

Comparative Analysis of Health Care Service Quality between Public & Private Sector Hospitals in Odisha: an Optimization model based Approach

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ABSTRACT

Background: Healthcare services are the backbone of any civilized society as it helps in building and maintaining a sizable and healthy human resource that can contribute towards the growth of a nation. In a developing country like India, the healthcare services has taken a giant leap towards development in the recent decades as both government and private sectors have joined together to provide holistic healthcare services to the general public. But, as the healthcare sector is highly personalized in nature, it majorly depends upon the service quality to provide commendable offerings to the people. With this in background and as portion of a greater doctoral education, we have tried to assess the quality of services offered by various private and public sector medical college hospitals in the state of Odisha, India.

Objectives: This basic aim of the study is to make comparison between quality of services offered through the private and public sector tertiary care hospitals in order to assess the ground realities and to figure out the deficiencies so that corrective measures can be recommended. Another objective is to take the help of optimization model in order to shortlist the hospitals amongst the private & public entities that can provide better quality services while minimizing the costs.

Methods: The study was conducted with a total 436 nos. of respondents visiting various public and private teaching hospitals in the state of Odisha in India. While recording their responses, we have used the famous SERVQUAL scale with a seven point likert scale. An optimization model has been introduced to minimize the cost when a patient selects the hospital for treatment.

Findings: The people visiting the private sector entities were comparatively more satisfied with the service offerings than the respondents visiting the public sector hospitals. The optimization technique used in the study also yielded results in the same line, where it was found that the patients will prefer the private hospitals with better quality of services and comparatively minimal costs. Though, a good percentage of people were found to be satisfied with the quality of services offered but still there exist many areas of improvements which are listed in the article as well as some reformative suggestions are discussed which if implemented properly can go a long way in making the whole process more fruitful.

Keywords

Service Quality, Customer Satisfaction, Hospitals, Expectations, Perception, Optimization Technique.

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

In this era of globalization, time & again, the term excellence has been showed to be the buzzword that helps the patrons in deciding the products and services to avail. In case of the health care sector, the importance of service quality grows manifolds as the proper implementation of it not only provides relief to the sufferers but also help to build and sustain significant proportion of healthy & hearty human capital for a nation. Therefore, frequent measurement of the service quality is needed in order to find and fill up the gaps that may arise amid the anticipation and insight stages of the patrons. The idea behind all this is to strengthen the quality of health care services in order to meet and exceed the requirements & expectations of the customers for gaining sustainable competitive advantage[1][2].

Coming to the Indian saga just before the dawn of the new millennium, the government initiated the efforts of LPG (Liberalization, Privatization and Globalization) policy in the early 1990s that helped greatly in shaping the future directives for the country in a positive manner. Taking advantages of this market driven economy, both the

government as well as the private sector players entered into different industry sectors that resulted in sharp increase in the consumerism phenomena which was unheard of in a before earmarked culture like ours[3]. Continuing in the same track, the healthcare sector also experienced major boost during the same period when multi-level & multi-modal reforms were introduced into it as well as whole heated support were provided by both the government and private sectors[4]. Even during the mid-2000s when the whole world suffered from economic recession and many business sectors experienced slowdown, the hospital sector remained largely unaffected and rather continued its unprecedented growth. Many of the leading agencies like Asscocham, RNCOS & Economics Times have predicted the growth of health care industry in India to go about threefold to USD 372 billion by the year 2022 from USD 110 billion in 2016[5].

From the discussions above, we can derive about the shining story of healthcare sector in India but when we look towards the flipside of the tale, the scenario appears to be paradoxical where frequent news about infant and maternal morbidity & mortality, social taboos, unavailability of essential healthcare infrastructures, instances of

malnutrition, frequent outbreak of contagious diseases, misbehaviour & carelessness shown by the health care service providers, and many more heart breaking stories appears in various medias that definitely points towards a sorrowful state of affairs [6][7].

Therefore, it is the call of the time to assess the root causes of the situation and take corrective actions to improve the facilities and conditions in command to reach to a comfortable position in the global map. In this regard, as portion of a greater doctoral learning, we consume made a comparative study for assessing the service quality offered by the public and private sector medical college hospitals in the eastern state of India, in Odisha[8]. A total of 436 numbers of respondents were interviewed as part of the study to assess the current state of service quality prevailing at the teaching hospitals[9] [10][11]. Through various research works done over years, it has been proved that the teaching hospitals offer higher quality of services in comparison to the non-teaching hospitals as they are involved in education, research, and extension works for which we have taken them as the field of study.[12][13][14][15]

Literature Review

In the post world war period, when the whole world was gearing up to shape their economies, the concept of service quality found its true dimensions as more and more people started to discuss and use it in their business processes (Lapierre, 1996). Gradually increasing numbers of researchers, academicians, business practitioners and scholars tried to explore different angles of this service quality and relate it with customer loyalty and consistent buying intentions may also represent satisfaction[16][17]. Therefore, in order to gain sustainable competitive advantage in this dynamic yet competitive marketplace, the three key cornerstones of success can be listed as service quality, customer satisfaction as well as loyalty[18][19]. The service quality is the single most important meditating factor when it comes to type or disruption a contract and directly related to the make twin as well as brand performance for the service providers that affects the behavioural intentions of the customers in the market[20][21][22]. By definitions, the term quality can be understood as the amalgamation of technical aspects (What is given?) and functional aspects (How it is given?) of any products or services that affects the customer's view where as some explains it as the gap existing between the expectation levels (before availing the services) and perception scores (after availing the services) of the customers [23][24][25].By these multifaceted definitions given by the researchers lead us to define it as the framework of superior offerings that increases the customer's satisfaction levels , help in gaining profitability as well as help in enhancing the market share of the company.In order to find the gap between the expectations and perceptions of the people, many models and scales have been developed Zeithamal has been improving the SERVQUAL scale over the years in mapping the gap scores of the customers have been established as the major yardstick and is successfully tested in different industries and scenarios to yield consistent results. They have chosen

the SERVQUAL scale for our analysis because of its universal acceptability and use across the industries[26][27].

Objectives

The various points of the study can be listed as below.

- a. To assess the various influencing factors affecting the customer's choices selecting various hospitals for their treatments.
- b. To map the difference between the expectations and perception of people towards the healthcare services offered at the medical college hospitals in order to identify and analyze the major service quality gaps prevailing there.
- c. To evaluate the overall satisfaction levels of patients towards quality of services.
- d. To map the price sensitivity of people.
- e. To judge the attitudinal loyalty of patients to map their intentions.
- f. To suggest measures to improvise the quality standards in service delivery of the medical college hospitals based on the findings of the study.
- g. To shortlist the hospitals that offer better quality healthcare services with minimal costs.

Methodology

The study was conducted across the state of Odisha in India where the feedbacks of the patients visiting to various renowned public and private sector medical college hospitals were taken. After thorough literature review, a questionnaire based on the renowned SERVQUAL scale containing 5 quality of service dimensions of reliability, assurance , tangibility , empathy and reactivity which are speeded through 22 questions has been established. For data collection from visitors, a 7-point Likert scale from the absolutely incompatible with the entire agreement was used. Based on their year of establishment and operational status, a total of three numbers of public and three numbers of private hospitals were chosen and a total of 436 numbers of successful interviews were conducted for the study. The sample size achieved can be listed as follows.

Sl.	Name of the Medical College and Hospitals	Type	Sample Size
1	Srirama Chandra Bhanja (SCB) Medical College & Hospital, Cuttack	Public Sector	77
2	Veer Surendra Sai Institute of Medical Sciences and Research, (VIMSAR) Burla, Sambalpur		65
3	The Maharaja Krishna Chandra Gajapati (MKCG) Medical College & Hospital, Berhampur, Ganjam		73
4	The Institute of Medical Sciences (IMS) and SUM Hospital, Bhubaneswar, Khurda	Private Sector	84
5	Kalinga Institute of Medical Sciences (KIMS) & Pradyumna Bal Memorial Hospital (PBMH), Bhubaneswar, Khurda		66
6	Hi-Tech Medical College & Hospital, Bhubaneswar, Khurda		71
	Total	06	436

Interpretations:**Table 1: Profiling**

Parameters	Definitions	% in Public Sector Hospitals	% in Private Sector Hospitals	% in Total Sample Size
Area	Urban	75.80	82.80	79.40
	Rural	24.20	17.20	20.60
Gender	Male	69.30	75.10	72.20
	Female	30.70	24.90	27.80
Age	Below 25 Years	9.30	8.60	8.90
	26 to 45 Years	61.40	62.90	62.20
	Above 45 Years	29.30	28.50	28.90
Marital Status	Unmarried	6.50	6.30	6.40
	Married	88.40	89.60	89.00
	Older Couple Staying Alone	5.10	4.10	4.60
Education	Up to 10th Class	33.5	19.9	26.6
	Up to Under Graduate	23.3	19.5	21.3
	Graduate & Above	43.3	60.6	52.1
Income Levels	< Rs. 20000	3.7	6.3	5
	Rs. 20001- Rs. 40000	32.1	29.9	31
	Rs. 40001- Rs. 60000	50.7	48.4	49.5
	> Rs. 60000	13.5	15.4	14.5
Nature of Visit	First Visit	22.3	15.8	19
	Repeat Visit	77.7	84.2	81
Expenses per visit	<Rs. 1000	5.6	3.6	4.6
	Rs. 1000 – Rs. 3000	33.5	27.6	30.5
	Rs. 3001 – Rs. 5000	37.2	34.8	36
	Rs. 5001 – Rs. 10000	22.8	22.2	22.5
	> Rs. 10000	0.9	11.8	6.4

Source: Primary Data (All figures are in Percentage)

✓ Of the total samples, around 79.40% went to the town areas somewhere as the rest 20.60% of individuals belonged to the interiors.

✓ Of the total, 72.20% were males and 27.80% were females.

✓ Age wise, 62.20 percent of the total respondents were in the age group of 26 to 45 years followed by 28.90 percent of people in the age group of above 45 years and only about 8.90 percent of the people were below 25 years of age.

✓ Marital Status stated 89% of the people to be married where as 6.40% of people were unmarried and

4.60% of the respondents were belonged to the older couples staying along category.

✓ Education wise, 52.10% of the respondents were having their literacy rate in graduation and above category followed by 26.60% of people who had qualification up to class 10th and around 21.30% of people were undergraduates.

✓ About 49.50 percent were in the revenue category when asked about their monthly household income (MHI), of Rs. 40,001/- to Rs. 60,000/- Only per month followed by 31% in the range of Rs. 20,001/- to Rs. 40,000/- Only per month, 14.50% in more than Rs.60,000/- Only per month and around 5% in less than Rs. 20,000/- Only per month group.

✓ Around 19% of the total respondents were the first time visitors whereas the rest 81% were repeat visitors to the hospitals.

✓ About 36 percent were asked about average expenditure per hospital visit. their expenses in the range of Rs. 3,001/- to Rs. 5,000/- only followed by 30.50% of people between Rs. 1,000/- to Rs. 3,000/- only, 22.50% between Rs. 5,001/- to Rs. 10,000/- only and 4.60 % in less than Rs.1,000/- only category.

Factors affecting the preferences towards a particular hospital

Table 2: Reasons for visiting the hospitals (Overall, Public Vs Private)

Reasons For Visit	Overall (436)	Public (215)	Private (221)
Hospital Image	62.61	59.53	65.61
Patient Delight	23.17	23.72	22.62
Professional Advice of the doctors	63.07	59.53	66.52
Quality of Services	71.56	65.58	77.38
Range of Services (More Nos. of Departments)	67.20	66.51	67.87
Convenience of Access	61.70	57.21	66.06
Administrative Procedures	19.27	15.35	23.08
Payment Modes	21.10	17.21	24.89
Coverage of Health Insurance	45.41	39.53	51.13
Cost of Treatments	66.28	83.26	49.77

Source: Primary data (All figures are in Percentage)

When the factors affecting the respondents’ preferences towards various hospitals were assessed, the service quality came up as the predominant factor followed by other causes such as types of treatments available, costs, competent doctors, image of the hospitals etc. Similarly, factors such as administrative procedures, multiple payment modes, and

patients’ delight etc. had the least meditating effects on consumer’s preferences towards the hospitals. Sector wise, the private sector hospitals were preferred for their quality of services where as the public sector hospitals were preferred majorly due to their affordability.

Service quality gap analysis (The SERVQUAL Scale):

Table 3: GAP Analysis Scores (Overall, Public Vs Private)

Parameters	Statements	Overall MS		Public MS		Private MS		GAP Scores	GAP Scores	GAP Scores
		E	P	E	P	E	P	Overall	Public	Private
Reliability Overall E = 6.13 P = 4.50 GAP = 1.63	On time provision of services	6.15	4.32	6.13	4.19	6.17	4.45	1.83	1.95	1.72
	Services carried out correctly from beginning	6.15	4.51	6.13	4.36	6.18	4.66	1.64	1.76	1.52
	Professionalism & competency of doctors & staffs	6.22	4.8	6.25	4.71	6.19	4.88	1.42	1.54	1.31
	Error free and fast retrieval in documentations	6.06	4.2	6.04	4	6.08	4.39	1.86	2.03	1.69
	Consistency of Costs	6.08	4.67	6.07	4.58	6.09	4.76	1.4	1.49	1.32
Assurance Overall E = 6.24 P = 4.93 GAP = 1.30	Mannerism & Politeness	6.2	4.81	6.11	4.5	6.28	5.1	1.39	1.61	1.18
	Broad based knowledge	6.33	5.26	6.36	5.24	6.3	5.29	1.07	1.13	1.01
	Honourability &	6.18	4.81	6.19	4.71	6.17	4.91	1.37	1.48	1.26

	dignified behaviour									
	Thorough explanations regarding conditions	6.24	4.85	6.23	4.71	6.24	4.99	1.39	1.52	1.26
Tangibility Overall E = 6.13 P = 4.19 GAP = 1.95	Modern equipment and facilities	6.32	4.4	6.31	4.14	6.34	4.64	1.93	2.16	1.7
	Hygienic & Comfortable environment	6.15	3.84	6.15	3.27	6.14	4.4	2.31	2.88	1.74
	Neat appearance of doctors & Staffs	5.93	4.32	5.84	4.09	6.02	4.54	1.61	1.75	1.48
Empathy Overall E = 6.12 P = 4.29 GAP = 1.83	Feedbacks from the patients	5.91	3.49	5.86	3.14	5.96	3.82	2.43	2.72	2.14
	Round the clock availability of services	6.09	4.08	6.07	3.79	6.1	4.38	2	2.29	1.72
	Treating the Patients' with their interests at heart	6.12	4.6	6.18	4.4	6.05	4.8	1.51	1.78	1.26
	Understanding the specific needs of the patients	6.17	4.57	6.18	4.43	6.17	4.7	1.61	1.75	1.47
	Personalized attention to the patients	6.21	4.51	6.2	4.4	6.21	4.63	1.69	1.81	1.58
	Caring fashion while dealing with the patients	6.21	4.49	6.2	4.33	6.22	4.65	1.72	1.87	1.57
Responsiveness Overall E = 6.16 P = 4.34 GAP = 1.82	Promptness of services	6.21	4.31	6.22	4.12	6.2	4.49	1.9	2.1	1.71
	Doctors & Staffs are responsiveness	6.2	4.4	6.22	4.15	6.17	4.64	1.8	2.07	1.53
	Postiveness attitude shown by the doctors & Staffs	6.16	4.44	6.17	4.36	6.14	4.52	1.72	1.81	1.62
	Least amount of waiting time while availing services	6.09	4.21	6.11	3.96	6.07	4.46	1.87	2.15	1.61

Table 4: Satisfaction Scores (Overall, Public Vs Private)

Range of Satisfaction	Overall (436)	Public (215)	Private (221)
Extremely Dissatisfied	5.96	9.30	2.71
Very Dissatisfied	9.63	12.09	7.24
Somewhat Dissatisfied	13.53	15.81	11.31
Neither Satisfied Nor Dissatisfied	19.50	18.60	20.36
Somewhat Satisfied	28.67	25.12	32.13
Very Satisfied	20.64	17.67	23.53
Extremely Satisfied	2.06	1.40	2.71
<i>Mean Scores</i>	4.25	3.96	4.53

Source: Primary data (All figures are in Percentage except the mean scores)

When the satisfaction scores towards the hospitals were assessed, 51.37% of the respondents were quite satisfied with the services whereas around 29.13% of the people were dissatisfied with the offerings (Combined scores of somewhat dissatisfied, very dissatisfied and extremely dissatisfied). Around 19.50% were not sure about their decision on satisfaction or dissatisfaction. Between public and private sectors, around 58.37% of the respondents visiting private hospitals were satisfied in comparison to 44.19% in public hospitals.

Source: Primary data (Mean Scores of Expectations and Perceptions)

When the SERVQUAL scores were assessed by taking all the five dimensions and twenty two statements we couldn't get any negative scores among the anticipation and insight stages of the patients which can be inferred as the fact that neither the public nor the private hospitals were matching the expectation levels of the patients. Comparatively narrower gap scores were obtained in private hospitals than the public ones that describes higher perception scores for the private entities from the patients. Similarly, higher gap scores were obtained for tangibility parameter followed by empathy and responsiveness comparative to other aspects of assurance and reliability. Going into further details, higher gaps were existed in getting feedbacks, communication with the patients and their attendants, poor grievance handling procedures, absence of hygienic & comfortable environment, availability of services particularly in odd hours, infrastructure and equipments, promptness in services, 1 etc. which pointed towards many areas for improvement.

Overall Satisfaction towards the Hospitals:

Views regarding the pricing of various services:

Table 5: Opinions on Pricing (Overall, Public Vs Private)

Opinion on Pricing	Overall (436)	Public (215)	Private (221)
Very Cheap	0.69	0.93	0.45
Cheap	12.16	18.14	6.33
Reasonable	44.50	55.35	33.94
Expensive	29.13	20.47	37.56
Very Expensive	13.53	5.12	21.72
Mean Scores	3.43	3.10	3.73

Source: Primary data (All figures are in Percentage except the mean scores)

When the price sensitivity scores were mapped, around 42.66% of the respondents opined them to be expensive (combined scores of expensive & very expensive) whereas only 12.85% perceived them to be on the cheaper side (combined scores of cheap & very cheap). Between the private & public sector hospitals, around 59.28% of patients visiting the private entities believed them to be expensive whereas around 25.59% people in public hospitals believed them to be expensive. In case of public sector hospitals, around 55.35% of people at the public hospitals perceived the costs to be reasonable.

Attitudinal loyalty towards the Hospital Services

Table 6: Attitudinal Loyalty towards Hospitals (Overall)

Statements	Entirely Disagree	Mostly Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Mostly Agree	Entirely Agree	Mean Score
The services at the hospital are good	0.92	7.34	17.89	25.23	27.52	19.27	1.83	4.36
The services at the hospital are better than others	1.15	9.17	22.02	26.15	26.15	13.76	1.61	4.15
At a general level, this hospital provides high quality services	1.15	7.11	19.95	27.98	28.67	14.68	0.46	4.22
I will spread positive word of mouth publicity for the hospital	0.69	5.28	23.39	25.69	27.75	15.83	1.38	4.28
I will definitely recommend this hospital if someone ask me suggestion	0.92	3.67	24.31	25.92	29.82	13.53	1.83	4.28
I will definitely encourage my peers to undergo treatment here	1.83	5.96	22.48	24.08	30.96	13.07	1.61	4.22
I will choose this hospital as my first preference for medical services	0.46	6.88	28.9	23.62	27.75	11.47	0.92	4.09
I will definitely prefer this hospital for all types of ailments	2.06	9.4	27.29	29.13	24.08	6.88	1.15	3.89
Even if I change my residence to other place, I will come here for treatment	11.24	16.28	26.83	27.06	13.99	4.59	0	3.3
With every visit, this hospital provides better quality services	2.75	11.01	37.39	29.82	14.22	4.13	0.69	3.57

Source: Primary data (All figures are in Percentage except the mean scores)

When the attitudinal loyalty of the patients were measured, relatively positive acceptability scores were found for the statements like the quality of services, positive word of mouth publicity, future recommendations to the friends and relatives etc. were obtained. However, lower scores were obtained for parameters like availing all types treatments at a particular hospital, returning back to the same hospitals in case of change of location etc. Between the public and private entities, comparatively higher scores were obtained from respondents at the private hospitals across all parameters.

Problems in the Selected Hospitals:

Table 7: Common problems prevailing in Hospitals (Overall, Public Vs Private)

Sl.	Dislikes about the hospitals	Overall (436)	Public (215)	Private (221)
1	Unhygienic conditions in and around the hospital	51.15	60.93	41.63
2	Longer waiting time before availing the healthcare services	48.17	58.14	38.46
3	Issues regarding Infrastructural safety (Equipment, electrical & water related issues)	41.74	50.7	33.03
4	Issues regarding physical safety (Harbouring of Drunkards, Goons & Thieves)	33.26	55.81	11.31
5	Longer & informal procedures adopted during treatment/discharge/transfer/death/post mortem etc.	39.91	43.26	36.65
6	Behavioural issues of the doctors and staffs	43.12	55.35	31.22
7	Inconvenient & inadequate parking facilities	36.47	37.67	35.29
8	Inefficient, including delay & chaos in the lab testing procedures	39.22	46.51	32.13
9	Insufficient provisions for the attendants with the patients	39.68	45.58	33.94
10	Expensive treatment procedures, prescription of high cost medicines	26.38	13.02	39.37
11	Inefficient medical recordkeeping / retrieval system	43.58	53.49	33.94
12	Crowd management issues at places like OPD, OT, medicine outlets, laboratories etc.	40.83	46.51	35.29
13	Deficiencies of essential and regular equipments	36.24	47.44	25.34
14	Deficiencies in specialists doctors	39.68	41.86	37.56
15	Control & coordination issues where agents are roaming inside the hospital, patient harassment issues etc.	27.06	50.23	4.52
16	Infrastructural issues like unavailability of beds, labs, equipments, power backups, food & beverage services, drinking water etc.	40.37	50.23	30.77
17	Lack of zeal of the staffs towards attending the patients, especially in odd hours	34.63	40	29.41
18	Absence of grievance handling mechanism including proper feedback system	49.31	49.3	49.32
19	Corrupt practices like prescribing non-generic medicines, high value medicines in high quantities, non-refund policies, bribery, pushing for visit to private clinics etc.	39.68	46.51	33.03
20	Neglected indoor patients	22.94	26.98	19
21	Improper functioning of information system and help desk	25.92	33.49	18.55
22	Unavailability of essential services like ambulance at the need of the time.	28.9	38.14	19.91

Source: Primary data (All figures are in percentage)

When we tried to list down the problems faced by the patients while visiting the hospitals, it attracted us towards many of the drawbacks prevailing there. More than half of the people listed the unhygienic conditions followed by others like prolonged waiting hours for availing different services, unsafe facilities, inconvenient parking options available, mismanaged lab testing and medical procedures, inadequate facilities offered for the attendants, crowd management, proficiency & behaviours of the doctors & staffs, inadequate emergency services, absence of proper grievance redressal systems, etc. which were affecting the satisfaction scores given by the people. Comparatively, people visiting the public hospitals were longer list of complaints than the patients at the private hospitals.

Mathematical Formulation based on the Optimization Model:

Another objective of the study is to shortlist the hospitals that offer better quality healthcare services with minimum costs. Therefore, we have explored further the various reasons for visiting particular hospitals as well as costs incurred while visiting the hospitals on which the optimization model is applied to get the suitable answer.

Table 8: Average Spending (In Percentage) for individual hospitals

Average Spending	Percentage								
	Public	SCB	VSS	MKCG	Private	IMS & SUM	KIMS	Hitech	Overall
Less than Rs. 1000	5.6	3.9	0	12.3	3.6	8.3	1.5	0	4.6
Rs. 1000 to Rs. 3000	33.5	41.6	26.2	31.5	27.6	35.7	25.8	19.7	30.5
Rs. 3001 to Rs. 5000	37.2	29.9	47.7	35.6	34.8	32.1	28.8	43.7	36
Rs. 5001 to Rs. 10000	22.8	23.4	26.2	19.2	22.2	16.7	24.2	26.8	22.5
More than Rs. 10000	0.9	1.3	0	1.4	11.8	7.1	19.7	9.9	6.4

Source: Primary data (All figures are in percentage)

In this regard, an optimization technique is the best mathematical tool for the decision maker to select the specific hospital. Let x_j for $j = 1, 2, \dots, 6$ be the decision variables that represent the name of the hospitals like SCB, VSS, MKCG, IMS and SUM, KIMS, Hi-tech. Our main objective is to minimize the cost when selecting the hospital. In formulating the optimization model, an objective must be computable from the values of decisions variables. Mathematically, objectives are the functions of the variables. For the given problem, we have only one objective i.e. the cost should be minimum when a patient visits the Hospital.

Let c_j , f or $j = 1, 2, \dots, 6$ be the cost values when a patient visit the Hospitals x_j , for $j = 1, 2, \dots, 6$ respectively. The total cost is simply the sum of the individual costs of all the Hospitals and our objective is to minimize the cost i.e.

$$\text{Minimize Cost} = \sum_{j=1}^k c_j x_j$$

As per our objective, we explicitly require that the selected Hospital that provide at least certain amount of each facility like Hospital image, patients' delight, professional advice of the doctors, superiority of amenities, range of amenities i.e. more nos. of departments, convenience of access, administrative measures, expense methods and coverage of Health Assurance. Therefore, our model must have some

constraints associated with Hospital image, patients' delight, professional advice of the doctors, quality of services, range of services i.e. more nos. of departments, convenience of access, administrative actions, imbursement modes, attention of Health Insurance when a patient visit the Hospital.

Let the amount of Hospital image provided by x_1 Hospital that a patient select is $a_{11}x_1$. Similarly the amount of Hospital image provided by the other Hospitals x_j , f or $j = 2, 3, \dots, 6$ that a patient select is $a_{12}x_1, a_{13}x_1, a_{14}x_1, a_{15}x_1, a_{16}x_1$. So the total amount of Hospital image provided by x_1 Hospital is $a_{11}x_1 + a_{12}x_1 + a_{13}x_1 + a_{14}x_1 + a_{15}x_1 + a_{16}x_1$. Since a patient requires the amount of Hospital image be at least b_1 which leads to the following constraint.

$$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 1$$

Now in like manner the other constraints corresponding to the facility as patients' delight, professional advice of the doctors, Service quality, selection of facilities, ease of access, administrative processes, modes of payments and health insurance coverage can be formulated. The corresponding constraints are as follows:

Table 09: Constraints towards the facilities

(Patients' delight) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 2$
(Professional advice of the doctors) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 3$
(Eminence of services) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 4$
(Range of services) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 5$
(Expediency of access) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 6$
(Administrative procedures) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 7$
(Compensation modes) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 8$
(Reporting of Health Insurance) :	$\sum_{j=1}^6 a_{ij}x_j \geq b_i, \text{ for } i = 9$

Therefore, the Optimization Model for Hospital Selection (OMHS) to minimize the cost and with all constraints that satisfy the model is presented as follows:

$$(OMHS) : \text{Minimize Cost} = \sum_{j=1}^6 c_j x_j$$

$$\text{subject to } \sum_{j=1}^6 a_{ij} x_j \geq b_i, \text{ for } i = 1, 2, \dots, 8$$

$$x_j \geq 0, j = 1, 2, \dots, 6.$$

The above OMHS problem is a linear programming problem (LPP) which can be solved by using the general LPP techniques. Here we applied the LINGO software to obtain the optimal solution.

Numerical Example

The cost value for a patient when he visit the hospital is given as follows:

Table 10: Hospital wise Costs incurred while visiting

Hospital name	SCB	VSS	MKCG	IMS & SUM	KIMS	Hitech
Cost of Treatment (in Rs.)	1000	2000	2500	1000	8000	7000

Source: Primary data (All figures are in Rs.)

The basic requirement of each facility (in percentage) for a patient to visit the Hospital is given as follows.

Table 11: Reasons affecting decision to visit a hospital

Facility	In Percentage
Hospital Image	70
Patient's Delight	40
Professional Advice of the Doctors	70
Quality of Services	80
Range of Services	70
Convenience of Access	80
Administrative Procedures	40
Payment Modes	40
Coverage of Health Insurance	50

Source: Primary data (All Figures are in Percentage)

And the other data for visiting the Hospitals for a patient are given in the following table.

Table 12: Reasons for Visiting (In Percentage) for individual hospitals

Reasons for Visiting	Percentage								
	Public	SCB	VSS	MKCG	Private	IMS & SUM	KIMS	Hitech	Overall
Hospital Image	59.53	66.2	70.8	42.47	65.61	77.38	46.97	69.01	62.61
Patients' Delight	23.72	24.7	27.7	19.18	22.62	28.57	15.15	22.54	23.17
Professional Advice of the doctors	59.53	62.3	69.2	47.95	66.52	72.62	51.52	73.24	63.07
Quality of Services	65.58	66.2	72.3	58.9	77.38	91.67	71.21	66.2	71.56
Range of Services (More Nos. of Departments)	66.51	68.8	75.4	56.16	67.87	67.86	66.67	69.01	67.2
Convenience of Access	57.21	68.8	60	42.47	66.06	51.19	81.82	69.01	61.7
Administrative Procedures	15.35	18.2	18.5	9.59	23.08	21.43	27.27	21.13	19.27
Payment Modes	17.21	24.7	12.3	13.7	24.89	29.76	24.24	19.72	21.1
Coverage of Health Insurance	39.53	48.1	36.9	32.88	51.13	35.71	62.12	59.15	45.41

Source: Primary data (All figures are in percentage)

Solution: The optimization model for the above described data is given by

$$(OHMS 1): \text{Minimize Cost} = 1000x_1 + 2000x_2 + 2500x_3 + 1000x_4 + 8000x_5 + 7000x_6$$

$$\text{Subject to } 66:23x_1 + 70:77x_2 + 42:47x_3 + 77:38x_4 + 46:97x_5 + 69:01x_6 \geq 70$$

$$24:68x_1 + 27:69x_2 + 19:18x_3 + 28:57x_4 + 15:15x_5 + 22:54x_6 \geq 40$$

$$62:34x_1 + 69:23x_2 + 47:95x_3 + 72:62x_4 + 51:52x_5 + 73:24x_6 \geq 70$$

$$66:23x_1 + 72:31x_2 + 58:90x_3 + 91:67x_4 + 71:21x_5 + 66:20x_6 \geq 80$$

$$68:83x_1 + 75:38x_2 + 56:16x_3 + 67:86x_4 + 66:67x_5 + 69:01x_6 \geq 70$$

$$68:83x_1 + 60:00x_2 + 42:47x_3 + 51:19x_4 + 81:82x_5 + 69:01x_6 \geq 80$$

$$18:18x_1 + 18:46x_2 + 9:59x_3 + 21:43x_4 + 27:27x_5 + 21:13x_6 \geq 40$$

$$24:68x_1 + 12:31x_2 + 13:70x_3 + 29:76x_4 + 24:24x_5 + 19:72x_6 \geq 40$$

$$48:05x_1 + 36:92x_2 + 32:88x_3 + 35:71x_4 + 62:12x_5 + 59:15x_6 \geq 50$$

Using LINGO package the optimal solution of the above problem is $x_1 = x_2 = x_3 = x_5 = x_6 = 0$ and $x_4 = 1:866542$ and the Min Cost = 1866:542.

Thereby, we can conclude that the IMS & SUM hospital offers better quality and facilities of healthcare services with minimal costs and thus offers a competitive option for the patients.

Recommendations

Based on the findings of the study and stimulated by the suggestions obtained from various respondents, we have tried to enlist some of the improvement measures in order to improvise upon the quality of services available at various hospitals across the state. They can be listed as follows.

- The hospitals need to regularly train their staffs with behavioral aspects while dealing with the patients as many a time the grievances related to the attitude and way of behavior of the hospital staffs surfaced during the study.

- Proper counseling and communication with the patients and their relatives have to be established in order to carry out the services right from the beginning. Similarly, the staffs need to show caring, and sympathetic attitude towards the patients during their treatment even before and after the procedures also.

- Drawbacks like the unavailability of specialized doctors, absenteeism, delay reporting on duties, unavailability at the working areas, chaotic crowd at essential areas, unethical & corrupt practices like bribery & preferences etc., Non-generic prescription and high-quantity medicinal products, and opting for superfluous tests and a high-value drug policy, etc. Can be dealt with strict administrative measures which will ensure a flawless environment to the patients.

- Similarly, the job satisfaction levels of the doctors and staffs need to be taken into account while designing their work schedules as it directly affects their behaviors and operational procedures. Activities like adequate training & development initiatives, unbiased performance appraisal system, fair-pay systems, proper & adequate motivation, appreciation, proper working conditions, fair workloads, and shift assignments, can reduce the job strain and thereby retain the good performing staffs for a longer period of time.

- The infrastructure of the hospitals needs to be improved with clean, hygienic, easy to use facilities, and provision of up-to-date equipment which can be used as and when necessary.

- The grievance handling procedures along with the post discharge / treatment procedures also need to be looked upon as they also affect the overall perception towards the quality of services.

- The medical record keeping as well as retrieval system needs to be modernize with suitable use of technology which can resolve a lot of problems in terms of time and treatment of the patients.

- Proper arrangements of facilities for the attendants with the patients also need to be looked upon as they also affect the choice of hospitals for treatment.

- Finally the cost factor regarding the healthcare services needs to be properly facilitated in order to ensure quality medical care in affordable costs to attract people from all strata of the society towards us.

Way forward

In this era of competitiveness, India has become a fast growing country with an aspiration to become a world power in the recent future. But when it comes to the provision of healthcare initiatives for the common citizens, there exists many loopholes which have to be eliminated. In this regard, we need to carefully assess, strengthen, and maintain our position in every industry sector including the healthcare services which has been marked as one of the core areas of human resource development. Consequently, steps are required to bridge the differences between people's expectations and perceptions to achieve a sustainable competitive advantage over others.

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