EFFICIENCY MEASUREMENT AMONGST MEDICAL TOURISM SERVICE PROVIDERS IN INDIA

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Abstract

The purpose of the present study is to develop an appropriate construct to benchmark Medical tourism service providers in India for formulating strategies through understanding deficiencies for improving their performance. This paper applies a non-parametric technique known as Data Envelopment Analysis (DEA) as a performance assessment tool for benchmarking of Medical tourism in India. A total of thirty nine medical tourism service providers in India are chosen for benchmarking purpose. The average score of efficiency is found 0.95 with a standard deviation of 0.084 when Charnes, Cooper and Rhodes (CCR) model is used. Similarly, when the Banker, Charnes and Cooper (BCC) model is used the average score is found to be 0.975 with a standard deviation of 0.06. In order to check for existence of significant difference between medical tourism performance scores calculated using DEA models (CCR and BCC), a paired sample t-test is carried out. It is found that there is a significant difference between efficiency scores obtained through CCR and BCC models. The study identifies the parameters in which the inefficient DMUs lack for formulating necessary strategies to improve upon them. This method, being a generic one can be adopted by the managers to assess Medical tourism performance in any environment provided the DMUs are homogenous in nature. The study alleviates the inconsistent methods of benchmarking practices using a simple but comprehensive methodology.

Keywords: Medical tourism; Benchmarking; Data envelopment analysis (DEA); Decision making units (DMUs)

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Introduction

India is a preferred medical tourism destination in the world due to availability of best healthcare services at substantially less cost. The growth in foreign patients' arrivals to India has usually been pegged at 25% annually (Debata et al., 2011). The study conducted jointly by McKinsey and Confederation of Indian Industry in 2004 reveals that gross revenue generated from medical tourism was worth USD 40 billion worldwide. The report projects that the medical tourism industry may achieve a mark of USD 100 billion by 2012. However, the Indian medical tourism sector faces various challenges viz. an image of poverty and poor hygiene, inefficient consumer redressal forum, safety of the patients (Kalshetti and Pillai, 2008; Begde, 2008). These challenges threaten the sector's survival and financial viability. The primary focus of medical tourism is to capitalize on returns and identify the best business practices for establishing quality standards. In this context, the decision makers are actively involved in determining the operational effectiveness of medical tourism sector. However, it is difficult to compare the performance of various entities in the sector due to existence of complex multiple input-output relationship. Therefore, the major concern of healthcare managers is to evaluate medical tourism performance and identify weaknesses for deciding upon subsequent improvement measures. The present study proposes Data Envelopment Analysis (DEA) technique, for performance evaluation in Indian Medical tourism sector.

Literature Review

DEA has been extensively used for efficiency analysis of health care organizations due to its ability to handle multiple inputs and outputs (Chang, 1998; Shroff et al., 1998; Linna et al., 2003; Hollingsworth, 2003). DEA has been successfully used to study healthcare issues such as public policy efficiency (Coppola et al., 2003), pharmaceutical industry (Key et al., 2005), Health Maintenance Organizations (HMO) industry (Brockett et. al., 2004), long term care (Bjorkgren et al., 2001). The applications of DEA to measure hospital efficiency have also been reported in literature (Retzlaff-Roberts et al., 2004; Osei et al., 2005). Salehzade and Ketabi (2011) have evaluated the relative efficiency of public and private hospitals in Qatar using CCR and BCC models. In Indian context, application of DEA for measuring the hospital efficiency is limited. Shetty and Pakkala (2010) have analyzed technical efficiency (TE) based on health outcomes such as reduced infant mortality and increased life expectancy at birth to measure the performance of health system.

Methodology

The proposed methodology uses DEA-CCR and DEA- BCC for benchmarking of medical tourism performance in India. In this study, a DMU refers to hospitals providing medical tourism service. The thirty nine DMUs are selected on the basis of stratified random sampling method. The efficiency of each DMU is calculated

in relation to all other DMUs using actual input-output values is called relative efficiency. DEA also determines the level and amount of inefficiency for each of the inputs and outputs. The magnitude of inefficiency of the DMUs is determined by measuring the radial distance from the inefficient unit to the frontier. DEA makes use of linear programming problem (LPP) to measure the relative performance of DMUs.

Selection of Input and Output Parameters

This paper suggests ten inputs (V) and three outputs (U) as shown in Table I. The customer returns is defined as the medical tourists undergone treatment in a specific medical tourism service provider and revisited the same premises for further checkup or follow-up. The output customer returns (U_1) is the ratio of number of medical tourists revisiting to the total number of medical tourist undergone treatment with a specific service provider in a year. Therefore, customer return is quantified by averaging for three years (during 2008-2011). This indicates tourists' behavioral intention and brand loyalty in availing effective medical tourism service quality. Customer satisfaction (U_2) is expressed as medical tourist's satisfaction captured in a scale between 0 to 100. The medical tourists are advised to provide with their level of satisfaction on the scale and the responses are averaged over last three years. Success rate (U_3) is expressed as the percentage of tourists successfully discharged from the medical tourism service provider after availing healthcare services in a year and averaged over last three years. This indicates the accomplishment in appropriate health recovery over the number of medical tourists admitted to a specific medical tourism service provider.

INPUTS (V)	
	Number of Doctors (V_1)
	Number of Nurses (V_2)
	Ratio of Nurse to patient (V_3)
	Average cost of Treatment (V_4)
	Average Waiting time (V_5)
	Average Treatment time (V_6)
	Tie up with Tour Promoter (V_7)
	Floor Space (V_8)
	Distance from Airport/City (V_9)
	Number of Bed (V_{10})
OUTPUTS (U)	
	Customer Returns (U_1)
	Customer Satisfaction (U_2)
	Success Rate (U_3)

Table I: Inputs and Outputs

Result and Discussion

The general input-oriented maximization CCR-DEA model is used to obtain efficiency score. LINDO 6.1 version is used to solve the DEA model. The result shows that in a scale of 0-1 the mean efficiency score for the medical tourism service providers is 0.95 with a standard deviation of 0.084 when CCR model is used. This means that there exists a large scope for improvement of medical tourism performance in India. Ranking based on relative efficiency scores (Table II.), indicate that twenty seven DMUs out of thirty nine DMUs have emerged as benchmarking units for the other twelve DMUs. The efficiency score for efficient DMUs approach unity while that of DEA-inefficient DMUs show relative efficiency less than unity. The inefficient units can refer the DMUs listed in column four with corresponding peer weight given in column five for the improvement in medical tourism performance.

DMU	Efficiency	Ranking by DEA	Benchmarking	Peers Weight	Peers Count
DMU_1	1	1	DMU_1	1	0
DMU_2	1	1	DMU_2	1	1
DMU_3	1	1	DMU_3	1	0
DMU_4	1	1	DMU_4	1	4
DMU_5	0.851209	34	DMU_{23},DMU_{25}, DMU_{37}	0.1125, 0.911, 0.0515	0
DMU_6	0.838934	35	DMU_4, DMU_{15}, DMU_{25}	0.344, 0.4723, 0.1633	0
DMU_7	1	1	DMU_7	1	2
DMU_8	0.890776	31	DMU_4, DMU_{15},DMU_{25}, DMU_{37}	0.3997, 0.4822, 0.1980, 0.1082	0
DMU_9	1	1	DMU_9	1	0
DMU_{10}	1	1	DMU_{10}	1	0
DMU_{11}	1	1	DMU_{11}	1	1
DMU_{12}	1	1	DMU_{12}	1	1
DMU_{13}	0.688619	39	DMU_7, DMU_{15}, DMU_{30}, DMU_{36}	0.1032, 0.4205, 0.2296, 0.3218	0
DMU_{14}	1	1	DMU_{14}	1	0
DMU_{15}	1	1	DMU_{15}	1	8
DMU_{16}	1	1	DMU_{16}	1	0
DMU_{17}	1	1	DMU_{17}	1	1
DMU_{18}	0.766569	37	DMU_{12}, DMU_{15}, DMU_{36}	0.3915, 0.4562, 0.522	0
DMU_{19}	1	1	DMU19	1	2
DMU_{20}	0.739056	38	DMU_7, DMU_{15}, DMU_{17}, DMU_{37}	0.0375, 0.775, 0.145, 0.4	0
DMU_{21}	1	1	DMU_{21}	1	0
DMU_{22}	0.875	33	DMU_{15}	1	0
DMU_{23}	1	1	DMU_{23}	1	1
DMU_{24}	0.96847	29	DMU_{15}, DMU_{19}, DMU_{39}	0.3042, 0.3004, 0.5703	0
DMU_{25}	1	1	DMU_{25}	1	6

DMU	Efficiency	Ranking by DEA	Benchmarking	Peers Weight	Peers Count
DMU_{26}	0.991945	28	DMU_{11}, DMU_{19}, DMU_{25}	0.2422, 0.7227, 0.1460	0
DMU_{27}	1	1	DMU_{27}	1	0
DMU_{28}	1	1	DMU_{28}	1	0
DMU_{29}	1	1	DMU_{29}	1	0
DMU_{30}	1	1	DMU_{30}	1	1
DMU_{31}	1	1	DMU_{31}	1	0
DMU_{32}	1	1	DMU_{32}	1	0
DMU_{33}	1	1	DMU_{15}	1	0
DMU_{34}	0.882665	32	DMU_{2}, DMU_{4}, DMU_{15}, DMU_{25}	0.0228, 0.2647, 0.7395, 0.0596	0
DMU_{35}	0.820351	36	DMU_{4}, DMU_{15}, DMU_{25}	0.0736, 0.838, 0.2224	0
DMU_{36}	1	1	DMU_{36}	1	2
DMU_{37}	1	1	DMU_{37}	1	3
DMU_{38}	0.933333	30	DMU_{23}, DMU_{39}	0.1363, 0.8181	0
DMU_{39}	1	1	DMU_{39}	1	2
Note: Mean Efficiency (CCR) - 0.95, Minimum - 0.689, Standard Deviation - 0.084					

Table II: Results of DEA (CCR model)

It is to be noted that DMU_{13} having efficiency score of 0.688619 is treated as most inefficient unit. The above table also shows the peers and peer weights for the inefficient medical tourism service providers. The inefficient DMUs can identify the parameters in which they lack and take necessary steps for improvement.

The BCC score is based on VRS assumption and measures the pure TE. Ten DMUs are found to be the DEA-inefficient units in BCC model. The average score for the medical tourism service providers is found 0.975 (which happen to be more than that of CCR-model) with a standard deviation of 0.06 when BCC model is used (Table III).

DMU	Score	Rank	Benchmarking	Peer Count
DMU_{1}	1	1	DMU_{1}	0
DMU_{2}	1	1	DMU_{2}	3
DMU_{3}	1	1	DMU_{3}	0
DMU_{4}	1	1	DMU_{4}	4
DMU_{5}	0.9	34	DMU_{25}, DMU_{37}	0
DMU_{6}	0.87211	38	DMU_{4}, DMU_{15}, DMU_{25}	0
DMU_{7}	1	1	DMU_{7}	3
DMU_{8}	0.98716	31	DMU_{4}, DMU_{7}, DMU_{15}, DMU_{25}, DMU_{28}	0
DMU_{9}	1	1	DMU_{9}	0

DMU	Score	Rank	Benchmarking	Peer Count
DMU_{10}	1	1	DMU_{10}	0
DMU_{11}	1	1	DMU_{11}	1
DMU_{12}	1	1	DMU_{12}	0
DMU_{13}	0.70136	39	DMU_{7}, DMU_{15}, DMU_{28}, DMU_{30}, DMU_{36}	0
DMU_{14}	1	1	DMU_{14}	0
DMU_{15}	1	1	DMU_{15}	7
DMU_{16}	1	1	DMU_{16}	0
DMU_{17}	1	1	DMU_{17}	0
DMU_{18}	0.88889	35	DMU_{28}	0
DMU_{19}	1	1	DMU_{19}	0
DMU_{20}	0.88387	36	DMU_{2}, DMU_{4}, DMU_{25}, DMU_{28}	0
DMU_{21}	1	1	DMU_{21}	0
DMU_{22}	0.875	37	DMU_{15}	0
DMU_{23}	1	1	DMU_{23}	0
DMU_{24}	0.9786	32	DMU_{11}, DMU_{15}, DMU_{28}, DMU_{39}	0
DMU_{25}	1	1	DMU_{25}	5
DMU_{26}	1	1	DMU_{26}	0
DMU_{27}	1	1	DMU_{27}	0
DMU_{28}	1	1	DMU_{28}	6
DMU_{29}	1	1	DMU_{29}	0
DMU_{30}	1	1	DMU_{30}	0
DMU_{31}	1	1	DMU_{31}	0
DMU_{32}	1	1	DMU_{32}	0
DMU_{33}	1	1	DMU_{15}	0
DMU_{34}	0.93453	33	DMU_{2}, DMU_{4}, DMU_{15}, DMU_{25}, DMU_{28}	0
DMU_{35}	0.99496	30	DMU_{2}, DMU_{4}, DMU_{7}, DMU_{15}, DMU_{28}	0
DMU_{36}	1	1	DMU_{36}	1
DMU_{37}	1	1	DMU_{37}	1
DMU_{38}	1	1	DMU_{38}	0
DMU_{39}	1	1	DMU_{39}	1

Table III: Results of DEA (BCC model)

Results obtained from CCR and BCC models; it is interesting to note that four DMUs (DMU_{11}, DMU_{15}, DMU_{23} and DMU_{39}) have become efficient units in both the models. In order to check for existence of significant difference between medical tourism performance scores calculated using DEA models (CCR and BCC),

a paired sample t-test is carried out (Bain and Engelhardt, 1992). The test indicates that significant difference exist between efficiency scores obtained through CCR and BCC models.

Conclusions

The process of benchmarking is useful in identifying the best medical tourism practices. Two approaches of DEA known as CCR and BBC are considered to obtain efficiency of medical tourism service providers. Twenty seven units out of thirty nine DMUs have emerged as benchmarking units for the other twelve DMUs in the CCR model whereas twenty nine units are found to be efficient in BCC model. In total, ten DMUs (DMU_5, DMU_6, DMU_8, DMU_{13}, DMU_{18}, DMU_{20}, DMU_{22}, DMU_{24}, DMU_{34} and DMU_{35}) have become inefficient units in both CCR and BCC models based on their efficiency scores. The efficiency scores obtained by CRS and BCC models are compared using a paired sample t-test. It has been demonstrated that statistical significant difference exists on ranking of units in both models. Therefore, managers must be cautious regarding use of scale assumption. A thorough understanding of behavior of input and output variables is needed while assuming scale. Further, DEA is quite sensitive to sample size. In future, number of medical tourism service providers can be increased for better insight into the problem.

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