities. The α-cut method is less controversial and takes into account decision makers' attitudes to risk [32]. In this study, α-cut method is used for converting healthcare tourism services of patients' satisfaction attributes TFN weights gained by FAHP to crisp values based on the following equation:

$$C_\lambda = \lambda \times aRight + (1-\lambda) \times aLeft \tag{6}$$

Where C_λ represents the average crisp value and λ represents the degree of optimism, which ranges between [0, 1], and α represents as α-cut method.

$$aLeft = a \times (m-l) + l \tag{7}$$
$$aRight = u - a \times (u-m) \tag{8}$$

3. RESULTS AND DISCUSSION

3.1 Methodology

A simple random sampling was conducted to discover what kind of selection of healthcare tourism services that is normally preferred by those patients who have experience in healthcare tourism services. Due to this, simple random sampling is a method of selecting the units from the population where all possible samples are equally likely to get selected [33]. This indicates that everyone in the target population has an equal chance of being selected. Target population is the total group of individuals from which the sample size might be drawn. The simple random sampling was used to collect the respondents for the medical tourism services from Pulau Pinang, Kuala Lumpur and Selangor state. All the population in Pulau Pinang, Kuala Lumpur and Selangor state has equal chance to be selected in the study for data collection. As an overall, 103 respondents were being used for descriptive analysis by using Statistical Package for the Social Sciences (SPSS). This study uses the questionnaire which was distributed though the printed paper to the respondent in order to collect the respondents' response towards the study.

3.2 Attributes Ranking Using Absolute Largest Weights by Kano Model

In order to rank attributes classified by Kano model using absolute largest weights, patients' satisfaction and dissatisfaction coefficients weight are calculated using equations (1,2,3,4 & 5). Table 3 shows extent of Satisfaction Index (SS) and Dissatisfaction Index (SD), satisfaction coefficients weight (S_i) and dissatisfaction coefficients weight (D_i), absolute largest weight and attributes rank.

Table 3 Healthcare tourism services attributes patients' satisfaction and dissatisfaction coefficients' weights and ranks

	Attributes	Satisfaction Index (SS)	Dissatisfaction Index (SD)	S_i	D_i	Absolute largest weight	Rank
Attributes related to cost							
Must be							
A2	Healthcare facility cost	0.500	0.850	0.0259	0.0361	0.0361	15
A3	Healthcare medical operations cost	0.450	0.900	0.0233	0.0382	0.0382	7
One dimensional							
A1	Healthcare service cost	0.600	0.900	0.0311	0.0382	0.0382	8
A4	Cost of hired physician	0.650	0.951	0.0337	0.0403	0.0404	2
A5	Cost of efficient state of the art medical equipment	0.650	0.900	0.0337	0.0382	0.0382	9
Attributes related to perceived value							
Must be							
A6	Perceived medical quality	0.450	0.900	0.0233	0.0382	0.0382	10
A10	Perceived sacrifice of risk	0.200	0.600	0.0104	0.0255	0.0255	20
One dimensional							
A7	Perceived service quality	0.600	0.900	0.0311	0.0382	0.0382	11
A8	Perceived enjoyment	0.750	0.850	0.0389	0.0361	0.0389	6

A9	Perceived sacrifice of fee	0.650	0.650	0.0337	0.0276	0.0337	19
Attributes related to service quality							
One dimensional							
A12	High communication skills of staff	0.752	0.900	0.0390	0.0382	0.0390	5
A14	Effective medication	0.950	0.650	0.0492	0.0276	0.0492	1
Attractive							
A11	The variety of medical services	0.700	0.400	0.0363	0.0170	0.0363	14
A13	Fast service delivery	0.702	0.500	0.0364	0.0212	0.0364	13
A15	Transparency of cost	0.754	0.600	0.0391	0.0255	0.0391	4
Attributes related to patient satisfaction							
Must be							
A16	Hospital stay	0.350	0.950	0.0181	0.0403	0.0403	3
A20	Scheduled of test and procedure	0.450	0.800	0.0233	0.0340	0.0340	18
One dimensional							
A17	Waiting time	0.650	0.850	0.0337	0.0361	0.0361	16
A18	Scheduled of medical check-up appointment	0.650	0.900	0.0337	0.0382	0.0382	12
A19	Responses of medical treatment	0.650	0.850	0.0337	0.0361	0.0361	17

The table shows the results of the absolute largest weight ranking method for each of the attributes, including the Satisfaction Index (SS) and Dissatisfaction Index (SD) based on the Kano model analysis. The highest absolute largest weight was A14 (0.0492) which contribute by effective medication, followed by A4 (0.0404) which contribute by cost of hired physician and A16 (0.0535) which contribute by hospital stay. This method considers only one side of satisfaction or dissatisfaction is the one with the largest weights, which assuming that achieving customer satisfaction and preventing customer dissatisfaction are equally important. In order to improve the customer expectation, the medical tourism service able to focus on the elements with high absolute largest weight in order to bring high impact towards customer expectation which will contribute to the patients' satisfaction in the medical tourism services.

3.3 Healthcare Quality Attributes' Weights and Rank Using Fuzzy Analytic Hierarchy Process (FAHP)

Based on the FAHP weights of attributes in table 4 below, it is concluded that one-dimensional attributes have the largest weights and have the first priority in ranking, which indicates that healthcare providers should give more attention to these attributes to eliminate patients' dissatisfaction, and maintain their competitiveness in the healthcare tourism industry. The second rank is for attractive healthcare tourism services attributes and third rank is for must-be attributes with the least weights.

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According to Table 4 below, one-dimensional healthcare tourism services attributes have the highest weights where "A1: Healthcare service cost" was the first attribute with 0.159. Attractive healthcare tourism services attributes have intermediate weights where "A25: Transparency of cost" and "A23: Fast service quality" were second and third attribute, with 0.134 and 0.124, respectively. Must-be healthcare tourism services attributes have the least weights where "A30: Scheduled of test and procedure" was forth attributes, with 0.068.

As a consequence, healthcare providers should fulfill the one-dimensional attributes first with conservative improvement strategy to be fulfilled for better patients' satisfaction. After that attractive attributes should to delight and surprise the patients. The third priority should go to must-be attributes to achieve the minimum requirements, and to prevent patients move to another competitor.

Table 4 Healthcare tourism services attributes' weights and rank using FAHP

Healthcare Dimension	Kano classes	Quality attributes	Total Weights (TFNs)	Crisp value	Normalized crisp value	Rank
Cost	Must-be	A2	(0.004,0.009,0.019)	0.011	0.007	16
		A3	(0.022,0.044,0.092)	0.053	0.036	9
	One-dimensional	A1	(0.091,0.195,0.418)	0.235	0.159	1
		A4	(0.011,0.024,0.058)	0.031	0.020	12
		A5	(0.020,0.045,0.100)	0.055	0.037	8
Perceived Value	Must-be	A16	(0.006,0.011,0.0217)	0.039	0.026	11
		A20	(0.001,0.002,0.003)	0.002	0.001	20
	One-dimensional	A17	(0.032,0.065,0.138)	0.078	0.053	6
		A18	(0.008,0.017,0.038)	0.021	0.014	14
		A19	(0.003,0.007,0.017)	0.027	0.016	13
Service Quality	One-dimensional	A22	(0.003,0.006,0.012)	0.007	0.005	17
		A24	(0.020,0.041,0.082)	0.048	0.032	10
	Attractive	A21	(0.007,0.016,0.034)	0.019	0.013	15
		A23	(0.021,0.051,0.112)	0.184	0.124	3
		A25	(0.070,0.167,0.356)	0.198	0.134	2
Patient Satisfaction	Must-be	A26	(0.001,0.003,0.007)	0.004	0.003	19
		A30	(0.003,0.008,0.019)	0.010	0.068	4
	One-dimensional	A27	(0.023,0.049,0.105)	0.059	0.040	7

| | | A28 | (0.003,0.005,0.001) | 0.003 | 0.004 | 18 |
| | | A29 | (0.010,0.019,0.040) | 0.080 | 0.054 | 5 |

3.4 Comparing Integrated Kano-FAHP with Absolute Largest Weights

The ranking of healthcare tourism services attributes calculated by integrated Kano-FAHP method is compared with the absolute largest weights method suggested by [34]. Then, this comparison is to investigate the difference between them and the effect of uncertainty in the preference of patients in decision problems.

The ranking of healthcare tourism services attributes by using integrated Kano-FAHP, is more accurate than the absolute largest weights method because the overall satisfaction level, which includes both satisfaction and dissatisfaction of patients, is considered to rank attributes rather than ranking them based on satisfaction or dissatisfaction alone, as shown in Table 5 below.

Table 5 Rank of healthcare attributes using absolute largest weights and FAHP

Healthcare tourism services attributes		Rank		Remark
		Absolute largest weight	Integrated Kano-FAHP	
Attributes related to cost				
Must be				
A2	Healthcare facility cost	15	16	↓
A3	Healthcare medical operations cost	7	9	↓
One dimensional				
A1	Healthcare service cost	8	1	↑
A4	Cost of hired physician	2	12	↓
A5	Cost of efficient state of the art medical equipment	9	8	↑
Attributes related to perceived value				
Must be				
A16	Perceived medical quality	10	11	↓
A20	Perceived sacrifice of risk	20	20	□
One dimensional				
A17	Perceived service quality	11	6	↑
A18	Perceived enjoyment	6	14	↓
A19	Perceived sacrifice of fee	19	13	↑
Attributes related to service quality				
One dimensional				
A22	High communication skills of staff	5	17	↓
A24	Effective medication	1	10	↓

			Attractive	
A21	The variety of medical services	14	15	↓
A23	Fast service delivery	13	3	↑
A25	Transparency of cost	4	2	↑
		Attributes related to patient satisfaction		
		Must be		
A26	Hospital stay	3	19	↓
A30	Scheduled of test and procedure	18	4	↑
		One dimensional		
A27	Waiting time	16	7	↑
A28	Scheduled of medical check-up appointment	12	18	↓
A29	Responses of medical treatment	17	5	↑
		↑ Ascended, ↓ descended, □ unchanged		

4. CONCLUSION

In this research, Kano model is applied to classify healthcare tourism services attributes into five main categories based on their effects on patients' satisfaction. They are then ranked using FAHP. The results show that one-dimensional attributes (A1: healthcare service cost) gain the largest weights followed by attractive attributes which are (A25: transparency cost) and (A23: fast service delivery). The contribution of this research to the literature includes several points. First, the survey results identifies and classifies specific attributes that affect patient's satisfaction in dimensions that are not thoroughly covered in the literature such as cost, perceived value, service quality and patient satisfaction. Second, the proposed integrated Kano-FAHP model ranked the healthcare tourism services attributes within each Kano class. This investigation gives insights to providers to select the most appropriate improvement strategies. Third, the proposed model enables healthcare providers to capture the uncertainty and ambiguity in representing patients' preferences and importance. Moreover, Kano-FAHP model enables decision makers to classify and rank attributes taking into account the overall patients' satisfaction rather than ranking them based on satisfaction or dissatisfaction alone. For future research, the target sample size was also need to expand more respondents to improve the quality of the data collection. This is because the population of the medical tourism services was huge. Hence, a small sample size might not balance to represent the opinion for the whole population. Thus, a larger number of sample sizes are suggested for the future study in order to improve the data accuracy which benefits for the research findings.

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