

Application of Grey Decision Analysis for Patients' Satisfaction of Public and Private Sectors' Healthcare Service Quality

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ABSTRACT

The healthcare sector of a country requires adequate attention from the governments as the quality of healthcare offers hope and comfort to patients and their dependents. It also promotes a healthy human capital that contributes to the development of the country. Currently, while making use of any services or buying a product, quality has become the main attraction for customers, and it is also a strategic advantage for organizations to succeed and remain competitive on the market. The goal of the study is to examine the comprehensive relationship between patient satisfaction and quality aspects of public / private healthcare services in the city of Bangalore., using new grey relational analysis (GRA) model and the Hurwitz criteria for decision making under uncertainty. Grey relational analysis showed that assurance and tangibility predict patient satisfaction in the public and private healthcare markets, respectively, most strongly. The Hurwitz tests found that from private health care services, patients are more likely to be satisfied.

Key words- Grey Relational Analysis, Healthcare quality, Hurwitz criteria, Patient satisfaction

I. INTRODUCTION

Health care services in India is the prominent sector in the economic development as it has influenced medical, Financial, social, Political implications and outcomes. It is the largest sector in terms of income and job creation. With overall growth in the economic and socio economic

growth, there has been a lot of interest given to the field of healthcare, be it with technological upgradation, community hospitals, government schemes, minimized cost of treatment. In the recent years, mandate for the healthcare has risen drastically with various reasons being increasing demographics, changes in the lifestyles, increasing levels of affordability have paved the way for the growth. The Healthcare has grown to such an extent where, India has been top ranked for the Medical Tourism, it has achieved this feat by providing quality service at an affordable pricing.

In today's scenario, it is known that rendering service is not only a patient's expectations in competitive hospitals; Although, it is also one of the drivers to keep a competitive edge and maximizing profit for the healthcare organisations. Service quality is being an obligatory topic in view of its essential relationship towards profit, and market share of the healthcare organisation. The need for the enhancement with respect to the quality rendered by the public sector hospitals has been a critical matter of concern. Wherein the biggest challenge is to define and measure the quality service. Service quality can be defined as the difference between the Customer perceptions and expectations, but in the case of the healthcare sectors there is absence of the above understanding.

In the study is focused on evaluating the patients' satisfaction from both private and public hospitals by the applying SERVQUAL model. This study desires to recognize and rank service quality parameters that have an influence on the patient's satisfaction. This study is restricted to a small sample size, wherein the application Grey decision models have been applied.

II. REVIEW OF LITERATURE

A. Service quality

Even before the service industries started to compete with traditional industries such as manufacturing and production, service quality has become an important issue. Soheil Salehi (2019) examined the factors affecting the patient satisfaction of the services rendered at the emergency department. Hospitals and health centers are among the public centers that handle a substantial number of client every day. It is crucial to provide an attentive approach to patients visiting medical centers and to improve the quality and method of providing services. Proper planning and management will entail public satisfaction whereas, neglecting these factors may violate human rights.

Satisfaction is a concept that is particularly important in medical care, and it is crucial for the assessment of performance and the quality of services provided by public organizations. The objective of the study was to identify variables affecting patient satisfaction in the emergency department. The research covered a cross-sectional study conducted at Iranian hospital; Patients aged more than 18 years in ED with a minimum stay of 24 hours were included. Data was collected using a 24-item researcher-made questionnaire based on SERVQUAL quality measuring tool. The result of the study revealed that "tangibles" dimension played a significant in the patients' satisfaction. The data collection was done to the patients after a week of their discharge. The understudy might not able to uncover the detailed

information over their treatment in the emergency department.

A SERVQUAL Research by Rehaman B (2018) focused on the impact of service quality dimensions on the patients of the private healthcare industry. The study was conducted using questionnaires as tools for data collection by constructing 21 objects on a five-point Likert scale. The results of the study reveal that the most important factor that impact on service quality dimension is tangible and empathy so these are the most important factors of SERVQUAL model that impact on service quality. The main objective of the study was to identify which variable impacts more on the patient satisfaction by using the SERVQUAL model. The study showed that "assurance" dimension of the service quality had a significant for the patient satisfaction. The study concentrated on a small population which failed to understand the satisfaction levels of patients from other hospitals in the region. Furthermore, the study conducted by Prof. Preeti Singh (2013) focused on different dimensions of the service quality. The research was carried on to investigate the relationship between service quality and overall patients' satisfaction and their willingness to recommend the services offerings to their peers. The outcomes of the study were that patients gave more significance to responsiveness and assurance parameter both in the government and private healthcare service providers, the patients were only able to judge only the practical part of quality. The results show that satisfaction with doctor and reasonable costs is the biggest determinants of service quality in the public hospitals.

B. Perceived Quality:

Perceived quality cannot inherently be assessed objectively, partly because it is a belief, and partly because it requires decisions about what is relevant for consumers. Bakhtiar Aman (2016) aimed on analyzing the patients' perceptions regarding services and quality of healthcare

at public sector institutions. The study focused to provide the healthcare managements a better understanding about ways to implement their plans in those areas that have the most impact on customer perceptions. The results uncovered that 'assurance' dimension in particular played a significant impact on patient satisfaction. Asma Shabbir et al (2014) intended to explore the relationship between healthcare perceived service quality and patient Loyalty. The research encompasses approximately 600 stratified random sampling techniques from patients in Pakistan's public and private hospitals. The results showed that the perceived quality of service in healthcare had a significant positive impact on the loyalty of patients. And also few metrics showed that the quality of service perceived by patients in both public and private hospitals was significantly different. The results of the above study were restricted to select healthcare providers. The interventions of having the data collection from a specific ward from the hospital authorities may have had significant differences in perception of the patients in other wards.

C. Grey Relational Analysis:

Grey Relational Analysis (GRA) was developed by a Chinese professor Julong Deng from Huazhong University of Science and Technology, also known as Deng's Grey Incidence Analysis Model. It is one of the most widely used examples of the Grey structure theory. Saad Ahmed Javed et al (2018) stated a Grey analysis model in Pakistan to analyze the comprehensive relationship between patient satisfaction and dimensions of health care service quality in Pakistani Private and Public Health care sectors. The research was carried out by making use of Grey Relational Analysis (GRA) with the help of the Improved SERQUAL model. The models revealed that reliability and responsiveness are most likely to predict the Patient satisfaction. The

Study failed to accommodate "cost" factor, which would have been a significant effect on the results of the understudy. Mohammadkarim Bahadori et al (2016), Intended to identify important factors affecting the effectiveness of quality control circles in healthcare institutions and to rank their effectiveness by combining VIKOR and Grey Relational Analysis (GRA). The study revolves around Academic members, Experts from the field of nursing. The results showed that although 'Training the members', 'Using the right tools' and 'Reward system' were factors that were of greater importance, the organization's performance for these factors was poor. The study showed that by applying control circles in any organization helped as it provided greater scope for employees' creativity by reaching their organization's goals and objectives, and provides favorable working conditions for the employees' optimal performance. Roselina Sallehuddin et al (2008) focused on Grey Relational analysis (GRA) in determining most influential factors affecting grain crop yield in china. GRA was used to solve complicated interrelationships between factors and variables such as pesticides, consumption of chemical fertilizer, irrigation area, electricity consumed in rural areas and many more in the understudy. The study was able to suggest ways to predict and generate reports that makes suggestions on the use of affecting factors.

In the grey relational analysis, experimental data of the output responses are first normalized between the ranges of 0 to 1. This process is known as grey relational generation. After normalization grey relational coefficient are calculated to express relationship between actual and desired experimental data. Then overall grey relational grade is calculated by averaging the grey relational coefficient of the output responses. The overall quality characteristic of the multi-objective process depends on the determined grey relational grade.

If $X_0 = (x_0(1), x_0(2), \dots, x_0(n))$ is the basic/reference sequence representing a dependent variable and $X_i = (x_i(1), x_i(2), \dots, x_i(n))$ are the set of comparative sequences representing independent variables—after going through initialing operator—then grey relational grade (GRG), the real number degree representing the output of GRA model, is represented as γ_{0i} or $\gamma(X_0, X_i)$ and is given by⁵⁸

$$\gamma(x_0(k), x_i(k)) = \frac{\min_i \min_k |x_0(k) - x_i(k)| + \xi \max_i \max_k |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \xi \max_i \max_k |x_0(k) - x_i(k)|},$$

where $\xi \in (0, 1)$ Is the defining coefficient, the value of which is typically 0.5.

D. Decision making under uncertainty:

Decision making is a repetitive activity that is considered prudent and consistent in almost all the organizations and managers who intend to make optimal decisions using the accessible information. In the literature, there are several methods to decision-making that direct managers throughout decision-making and evaluate alternatives to decisions. The choice of these solutions generally depends on the nature of the complexity or uncertainty of the problem. Uncertain decision-making uses parameters that reflect the risk attitude of the decision-maker, ranging from pessimism to optimism, and Decisions are taken on the basis of the ' anticipated value criteria ' in which decisions are measured to maximize the expected profit or reduce the expected cost. There are many solutions to this; however, the Hurwicz criterion is one of the most common approaches in the literature. Analyzing decisions when implementing the mentality of decision-makers, both constructive and negative.

$$\begin{aligned} & \max a_i \{ \alpha \max s_j v(a_i, s_j) + (1-\alpha) \min s_j v(a_i, s_j) \}; \text{ if } v \text{ is "higher the better"} \\ & \min a_i \{ \alpha \min s_j v(a_i, s_j) + (1-\alpha) \max s_j v(a_i, s_j) \}; \text{ if } v \text{ is "lower the better"} \end{aligned}$$

III. Hypotheses

- H1: Patients saliently affiliate empathy with their satisfaction.
- H2: Patients saliently affiliate tangibility with their satisfaction.
- H3: Patients saliently affiliate assurance with their satisfaction.
- H4: Patients saliently affiliate responsiveness with their satisfaction.
- H5: Patients saliently affiliate reliability with their satisfaction.
- H6: There exists a difference between the perception of the public and private healthcare services.

IV. RESEARCH METHODOLOGY

The whole portion describes the process used to gather information and data for the purpose of performing the research and assessment needed for the decision-making process. The methodology includes Surveys, other research techniques which includes both present and historical data. Research based on a quantitative model (Grey Analysis). The Research is undertaken to find out patients' satisfaction towards services rendered by public and private healthcare institutions using SERVQUAL model. This study focuses on both primary and secondary information sources. Secondary data are collected through various sources in order to gain some

insight into the actual research problem. The study was then based on questionnaire preparation. Through the questionnaire it is intended to first identify whether quality rendered by healthcare institutions have significant influence on the satisfaction of the patients. Data was gathered from the patients through self-administrated questionnaire. The secondary data that is used for this study is collected from internet, catalogues, and articles. Grey Relational Analysis (GRA) is used to analyze patients' satisfaction over public and private sector hospitals in Bangalore.

V. RESULTS

Tables 5.1 and 5.2 displays the quantitative analysis of data through of GRA model for the private and public healthcare service providers. Deng's GRA model indicate that patients perceive tangibility among private hospitals as having the greatest effect (and association) on their satisfaction with hospital service offerings.

A. Deng's Grey Relational Analysis:

Table 5.1 Grey Relational Analysis for Public Healthcare Organisation:

PUBLIC HEALTHCARE ORGANISATION (a ₁)		
Dimensions	GRG	Rank
Tangibility (S ₁)	0.6186	2
Empathy (S ₂)	0.5495	5
Responsiveness (S ₃)	0.5688	4
Reliability (S ₄)	0.6073	3
Assurance (S ₅)	0.6270	1

The above model reveals that a Public health care facility's assurance is the most important factor contributing to the patient satisfaction of public hospitals, followed by tangibility, reliability, responsiveness and empathy.

Table 5.2 Grey Relational Analysis for Private Healthcare Organisation:

PRIVATE HEALTHCARE ORGANISATION (a ₂)		
Dimensions	GRG	Rank
Tangibility (S ₁)	0.6509	1
Empathy (S ₂)	0.5409	3
Responsiveness (S ₃)	0.4916	5
Reliability (S ₄)	0.5302	4
Assurance (S ₅)	0.5822	2

Deng's GRA model for private healthcare facilities demonstrates that patients interpret tangibility as having the greatest influence on their satisfaction with hospital services. Empathy, reliability and sensitivity accompanied by Assurance.

B. Hurwitz Criteria:

Table 5.3 The sixth hypothesis is being tested using the Hurwitz criterion. Rating the dimensions of quality that contribute to patient satisfaction,

Private Healthcare Organisation	GRG	Assurance > Tangibility > Reliability > Responsiveness > Empathy
Public Healthcare Organisation	GRG	Tangibility > Assurance > Empathy > Reliability > Responsiveness

Table 5.4 Defining the parameter of the decision:

Goal	Measurement of the grey relationship (association) between patient satisfaction and quality of healthcare services in the public and private healthcare organisation.
Criteria (A _i), J=1,2,3,4,5,..n	Tangibility (A ₁), Empathy (A ₂), Responsiveness (A ₃), Reliability (A ₄), Assurance (A ₅)
Alternative actions (b _i); i = 1, 2, ..., m	Grey relation was superior in private healthcare organisation (b ₁), Grey relation was superior in public healthcare organisation (b ₂).

Table 5.5 The Criteria- actions Matrix:(Refer Table 5.1,5.2)

i	A ₁	A ₂	A ₃	A ₄	A ₅
b ₁	.6509	.5409	.4916	.5302	.5822
b ₂	.6186	.5495	.5688	.6073	.6270

Formula: $\max_i \{ \alpha \max_j \nu(a_i, s_j) + (1-\alpha) \min_j \nu(a_i, s_j) \}$.

i. For Optimistic patients:

For optimistic patients, by considering $\alpha = 0.3$, the following results were obtained;

$$a_1: (0.3)0.6509 + (0.7)0.4916 = 0.5393$$

$$a_2: (0.3)0.6186 + (0.7)0.5495 = 0.4560$$

ii. For Moderate patients:

Among moderate patients with no intense optimism or extreme pessimism, the following findings were obtained by considering $\alpha = 0.5$;

$$a_1: (0.5)0.6509 + (0.5)0.4916 = 0.5712$$

$$a_2: (0.5)0.6186 + (0.5)0.5495 = 0.5840$$

iii. For Pessimistic patients:

For pessimistic patients, by considering $\alpha = 0.7$, the following results were obtained;

$$a_1: (0.7)0.6509 + (0.3)0.4916 = 0.6031$$

$$a_2: (0.7)0.6186 + (0.3)0.5495 = 0.5978$$

The strength level between patient satisfaction and efficiency measurements for moderate patients are approximately approaching each other. Furthermore, depending on the experiences of negative and positive patients, it can be argued that patients in the private healthcare organisations have more strongly associated their view of the quality of health care services to their satisfaction with the services. This means that patients are more likely to be satisfied with health care facilities in the private sector.

VI. CONCLUSION

The results show that private hospitals in Bangalore play a meaningful role, supporting their presence, continuation and development. Nonetheless, respondents thought there was a growing trend in the quality of healthcare services. The quality of healthcare facilities provided in the city of Bangalore has always been exceptional, the reasons being peaks in the standard of the service, the continuous upgrade of technical drift facilities has paved the way for the city to become a medical tourism destination in recent years. With continuous support from state and center governments, the service offering provided by public hospitals has been remarkably distinguished, has made the services cost-effective and better quality offering. With this analysis, we can

conclude that, as the current study indicates, responsiveness dimension is most likely to be important for patients in the public and private healthcare institutions, and reliability is most likely to be important for patients in the public hospitals. Therefore, if the private sector compromised sensitivity in relation to other dimensions and the public sector compromised efficiency in relation to other dimensions, then the problems would increase.

VII. REFERENCE

1. B, R., & M, H. (2018). The Impact of Service Quality Dimensions on Patient Satisfaction in the Private Healthcare Industry in Pakistan. *Journal of Hospital & Medical Management*, 04(01). doi: 10.4172/2471-9781.100044.
2. Aman, F. Abbas. (2016) Patient's perceptions about the service quality of public hospitals located at District Kohat. *Journal of the Pakistan Medical Association* · January 2016, 66(1):72-75.
3. Bahadori, M., Teymourzadeh, E., Bagejan, F. F., Ravangard, R., Raadabadi, M., & Hosseini, S. M. (2018). Factors affecting the effectiveness of quality control circles in a hospital using a combination of fuzzy VIKOR and Grey Relational Analysis. *Proceedings of Singapore Healthcare*, 27(3), 180–186. doi: 10.1177/2010105818758088
4. Javed, S. A., Liu, S., Mahmoudi, A., & Nawaz, M. (2018). Patients satisfaction and public and private sectors health care service quality in Pakistan: Application of grey decision analysis approaches. *The International Journal of Health Planning and Management*, 34(1). doi: 10.1002/hpm.2629.
5. Mohammadi-Sardo & Salehi (2019). Emergency Department Patient Satisfaction Assessment using Modified Servqual Model; a Cross-sectional Study. *Advanced Journal Of Emergency Medicine*. 2019; 3(1): e3. DOI:10.22114/ajem.v0i0.107.
6. Sallehuddin, R., Shamsuddin, S. M. H., & Hashim, S. Z. M. (2008). Application of Grey Relational Analysis for Multivariate Time Series. 2008 Eighth International Conference on Intelligent Systems Design

- and Applications. doi: 10.1109/isda.2008.181
7. Shabbir, A., Malik, S. A., & Malik, S. A. (2016). Measuring patients' healthcare service quality perceptions, satisfaction, and loyalty in public and private sector hospitals in Pakistan. *International Journal of Quality & Reliability Management*, 33(5), 538–557. doi: 10.1108/ijqrm-06-2014-0074
 8. Singh, P. P. (2013). Comparison of Service Quality between Private and Public Hospitals: Empirical Evidences from Varanasi District in up. *Paradigm*, 17(1-2), 37–46. doi: 10.1177/0971890720130105.
 9. Parasuraman A, Zeithaml VA, Berry LL. SERVQUAL: a multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*. 1988;64(1): 12-40.
 10. Javed, S. A., & Liu, SF. (2017). Evaluation of project management knowledge areas using grey incidence model and AHP. *Proceedings of the 6th IEEE International Conference on Grey Systems and Intelligent Services*. Stockholm, Sweden: IEEE. <https://doi.org/10.1109/GSIS.2017.8077684>

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