



## MEASUREMENT OF SERVICE QUALITY AND ITS IMPACT ON PATIENT SATISFACTION IN HOSPITALS USING STATISTICAL DATA AND PLS ANALYTICAL TOOLS

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### ABSTRACT

Service quality is being considered as the prime factor in their branding strategy which has been evident through the advertisements focused on care and quality. Therefore, offering best possible service quality has become the competitive edge for managements where in the technological equipment's are installed with every hospital and Service quality is considered for ROI (Return on investment). This means that service-based companies are compelled to provide some excellent services to their customers in order to have sustainable

competitive advantage. There is however, a need for these organizations to understand what service quality is in order to achieve their objectives.<sup>[1]</sup>

Assessing healthcare quality is more complex than other service products, because customer himself and the quality of his treatment by the hospital are evaluated. Certain instances, like the technical details of treatment may not be understood by the customers/patients and the role of the hospital staff becomes critical in efficient service quality delivery.

The SERVQUAL dimensions are put in to assessment against the patient's perception of quality with regard to the physical facilities in the hospital; It is also considered that the tangible things of service facility such as equipment, machinery, signage, employee appearance, and artificial material environment prevalently called 'services capes', More over it encompasses the other important parameters like cleanliness, availability of services, visually appealing into SERVQUAL model as tangibles. Tangibles have also been considered by various other researchers such as E. Anderson, and T. Taner 1995.<sup>[2]</sup>

With this background, this study aims at empirically assessing the relationship between service quality and customer satisfaction. The customer satisfaction is a key marketing variable, widely used in marketing literature in the context of customer retention and positive word of mouth communication.

### **I Need for the study**

The mushrooming of various forms of clinics and treatment modalities in particular the multi-specialty hospitals seems to be on the increase. There is a possibility of lack of provision of service quality or deterioration could be visible in these hospitals. More visits and in-depth study are required to assess the service quality. India witnessed one of the highest in child mortality, increased incidences of heart ailments and so studying on the service quality is vital for the patients and society at large. The successful management of offering the best treatment along with excellent service will have significance of service quality rendered by the hospitals.

Those who are highly satisfied or delighted with the hospital are much less ready to shift. High satisfaction or delight creates an emotional bond with the hospital in the mind of the patient, not just rational preference. The result is high patient loyalty, which is what every hospital is looking at, to cut the competition. The basic idea of the interplay between factors such as quality of health care services, its outcome, and patient satisfaction, has become an invaluable input for designing and managing health care systems in India.

### **II Motivation and problem statement**

The assessment of service quality and the impact of the same with regard to customer satisfaction is a highly challenging task owing the various complexities involved with the service products, because it is the customer is the patient and the quality of his or her treatment by the hospital that are evaluated. In this context it is highly recommended that the services are delivered without any flaw or in other words Zero defect in order to satisfy their customers.

### **III Objectives of the study**

The Service quality perception positively affects customer satisfaction. Customer satisfaction may depend on the level of service quality provided by the multi-speciality hospitals to their patients.

The review of literature suggested that service quality can make customer satisfaction among patients. In other words, it is an indication that the patients would make repeat visits to the hospital for treatment and follow up while complimenting the various services rendered to them. Service quality is important from the research point of view, because the focal relationships in this study depend on service quality at various multi speciality hospitals.

#### **IV Theoretical Foundation and Hypothesis Framework**

A healthcare service is one that requires high consumer involvement in the consumption process, and Lengenick-Hall (1995) argued that the traditional health sector views of quality and patient satisfaction were inadequate to manage the complex relationships between the healthcare provider and the patient. Importantly, effective healthcare relies significantly on the co-contribution of the patient to the service delivery process. Studies have also shown compliance with medical advice and treatment regimes is directly related to the perceived quality of the service and the subsequent resulting health outcome.<sup>[3]</sup>

#### **V Research Design**

“The research design is the blue print for the collection, measurement, and analysis of data” Cooper & Schindler, 2003.<sup>[4]</sup> The research activity on a time-based plan is the essence of research design. The research design helps the researcher in assigning the resources by posing crucial choices in methodology.

The descriptive is a kind of research suitable for formalized studies which are structured with stated hypothesis. This study uses descriptive research as the domain has plenty of literatures to formulate the hypotheses and this study is cross sectional. There has been a review of over 290 journals and articles in the domain in order to identify the possible research gap. To cite a few examples viz. Managing Service Quality, Journal of Marketing, Journal of Academy of Marketing Sciences, Journal of Marketing Research and Health care Marketing Review.

The review process has identified three service quality models which have many numbers of empirical support and they are SERVPERF (of Joseph and Cronin), SERVQUAL (Parasuram et al) and Gronroos Service quality model. Based on the study requirements, the SERVQUAL model of service quality was adopted. The reason for adoption is that SERVQUAL model has RATER dimensions. These dimensions are required to capture the service quality offered by multi-speciality hospitals. The conceptual model was built using service quality perception as an exogenous variable and customer satisfaction as the endogenous variables. Needless to

mention that customer satisfaction variable is one of the most researched with many empirical studies conducted.

### **VI Sampling Method**

There are two stages of sampling in this study. The first stage is to select the hospitals and second stage is to choose samples from hospitals.

The methodology anticipated is to select the samples with a wide spread geographical territory, so bias can be minimized. The hospitals were chosen on the basis of speciality and National Accreditation Board of Hospitals & Healthcare Providers (NABH) report 2014-15.

#### **Stage I: Selecting Hospitals**

The hospital samples were selected using simple random sampling without replacement. The random sampling method was adopted in selecting Hospitals based on the NABH (National Accreditation Board for Hospitals) of Tamilnadu. The study had decided to have 25 hospitals in Tamil Nadu and this size can reduce the bias in the results.

#### **Stage II: Selecting respondents for the study**

The respondents were selected based on the services being rendered as IP (In Patient treatment) with the hospital for minimum number of five days. The hospital offering multi speciality treatment that means treatment for the different types of ailments was chosen for the study. The sampling unit in second stage is those patients, who make the repeated visit to hospital for their continuation of treatment. This was judged by the researcher as the study sampling unit.

#### **Constructs/concepts definition**

Six constructs were put in to operational in order to test the research model.

#### **Functional (process) quality**

Functional quality refers to the manner in which the health care service is delivered to the patient. Functional quality is usually the primary determinant of perceived service quality as postulated by Donabedian (1980, 1982); Kovner and Smits. (1978).

The five SERVQUAL dimensions were modified and applied to measure functional quality as stated by Parasuraman *et al.*,(1994). Tangibles - Physical facilities, equipment, and appearance of personnel in hospitals; Assurance - Knowledge and courtesy of employees

and their ability to inspire trust and confidence; Responsiveness - Willingness to help customers and provide prompt service; Reliability - Ability to perform the promised service dependably and accurately; Empathy - Caring, the individualized attention the firm provides its customers.

Following the suggestions made by Parasuraman *et al.*, (1994), taken only the perceptions and not the expectations of functional quality were measured. All 32 items were presented as statements on the questionnaire and they were measured using 5-point scales anchored by “Strongly disagree” (1) and “Strongly agree” (5).

#### **VI Customer satisfaction (Outcome) Quality**

It is an indication of the customer’s belief of the probability of a service leading to a positive feeling. Service quality and satisfaction are highly correlated and service quality is an antecedent of customer satisfaction (Anderson & Fornell, 2000; Chou & Kim, 2009; Churchill, 1982; Liu & Zhao, 2005; Olsen, 2002). Rust and Oliver (1994) define satisfaction as the “customer’s fulfillment response” which is an evaluation as well as an emotion-based response. Satisfaction is believed to be an attitudinal response to value judgments that patients make about their clinical encounter as stated by Kane *et al.*, 1997. Several studies conclude that satisfaction is an affective, rather than cognitive, construct (Oliver, 1997; Olsen, 2002).

#### **VII Measures**

Six constructs which includes customer satisfaction were put in to operational in order to test the research model. The constructs are reflective. The response format is a 5 point Likert scale. The anchor points of all the questions vary from “strongly disagree” =1 to “strongly agree” =5.

The construct “Functional Quality” contains five dimensions such as tangibility, reliability, assurance, empathy and responsiveness and customer satisfaction to define the second order construct.

#### **VIII Questionnaire**

The research design is descriptive in nature. It is a cross sectional study. Data were collected by using a questionnaire which has 32 items developed to assess the service offering to the patients. The questionnaire was tested with patients to check the reliability, content validity,

as a part of pilot study. This scale is generated and validated within hospital domain and along with the results of the pilot study suggest that no scale modification was required. All the items in were presented as statements on the questionnaire, with the same rating scale used throughout, and measured on a 5-point, Likert-type scale that varied from 1 strongly disagree to 5 for strongly agree.

Data were collected by administering questionnaire among patients who are selected by the use of judgement sampling method and undergone treatment with 25 multi-speciality hospitals situated in various locations on the state of Tamil Nadu. Data were collected using the “personal-contact” approach. The sample size is 395.

Questionnaire is made up of six theoretical constructs. Since the data is multi variate non-normal in nature. Interdependent multi variate techniques were applied to analyse the study by using Partial Least Square Structural Equation Modelling (PLS-SEM).

The study model has six constructs with 32 measures/items. These items of all the constructs have been adopted from the literature and modified to suits the basic Indian cultural scenario. These questions were simplified and modified in a manner that the core meaning has not changed.

The questionnaire has been translated into Tamil and translated back into English by language experts and this is called as double translation in qualitative research and this is a form of validity. During the double translation, if the target output is similar and close to the original, then it is valid and we found that the output is similar in our study. Besides this, the content validity is assessed by sending questionnaires to the four domain experts to discover any ambiguous items in the questionnaire. The constructs used in this study are reflective and thus follow classical test theory. According to classical test theory, reliability and validity are important pillars of research. The study does not possess any formative construct/Index and thus the study treat classical test theory as a basis. The software used for analysis of data was SPSS 21 and SMART PLS version 3.0.

## **IX DATA ANALYSIS AND INTERPRETATION**

This chapter discusses the various measurement models and tests performed to prove the service quality and customer satisfaction in multi-speciality hospitals. To understand the impact of the RATER model, the study first performs the frequency measures, which

determines the percentage of opinion for each item. The test of Independence is performed using Chi square test and the levels were found to be significant. The Skewness, Kurtosis, mean and standard deviation was calculated and the data was found to be non-normal. Thus, PLS was used for this study as PLS supports both normal and non-normal data. The study calculated the Reliability of the constructs and found the Cronbach alpha to be more than accepted level of 0.7. The study also calculated the correlation coefficients among constructs and found them to be significant.

To remove the common method bias, Harman's single factor test was performed and found that the t value is less than accepted level of 0.5. The Structural Relations Model concluded that all the hypothesis and the paths were significant. The Average Variance Extracted (AVE) is greater than 0.5, which concluded that the data possess convergent validity characteristics. The Hetero Trait and Mono Trait ratio was calculated and found that the data possess Discriminant validity. The predictive relevance Q2 was calculated and found to be greater than zero, thus the model can be tested in other data sets. The Global fit index is 0.556 which is greater than the accepted level of 0.336.

### **IX (1) Measurement Assessment**

The study model has six constructs with 32 measures/items. These items of all the constructs have been adopted from literature and modified to suit the Indian culture. These questions have been modified without changing the core meaning.

The questionnaire has been translated into Tamil and translated back into English by language experts; this procedure, called double translation in qualitative research, is a form of validation.<sup>[6]</sup> During the double translation, if the target output is similar and close to the original, then it is valid and we found that the output is similar in our study. Besides this, the content validity is assessed by sending questionnaires to the four domain experts to discover any ambiguous items in the questionnaire. The constructs used in this study are reflective and thus follow classical test theory. According to the classical test theory, reliability and validity are important pillars of research. The study does not possess any formative construct/Index and thus it treats classical test theory as a basis. The software used for analysis of data was SPSS 21<sup>[7]</sup> and SmartPLS 3.0.<sup>[8]</sup>

**IX (2) Frequency Table of Measures**

The missing data are analysed and imputed using Expectation Maximization (EM) algorithm. The study proposes to apply EM algorithm because of its superiority over other popular imputation techniques like Mean imputation.

**IX (3) TEST OF HYPOTHESES****(1) Chi-Square Test**

**Null-Hypothesis (Ho):** Gender of the respondents is independent towards their opinion on making patients feel safe in the hospital services.

**Table 1: Chi Square Test Result- Gender Vs Patients feel safe in the hospital services.**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.169 <sup>a</sup>	4	.883
Likelihood Ratio	1.171	4	.883
Linear-by-Linear Association	.047	1	.828
N of Valid Cases	395		

Pearson Chi-Square Value (P) = .883

Level of Significance (L) = .05

.883 > .05

P > L

Hence, Ho is accepted.

**Interpretation:** Gender of the respondents is independent towards their opinion on making patients feel safe in the hospital services.

**(2) Chi-Square Test - Gender Vs Patients feel safe in the hospital services**

**Null-Hypothesis (Ho):** Gender of the respondents is independent towards their opinion on dependability in handling patients and services performed.

**Table 2: Chi Square Test Result - Gender Vs Patients feel safe in the hospital service.**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.181 <sup>a</sup>	4	.702
Likelihood Ratio	2.135	4	.711
Linear-by-Linear Association	.729	1	.393
N of Valid Cases	395		



Pearson Chi-Square Value (P) = .702

Level of Significance (L) = .05

.702 > .05

P > L

Hence, Ho is accepted.

**Interpretation:** Gender of the respondents is independent towards their opinion on dependability in handling patients and services performed.

### (3) Chi-Square Test – Age group Vs Feel good about the decision to use this hospital

**Null-Hypothesis (Ho):** Age group of the respondents is independent towards their opinion on feel good about the decision to use this hospital.

**Table 3: Chi Square Test Result - Age group Vs Feel good about the decision to use this hospital.**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.930 <sup>a</sup>	16	.024
Likelihood Ratio	27.449	16	.037
Linear-by-Linear Association	.000	1	.985
N of Valid Cases	395		

Pearson Chi-Square Value (P) = .024

Level of Significance (L) = .05

.024 < .05

P < L

Hence, Ho is rejected.

**Interpretation:** Age group of the respondents is not independent towards their opinion on feel good about the decision to use this hospital.

### 4. Chi-Square Test – Educational qualification Vs Employees understand the need of their patients

**Null-Hypothesis (Ho):** Educational qualification of the respondents is independent towards their opinion on employees understand the needs of their patients.

**Table 4- Chi Square Test Result - Educational qualification Vs Employees understand the need of their patients.**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.493 <sup>a</sup>	16	.001
Likelihood Ratio	31.771	16	.011
Linear-by-Linear Association	6.018	1	.014
N of Valid Cases	395		

Pearson Chi-Square Value (P) = .001

Level of Significance (L) = .05

.001 < .05

P < L

Hence, Ho is rejected.

**Interpretation:** Educational qualification of the respondents is not independent towards their opinion on employees understand the needs of their patients.

### 5. Testing of hypotheses by multi group analysis in PLS

**Null-Hypotheses (Ho):** There is no significant difference between marital status of the respondents towards their opinion on quality dimension leads to service quality.

**Table 5: Multigroup analysis in PLS.**

	p-Value (MSmar_st(1.0) vs MSmar_st(2.0))	Sig.
<b>Assurance -&gt; service quality</b>	0.847	Not Sig.
<b>Empathy -&gt; service quality</b>	0.539	Not Sig.
<b>Reliability -&gt; service quality</b>	0.221	Not Sig.
<b>Responsiveness -&gt; service quality</b>	0.816	Not Sig.
<b>Tangibility -&gt; service quality</b>	0.025	Sig.

Marital Status of respondents coded as: (1) Unmarried and (2) Married.

Path is significant, if P value should be less than .05 or it should be greater than .95.

Here, Tangibility → Service quality path is significant with P value of 0.025

### Interpretation

There is no significant difference between the marital status of respondents towards their opinion on assurance leads to service quality.

There is no significant difference between the marital status of respondents towards their opinion on empathy leads to service quality.

There is no significant difference between the marital status of respondents towards their opinion on reliability leads to service quality.

There is no significant difference between the marital status of respondents towards their opinion on responsiveness leads to service quality.

There is a significant difference between the marital status of respondents towards their opinion on tangibility leads to service quality.

## 6. DESCRIPTIVE STATISTICS

The descriptive statistics were analyzed for the mean, standard deviation, skewness and kurtosis of every measures/items.

**Table 6: Descriptive Statistics.**

Items	Mean	Std. Deviation	Skewness	Kurtosis
E1	4.13	.854	-1.387	2.382
E2	4.10	.975	-1.483	2.151
E3	4.20	.850	-1.212	1.932
E4	3.98	1.009	-1.366	1.581
E5	3.95	1.022	-1.239	1.239
E6	3.75	.884	-.935	.433
T1	3.67	1.248	-.746	-.615
T2	3.45	1.221	-.595	-.683
T3	3.98	.968	-1.113	.870
T4	3.92	1.020	-1.316	1.333
T5	3.78	1.125	-.941	.084
R1	3.80	1.182	-1.057	.260
R2	3.97	1.007	-1.273	1.049
R3	3.87	1.120	-1.002	.814
R4	3.87		-1.042	.355
R5	4.04	.845	-1.041	1.016
A1	4.07	.907	-1.299	2.172
A2	3.90	1.071	-.977	.468
A3	3.95	.879	-1.035	1.476
A4	3.75	.885	-.917	.392
RS1	3.96	.981	-1.564	2.563
RS2	4.14	.817	-1.227	2.152
RS3	4.00	.992	-1.347	1.835
RS4	3.93	1.025	-1.089	.884
CS1	4.03	.823	-1.316	2.701
CS2	4.06	.808	-1.275	2.529
CS3	4.07	.771	-1.326	3.175
CS4	4.06	.785	-1.280	2.836

CS5	3.77	.873	-.917	.409
CS6	3.75	.894	-.995	.640
CS7	3.78	.859	-.909	.381
CS8	3.73	.903	-.960	.487

**Interpretation:** The above Table concludes that the data is non-normal, hence data transformation is carried out to correct the non-normality. Two common patterns of non-normal distribution are flat distribution and skewed distribution. As the distribution is skewed in this case, the negatively skewed distribution is transformed by employing cubed distribution and logarithmic distribution (Joseph F. Hair et.al).

## 7. RELIABILITY ANALYSIS

The classical test theory suggest that the reliability has an observed score X as made of two independent components: true score (O) and Error score (E), Therefore, reliability = Variance of observed score var (X)/variance of true score (O) and the value of reliability, will in the range of 0 to 1.

**Table 7: Reliability of Constructs.**

Construct	Number of items	Cronbach's Alpha
Reliability	5	0.737
Assurance	4	0.709
Tangibility	5	0.792
Empathy	6	0.747
Responsiveness	4	0.762
Customer Satisfaction	8	0.781

**Interpretation:** The above Table concludes that all the constructs for RATER scale have internal consistency and are Unidimensional and the value of Cronbach alpha for the constructs is above 0.7.<sup>[9]</sup>

### 7. (1) CORRELATION

The correlation coefficients among constructs are given below.

**Table 8: Correlations among constructs.**

	Constructs	1	2	3	4	5
1	Tangibility	1.00				
2	Reliability	0.638	1.00			
3	Responsiveness	0.611	0.736	1.00		
4	Assurance	0.622	0.763	0.707	1.00	
5	customer satisfaction	0.353	0.413	0.486	0.513	1.00

**Interpretation:** The above table concludes that correlation coefficients among constructs are positive and significant at 0.001 levels. The correlation among constructs indicates that it is suitable for structural equation modelling as SEM is a correlation/covariance-based technique.<sup>[10]</sup> The lower level constructs for RATER scale have internal consistency and interpreted as Unidimensional, as the Cronbach alpha is above 0.7.

## 8. TESTING FOR COMMON METHOD BIAS

The items used in this study are of the self-reporting type and there could be problems due to common method variance. There are number of pre hoc and post hoc methods used, after collecting the data. The questionnaire was prepared with mixing the questions of the study constructs as a pre hoc treatment for common method bias. A widely used post hoc method is Harman's single factor test<sup>[11]</sup> that uses exploratory factor analysis.

In this method, the factor is fixed to one, and the solution is unrotated; if the variance extracted is less than 50 per cent, it indicates that the data does not have the problem of common method variance. The limitation of the Harman's single factor test is that it does not control the method effects.<sup>[12]</sup>

**Table 9: Harman's Single Factor Test.**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.562	33.006	33.006	10.562	33.006	33.006
2	2.654	8.295	41.300	2.654	8.295	41.300
3	1.662	5.195	46.495	1.662	5.195	46.495
4	1.368	4.276	50.771	1.368	4.276	50.771

**Interpretation:** The above Table concludes that the study has 33 Per cent variance which is much below the minimum of 50 per cent, which suggests that there are no threats of common method variance.

## 9. STRUCTURAL EQUATION MODELLING (SEM)

The method of SEM is used for theory testing and is one of the major multivariate statistical tools.<sup>[13]</sup> SEM is also called latent variable modelling. SEM has seen a dramatic rise in utilization and attention and has become the technique of choice in investigating the relationship among latent constructs over the last decade.<sup>[14]</sup>

This technique combines factor analysis and multiple linear regressions. Authors such as (Anderson & Gerbing, 1988)<sup>[15]</sup> have provided directions and proposed a two step approach in SEM Analysis i.e., the measurement and structural model. SEM has two major purposes - estimation of parameters such as covariance, factor loading etc., and data-model fitting of the proposed model, thereby assisting in theory testing and theory building. There are two major approaches in SEM, viz. covariance based SEM and Partial Least square SEM (Astrachan, Patel, & Wanzenried, 2014) or components based SEM.

SEM has various restraints such as measurement level, multi variate normality, sample size, model identification, and factor indeterminacy and is more difficult for covariance-based SEM than PLS SEM.<sup>[16]</sup> The most common reason for using components-based SEM or PLS SEM is small sample size, multivariate non-normal and formative constructs.<sup>[17]</sup> The study has applied the PLS SEM, owing to non-normality, small sample size, etc. To analyze the PLS path modelling, the study uses the repeat indicator approach for evaluating the higher order constructs<sup>[18]</sup> - functional quality and perceived service quality.

**Table 10: Measurement Model.**

Constructs	Items	Loadings	t value	Alpha	C.R.	AVE
Assurance	Assurance1	0.829	36.462	0.705	0.835	0.629
	Assurance2	0.767	27.129			
	Assurance3	0.781	24.859			
Empathy	Empathy1	0.800	26.518	0.756	0.845	0.578
	Empathy2	0.764	24.021			
	Empathy3	0.869	22.469			
	Empathy4	0.737	17.205			
Reliability	Reliability 1	0.737	24.692	0.718	0.825	0.542
	Reliability 2	0.731	22.344			
	Reliability 4	0.730	22.904			
	Reliability 5	0.746	23.217			
Responsiveness	Responsiveness 1	0.793	30.159	0.769	0.852	0.592
	Responsiveness 2	0.836	46.944			
	Responsiveness 3	0.711	18.06			
	Responsiveness 4	0.73	20.838			
Tangibility	Tangibility 1	0.774	31.227	0.797	0.868	0.623
	Tangibility 2	0.772	30.011			
	Tangibility 3	0.869	73.702			
	Tangibility 4	0.737	19.4898			
Customer satisfaction	Customer satisfaction 1	0.762	21.423	0.8	0.87	0.625
	Customer satisfaction 2	0.784	24.188			
	Customer satisfaction 3	0.795	25.762			
	Customer satisfaction 4	0.821	33.745			

**Interpretation:** The above Table 5.48 concluded that the Average Variance Extracted (AVE) is more than the accepted level of 0.5 hence it is significant. The AVE and the Construct Reliability (C.R) are significant at 0.05 and 0.001 levels.

**Table 11: Structural Relations in the Model.**

Hypothesis	Sig. or Non-Sig.
H1: Reliability is positively related Service Quality Perception	Sig.
H2 : Assurance is positively related to Service Quality Perception	Sig.
H3: Tangibility is positively related to Service Quality Perception	Sig.
H4: Empathy is positively related to Service Quality Perception	Sig.
H5: Responsiveness is positively related to Service Quality Perception	Sig.
H6: Service quality is positively related to Customer satisfaction	Sig.

**Interpretation:** The above Table concluded that all the above hypotheses proposed in the hypothesized model are significant.

**Table 12: Structural Relations Path Values.**

Hypotheses	Paths	Beta	t Values
H <sub>1</sub>	Service Quality -> Assurance	0.833**	33.508
H <sub>2</sub>	Service Quality -> Empathy	0.844**	33.529
H <sub>3</sub>	Service Quality -> Reliability	0.858**	54.501
H <sub>4</sub>	Service Quality -> Responsiveness	0.870**	52.993
H <sub>5</sub>	Service Quality -> Tangibility	0.82**	20.78
H <sub>6</sub>	Service Quality -> Customer Satisfaction	0.630**	12.348
	** All paths are significant at p<0.001 and * significant at p<0.05		

**Interpretation:** The above Table concluded that all paths proposed are significant at 0.01 levels.

## X VALIDITY

### X (1) CONVERGENT VALIDITY

Average Variance Extracted (AVE) is used for the assessment of the convergent validity of individual constructs. If the AVE values are greater than 0.5, then it fulfills the convergent validity. The AVE value present in the Table 5.48 shows they are above 0.5, indicating the presence of convergent validity in the construct. Further to this, the factor loading for the measures of the study are at least above 0.5, suggest that they possess the convergent validity.

## X (2) DISCRIMINANT VALIDITY

Discriminant validity is used for assessing the difference, if any, in the constructs. If present, the constructs has discriminant validity. The study uses the Hetero Trait Mono Trait (HTMT) ratio which was suggested for PLS-SEM based analysis.

The discriminant validity is usually performed by comparing the average variance extracted (AVE) with square inter construct correlation and the value of AVE should be more than the squared inter construct correlation, which suggests the presence of discriminant validity in the construct. This is according to Fornell and Larcker (1981) suitable for covariance based SEM like Amos, LISREL etc., Recently, Henseler, Ringle, and Sarstedt (2015) have suggested a new method called HTMT ratio for variance based SEM like PLS SEM. These authors suggested that the value for the HTMT should be below the criterion value 0.85.

This analysis is performed by SmartPLS 3.0. HTMT ratio is defined as the “the ratio of average correlations between constructs to geometric mean of average correlations within measures of the same constructs”<sup>[19]</sup>.

**Table 13: Heterotrait-Monotrait Ratio (HTMT).**

	Assurance	Cust Satisfaction	Empathy	Reliability	Responsiveness	Tangibility
Assurance						
Cust Satisfaction	0.603					
Empathy	0.834	0.774				
Reliability	0.836	0.561	0.823			
Responsiveness	0.830	0.648	0.823	0.834		
Tangibility	0.777	0.443	0.742	0.723	0.753	

**Interpretation:** The above Table concluded that The HTMT ratio values are below 0.85, which indicate the constructs employed in the study have fulfilled discriminant validity.

**Table 14: Fornell-Larcker Criterion – Squared Inter Construct Correlation (SIC).**

	Assurance	Cust. Satisfaction.	Empathy	Reliability	Responsiveness	Tangibility
Assurance	<b>0.793</b>					
Cust Satisfaction.	0.513	<b>0.651</b>				
Empathy	0.633	0.648	<b>0.760</b>			
Reliability	0.672	0.472	0.646	<b>0.736</b>		
Responsiveness	0.680	0.574	0.694	0.712	<b>0.769</b>	
Tangibility	0.587	0.402	0.578	0.550	0.600	<b>0.790</b>



**Interpretation:** The above Table shows how much variance in the indicators that can explain the variance in the construct. Recommended approach to test for discriminant validity on the construct level are AVE-SE comparisons (Fornell-Larcker, 1981).

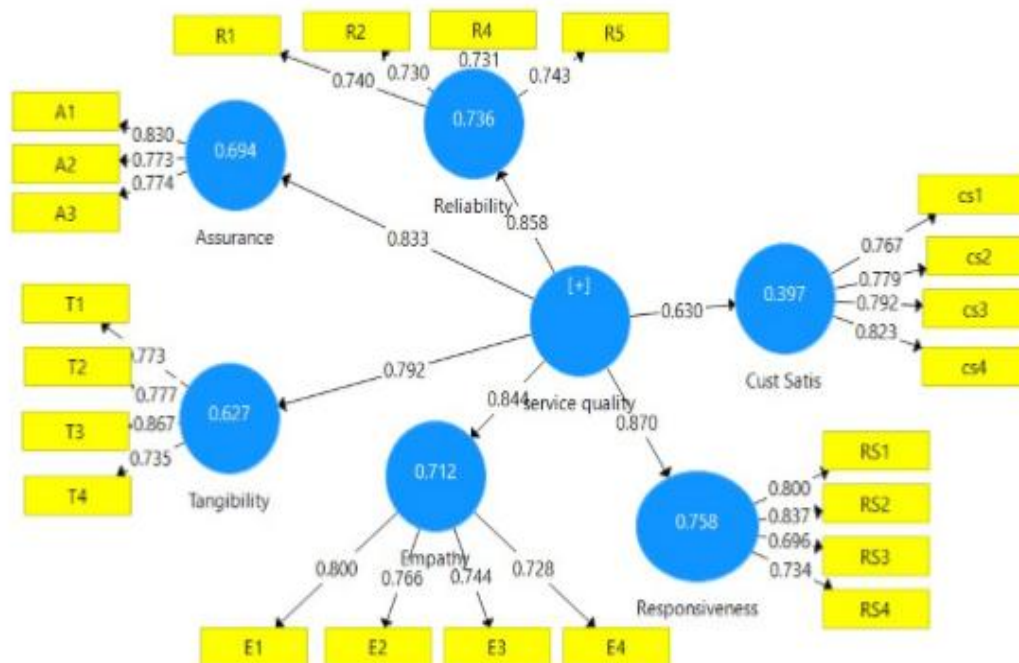


Figure 1: PLS – Loading Values Of Path Diagram.

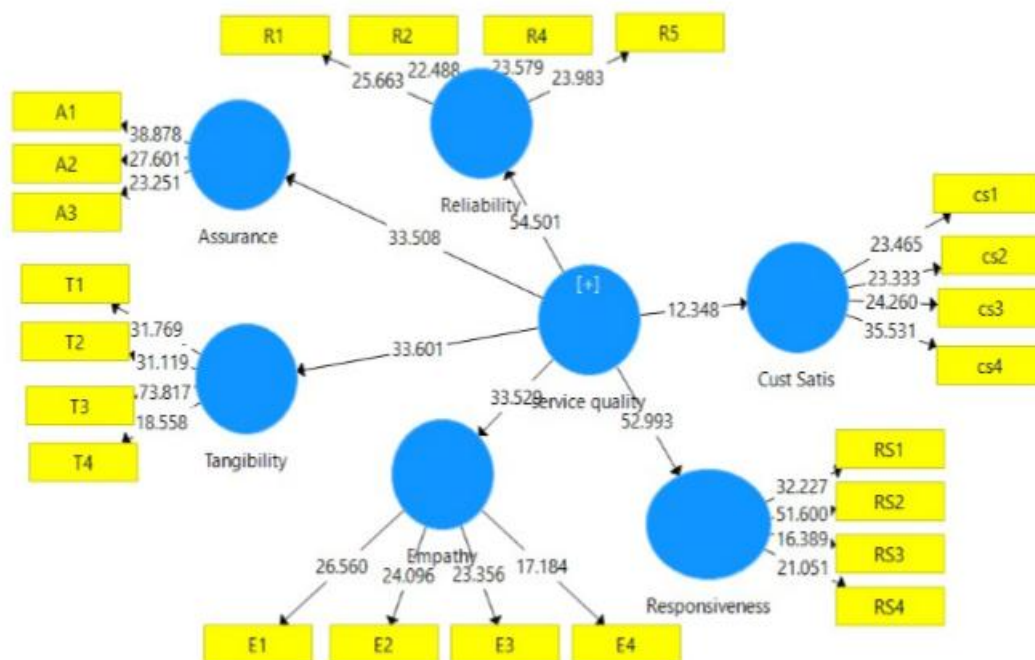
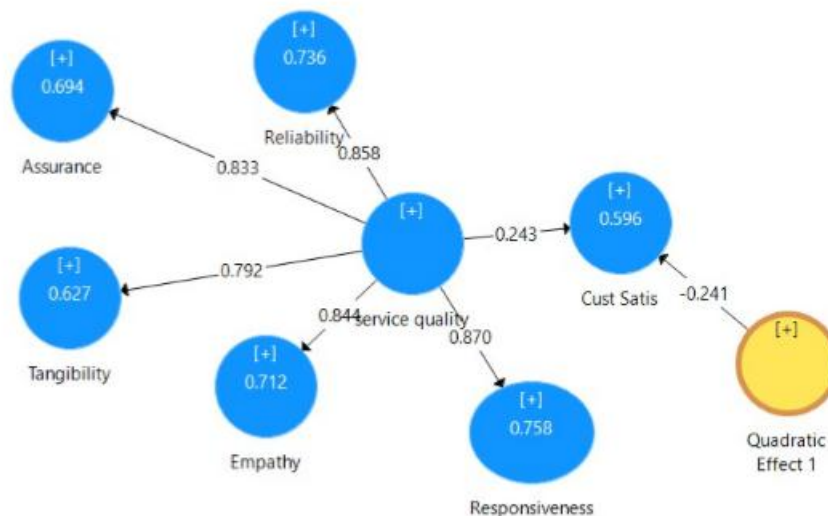


Figure 2: PLS – T Statistics Model Diagram.

**(SERVICE QUALITY AND CUSTOMERS SATISFACTION)**

**Figure 3: PLS-Quadratic Effect Diagram.**

### Interpretation

The PLS –Beta loading values of path diagram (Fig.5.39) confirms significance relation, as values of all measurement are above .70.

The t statistics values of the all the paths are well above than 2, (Fig. 5.40) which confirms the significance of path and model fitness.

Quadratic effect (Fig. 5.41) between service quality and customers satisfaction is -0.241. This analysis result confirms the relationship of increase in service quality leads to increase in customer's satisfaction; it behaves like positive relationship, but beyond the particular point it started showing negative relationship. It is evident that taxing money in terms of quality is not compromised by patients beyond the genuine price, in hospital health care sector.

### XI Predictive Relevance ( $Q^2$ )

The predictive relevance of the manifest variables to its latent construct is assessed through  $Q^2$  measure.

**Table 15: Predictive Relevance of constructs.**

	Q <sup>2</sup>
Assurance	0.415
Cust Satisfaction	0.132
Empathy	0.386
Reliability	0.378
Responsiveness	0.421
Tangibility	0.368

**Interpretation:** The above Table concludes that the predictive relevance is anything above zero ( $Q^2 > 0$ ) hence it is considered as acceptable. Therefore, this model has predictive relevance.

## XII Model Fit

The Global Goodness of fit (GOF) is referred to as geometric mean of the average communality and average  $R^2$  for endogenous variables.

$$GoF = \sqrt{AVE} \times \sqrt{R^2}$$

The PLS was utilized for validating the model. The goodness of global fit of the model is 0.556, which is much above the cut off value of 0.336. The hypothesized paths are significant with the t values above +/- 2. The model has predictive relevance, which means it can be tested in other setup.

## XIII Findings

### XIII (1) Findings of the Chi-Square test

- Gender of the respondents is independent towards their opinion on making patients feel safe in the hospital services.
- Gender of the respondents is independent towards their opinion on dependability in handling patients and services performed.
- Age group of the respondents is not independent towards their opinion on feel good about the decision to use this hospital.
- Educational qualification of the respondents is not independent towards their opinion on employees understand the needs of their patients.

### XIII (2) Findings of Multi group analysis in PLS

- There is no significant difference between the marital status of respondents towards their opinion on assurance leads to service quality.

- There is no significant difference between the marital status of respondents towards their opinion on empathy leads to service quality.
- There is no significant difference between the marital status of respondents towards their opinion on reliability leads to service quality.
- There is no significant difference between the marital status of respondents towards their opinion on responsiveness leads to service quality.
- There is a significant difference between the marital status of respondents towards their opinion on tangibility leads to service quality.

### XIII (3) Findings of Descriptive Statistics and PLS analysis

- The Reliability Statistics or Cronbach Alpha for this study was 0.821 with 32 items; which was much higher than the cutoff value of 0.7. This confirms the reliability of items.
- The skewness and kurtosis are well below the upper limit.
- The correlation coefficients among constructs were positive and significant at 0.001 levels. The correlation among constructs indicated that it was suitable for structural equation modelling as SEM is a correlation/covariance-based technique.
- The Harman's Single Factor Test was calculated and found the cumulative per cent of variance is 33 per cent which much below the accepted value of 50 per cent. This suggests that there are no threats of common method variance.
- The AVE values of all constructs are above 0.5, indicating the presence of convergent validity with constructs.
- The construct reliability is significant at 0.05 and 0.001 levels hence the hypotheses proposed are positive and significant.
- The Hetero Trait and Mono Trait Ratio test was carried out to confirm the constructs possess the discriminant validity. The HTMT value should be below the criterion value 0.85. The HTMT ratio values are below 0.85, which indicate the constructs employed in the study have fulfilled discriminant validity.
- All paths were\*\* significant at  $p < 0.001$  and \* significant at  $p < 0.05$  and these suggest that all the hypotheses (H1 to H6) proposed in the hypothesized model are significant.

H1: Reliability is positively related Service Quality Perception	Sig.
H2: Assurance is positively related to Service Quality Perception	Sig.
H3: Tangibility is positively related to Service Quality Perception	Sig.
H4: Empathy is positively related to Service Quality Perception	Sig.
H5: Responsiveness is positively related to Service Quality Perception	Sig.
H6: Service quality is positively related to Customer satisfaction	Sig.

- The PLS –Beta loading values of path diagram confirms significance relation, as values of all measurement are above .70.
- The t statistics values of the all the paths are well above than 2, which confirms the significance of path and model fitness.
- Quadratic effect between service quality and customers satisfaction is -0.241. This analysis result confirms the relationship of increase in service quality leads to increase in customer's satisfaction; it behaves like positive relationship, but beyond the particular point it started showing negative relationship. It is evident that taxing money in terms of quality is not compromised by patients beyond the genuine price, in hospital health care sector.
- The predictive relevance anything above zero ( $Q^2 > 0$ ) considers as acceptable therefore, this model has predictive relevance.
- The PLS was utilized for validating the model. The goodness of global fit of the model is 0.556, which is much above the cut off value of 0.336. The hypothesized paths are significant with the t values above +/- 2. The model has predictive relevance, which means it can be tested in other setup.

#### XIV CONCLUSION

After reviewing around 200 journals that focus on service quality paradigms, the Parasuraman service quality model was chosen for this study. This choice was driven by the conceptual definition of the model, which includes service quality and customers satisfaction. This service quality study is important in that it was conducted in Tamilnadu, India, one of the major states and country with predominant disease profiles in multi a vast geographical position pattern in the world. A questionnaire with 32 questions was administered to patients in the selected 25 multi-speciality hospitals. The questionnaire was translated to the local language (Tamil) and then translated back to English to validate the questionnaire.

Missing data were a problem in the dataset and the study imputed the missing data using Expectation Maximization (EM) algorithm. The EM algorithm is more effective than methods like mean imputation. The missing data in the study was less than 0.1 %. Descriptive statistics were generated using SPSS software. Mean, standard deviation, skewness and kurtosis were computed for each item. Wherever the skewness was above +/- 1 for an item, the data transformation method was used to reduce it. The study identified that there was no major problem with the descriptive statistics parameter value. The Common Method Bias

(CMB) was tested using Harman's single factor test and found that the CMB was not a major threat in the data. The study evaluated the effects of the following factors on service quality of Multi – speciality hospitals i.e., Service quality measures and Customer satisfaction. All these path coefficients in the research model were found to be positive and statistically significant.

*One important suggestion came out of the study that service quality is the core component for achieving the customer satisfaction which would influence positive word of mouth communication amongst people in community and that would pave way for retention and repeat visit to hospital.*

*The results from this work emphasized that hospital management should consider service quality with respect to all five constructs, which would lead to the patient satisfaction. There is a plenty of space in the research domain to carry out the future research with regard to the impact of positive word of mouth, image on the centre of excellence and a specific segment of paramedical staff e.g., nursing can be studied with regard to service quality and customer satisfaction. It has been found to have positive significant relationship between service quality and customer satisfaction.*

*The important outcome of the study found that the customer satisfaction tends to improve with service quality improvement. When the service quality is over emphasized by making the patient spend over and above the genuine cost, the relationship between service quality and customer satisfaction shows the negative relationship.*

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