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Measurement of efficiency of hospital care in terms of Patients' Health Expenses

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1. Introduction

In the globalized and liberalized India, it has been observed that there is a rapid growth in healthcare with the increase of private participation (Shah and Mohanty, 2010). Private healthcare providers put much importance on the quality of healthcare services in order to ensure patients' satisfaction (Shabbir et.al. 2010). Private hospitals, as they are not subsidized, have to depend on income from their clients and ensure the satisfaction of their clients by providing superior quality of health care (Andaleeb et. al. 2007). The privatization of healthcare sector and the continual augmentation of quality of the service cause the rise of healthcare expenditure which has become a financial burden for Indian households (Wagstaff et.al.2003, Xu et.al.2005, Van Doorslaer et.al.2006, Berman et.al, 2010). The experience of rising health expenses has led to a serious repercussions among Indian households (Wagstaff, and Van Doorslaer 2003, Xu et.al. 2005, Van Doorslaer et.al. 2006). Most of the Indian households attain fund to finance their health expenses by selling or mortgaging their assets or borrowing money from money lenders (Sauerborn et. al.1996, Kabir et.al., 2000, Russell S. ,2005).

The efficiency of healthcare service which is an important issue related to service quality has been measured on the basis of cost effectiveness. The efficiency of health care service will be higher if the service is provided in least cost (Peacock et.al. 2001, Garber and Skinner 2008, Cromwell et.al.2011). Therefore, it is important to understand how Efficiency of Hospitals in terms of Patients' Health Expenses has been determined.

2. Literature Review

Peacock et.al. (2001) explained three concepts of efficiency - 1) productive efficiency, technical efficiency and allocative efficiency. As per their definition, technical efficiency refers to the measurement of cost effectiveness of healthcare service. Cost effectiveness of healthcare refers to the delivery of an effective service in least cost.

Garber and Skinner (2008) opined that the productive efficiency of healthcare can be increased by establishing the simultaneous improvement of quality of healthcare and reduction of cost as well.

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Edwards et.al . (2011), established the concept of triple aim for the enhancement of the efficiency of hospitals in terms of patients' value for money. As per the triple aim concepts there are three initiatives viz. improvement of health of the population, enhancement of patients' understanding of care in terms of quality, reliability and access and minimization or controlling of per capita cost of care (Edwards et. al., 2011)

Cromwell and his coworkers (2011), illustrated that the cost of treatment is a basis on which the efficiency of hospitals can be determined. They defined efficiency of healthcare in terms of the ratio of healthcare outputs and resource inputs. Healthcare outputs refers to the healthcare service or health outcome and resource inputs comprises of physical efforts viz. nursing days and financial efforts viz. cost (Cromwell et. al., 2011).

Thomas (2006) determined an indicator of hospital efficiency on the basis of some issues viz. hospital stay,events of care, early readmission rate, hospital payment and cohort-based longitudinal patient–level indicators.

Gregory and Kautter (2007), suggested a process of population based efficiency measurement by calculating the ratio of actual per-capita expenditure and predicted per-capita expenditure. The ratio is known as efficiency index. The efficiency index determines the efficiency of physicians' organization (PO) in terms of per-capita expenditure.

$$Efficiency\ Index = \frac{Actual\ Per-capita\ Expenditure}{\Pr edicted\ Per-capita\ Expenditure}$$

When the value of Efficiency index is one, then PO is neither efficient nor inefficient. When it is less than one, it indicates the actual per-capita expenditure is less than the predicted one and thereby the PO is efficient. PO is inefficient when the value of index is more than one (Thomas et.al., 2004).

The efficiency of hospitals in terms of patients' health expenditure (EHPHE) is another aspect to realize the satisfaction of patients.

3. Objectives of the Study

The discussion in the above section of literature review has pointed out that it is important to consider both the quality improvement of healthcare and reduction of actual expenses of patients with the respect of their expected expenses so that the satisfaction of patients is assured. Therefore, it has become necessary to measure both the patient satisfaction and EHPHE. The objectives of the study are

- To measure the satisfaction of patient based on the gap between their expectation and perception towards the quality of health service.
- To measure EHPHE considering the gap between the expected and actual health expenses of patient in a hospital
- To measure the relation between EHPHE and patient satisfaction

4. Research Methodology

Data Collection

In this study, primary data regarding patients' expectation and perception towards the quality of healthcare and patients' estimated and actual expenses have been collected on the basis of questionnaire survey with patient and patient party. The perception and expectation scores of patients have been obtained on the basis of Likert pattern scale considering the agreeableness of respondents against twenty two quality features of healthcare service provided by different government and private hospitals in West Bengal. The following table (Table – 1) shows the twenty two quality features of healthcare service.

Table 1: Statements Describing Features of the Quality Health Care Service Provided by an Ideal Hospital

1)	Doctors should have a wide spectrum of knowledge and should be competent
2)	Doctors should understand the specific need of patients
3)	Doctors can put sincere effort to solve patients' problems
4)	Doctors can explain thoroughly the patient's medical condition to him.
5)	Doctors and staff should provide individualized attention to each patient
6)	Patients should be treated with dignity and respect
7)	Patients can feel secure in receiving medical care.
8)	Doctors and staffs should have patient's best interests at heart
9)	Doctors and staffs should listen to patients and keep them informed
10)	Hospital staffs should always be willing to help patients
11)	Doctors and staff should be friendly and courteous
12)	Attitude and behaviour of doctors and staff should instill confidence in patients
13)	Prompt service can be provided to patients
14)	Error free documentation can be available.
15)	Services can be provided at required time.
16)	24 hours service to patients can be available
17)	Services should be carried out right at the first time
18)	The hospital's equipment should keep up-to-date and well maintained
19)	Clean, comfortable and visually attractive environment should be there in an hospital or clinic
20)	High standard of hygiene practices should always be maintained
21)	Meals should be tasty and adapted to patients' nutritious needs
22)	The hospital can be easily accessible (e.g. parking facilities, Signage)

Another set of questions have been framed to obtain data related to general information viz. patients' age, occupation, family income, expected health expenses before or two days after admission in a hospital, actual health expenses at the time of discharge from a hospital, hospital stay, travelling time from residence to hospitals, waiting time at hospitals etc. An area sampling technique has been applied to select 474 respondents on

random basis from three region of West Bengal viz. Kolkata Metropolitan Area, the districts of North Bengal and South Bengal.

Data Analysis & discussions

Firstly, a factor analysis has been conducted to reduce number of twenty two components on the basis of perception score of patients. Secondly, a standard quality of healthcare service has been defined on the basis of average expected and perceived quality of patients towards healthcare service i.e. (Perceived quality + Expected quality)/2. Then patient satisfaction has been measured on the basis of a ratio of the difference of perceived and expected quality of individual patient and the standard quality i.e.

$$\text{Patient Satisfaction} = \frac{(\text{Perceived quality} - \text{Expected quality})}{(\text{Perceived quality} + \text{Expected quality})/2}$$

Patients are considered to be dissatisfied when the ratio has a value which is less than zero. When the value of the ratio is greater than zero it indicates patients' satisfaction.

In the third step of data analysis, the efficiency of hospitals in terms patients' health expenses (EHPHE) has been measured on the basis of the following method.

1) Determination of the standard health expenditure for individual patient by taking the average of the expected and actual expenditure for each individual patient i.e. (Expected Health Expenses + Actual Health Expenses)/2.
2) Calculation of the difference between expected and actual health expenses i.e. (Expected expenses – Actual expenses)
3) Determination of efficiency of hospitals by applying the following formula:

$$EHPHE = \frac{2\sum(Expected\ \text{exp}enses - Actual\ \text{exp}enses)}{\sum(Expected\ \text{exp}enses + Actual\ \text{exp}enses)}$$

Performance of a hospital is considered to be efficient when the value of EHPHE is either zero or more than zero. With the increase of the value of EHPHE, the efficiency of hospitals will also be increasing. A negative value of EHPHE indicates the inefficiency of hospitals.

A binary logistic regression model has been applied to determine the dependence of patient satisfaction on EHPHE scores by applying the following formula.

$$\mathbf{Y = \ln (p/1 - p) = a + b\,X}$$

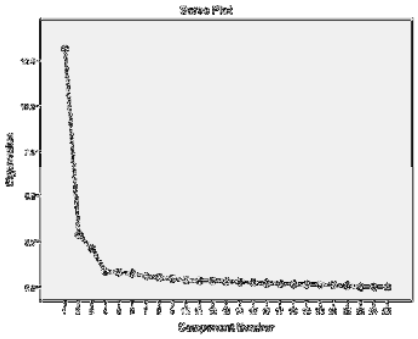
Where Y is binary number and represent the event of interest (response), coded as 0/1 for dissatisfaction/satisfaction, p is the proportion of satisfaction. 'X' is the independent variables and 'a' is an intercept and 'b' is a slope coefficient (i.e., the expected change in Y relative to one unit change in X). In this study, the patient satisfaction is a dependent variable and EHPHE is an independent variable.

Determination of dimensions of service quality

In the first step of data analysis, patients' perception scores have been considered for factor analysis in order to understand whether there is any inter correlation between twenty two parameters. The inter-correlated parameters can be reduced into a few numbers of factors which provide dimensions of service quality.

As per the scree plot in Figure – 1, there are three factors having Eigen value more than one. Three factors whose Eigen value is more than one have been considered for determining three dimensions.

Figure 1: Scree Plot based on Perception Scores



In a rotated component matrix the correlation between factors and different components has been presented. The Table –1 shows a rotated component matrix with three principal factors.

Table 1: Rotated Component Matrix

	Component		
	1	2	3
1.Doctors' wide spectrum knowledge and Competence	.236	.103	.858
2.Doctors' understanding of specific need of patients	.391	.145	.833
3.Doctors' sincere effort to solve patients' problems	.565	.193	.672
4.Doctors' thorough explanation regarding patients' medical condition	.450	.176	.631
5.Provision for individualized attention for each patient	.700	.239	.442
6.Patient treated with dignity and respect	.746	.263	.374
7.Patient's security and safety in receiving medical care	.717	.223	.338
8.Doctors and staff having patients' best interest at heart	.753	.252	.366
9. Willingness and interest of doctors and staff to listen to the patients and keep them informed	.826	.239	.235
10.Willingness to hospital staff to help patients	.839	.289	.119
11.Friendly and courteous behaviour of doctors and staff	.822	.323	.163

12.Attitude of doctors and staff instilling confidence in patients	.430	.152	.176
13.Prompt service to patients	.735	.328	.194
14.Error free documentation	.562	.181	.389
15.Providing services at required time	.372	.142	.257
16. 24 hours service to patients	.699	.163	.243
17. Providing services right at the first time	.744	.275	.263
18. Maintenance of hospital's equipment	.504	.541	.287
19. Clean, comfortable and visually attractive environment of hospitals	.339	.858	.126
20. Maintenance of high standard of hygiene	.289	.869	.164
21. Tasty meals as per patients' need	.327	.775	.215
22. Accessibility of the hospital (parking facility, signage etc.)	.207	.740	.034

As per the above rotated matrix shows high correlation amongst the parameters viz. provision for individualized attention for each patient, patients treated with dignity and respect, patients' security and safety in receiving medical care, doctors and staff having patients' best interest at heart, willingness and interest of doctors and staff to listen to the patients and keep them informed, willingness of hospital staff to help patients, friendly and courteous behaviour of doctors and staff , attitude of doctors and staff instilling confidence in patients, prompt services to patients, error free documentation, providing services at required time, 24 hours service to patients and providing services right at the first time which are grouped together to form Factor – I. Similarly, the Factor – II includes the parameters viz. maintenance of hospital equipment, clean, comfortable and visually attractive environment of the hospital, maintenance of high standard of hygiene, tasty meals as per patients' need, accessibility of the hospital (e.g. parking facility, signage etc.) as those parameters show high correlation amongst each other and the Factor – III includes the parameters viz. doctors' wide spectrum of knowledge and competence, doctors' understanding of specific need of patients, doctor's sincere effort to solve patients' problems and doctors' thorough explanation regarding patients' medical condition.

As per the theory of marketing these three factors are having certain resemblance with the three Ps of service marketing viz. physical evidence, people and process(Lovelock et. al. 2008, Ergen 2011, Mihai 2013, Masterson and Pickton 2014). The components of Factor – I have some resemblance with the process whereas Factor – II and Factor – III consists of some components which represents physical evidence and people. Therefore, the above-mentioned three factors have been identified by three dimensions viz. Process, Physical evidence and People.

As per the result presented in Table – 2 the value of KMO is 0.952 which indicates the sample is adequate to conduct factor analysis. A Bartlett's test of sphericity shows the high inter-correlation amongst the parameters. Therefore, an inference can be drawn that there is a significant inter-correlation amongst twenty two parameters of SERVQUAL. The total variance is explained in Rotation Sum of Square Loading is 75.33 %.

Table 2: KMO and Bartlett's Test-II

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.952
Bartlett's Test of Sphericity	Approx. Chi-Square	9288.003
	df	231
	Sig.	.000

In the next step of the study, Patient satisfaction has been measured on the basis of the formula given in the section of data analysis at research methodology. it has been observed that most of the patients are dissatisfied with the healthcare service in West Bengal considering all dimensions viz. Process, People and Physical evidence. The data regarding satisfaction and dissatisfaction has been presented in Table – 3.

Table 3: Category of patients based on their satisfaction with healthcare service in West Bengal

Dimensions	Satisfied patients	Dissatisfied patients	Total
Process	66	408	474
People	88	386	474
Physical Evidence	40	434	474
Overall	51	423	474

From the above table (Table – 3), it can be interpreted that patients can be categorized into two distinct classes based on their satisfaction towards service quality. These are satisfied patients and dissatisfied patients.

Measurement of the Impact of EHPHE on Patient Satisfaction

In the next step of analysis the impact of EHPHE on satisfaction has been determined by applying binary logistic regression considering the above-mentioned two categories of patients. Satisfied patients are denoted by 1 whereas dissatisfied patients are denoted by 0. Therefore, we can say that patient satisfaction, the dependent variable is expressed in binary number. EHPHE has been considered as an independent variable on which patient satisfaction depends. The result of logistic regression has been presented in Table – 4, Table – 5, Table – 6 and Table – 7. Table – 4 shows the P value corresponding to the efficiency of hospitals in terms of patients' expenses is less than 0.05. Therefore, it can be interpreted that patient satisfaction with process in both the private and government hospitals together is significantly dependent on efficiency of hospitals in terms of

patients' health expenses. It has also been observed that there is a positive relation between patient satisfaction with process and the efficiency of hospitals.

Table 4: Variables in the regression equation for patient satisfaction with process

Dependent Variable :Patient Satisfaction with Process		B	S.E.	df	Sig.	Exp(B)
	EHPHE	1.868	0.349	1	0	6.475
	Constant	-1.622	0.14	1	0	0.198

Similarly, results of the association between patient satisfaction with people and efficiency, patient satisfaction with physical evidence and efficiency, overall satisfaction and efficiency have been presented in the Table – 5, Table – 6 and Table – 7 respectively.

Table 5: Variables in the regression equation for patient satisfaction with people

Dependent Variable :Patient Satisfaction with People		B	S.E.	Sig.	Exp(B)
	EHPHE	1.589	0.31	0	4.9
	Constant	-1.229	0.13	0	0.293

Table 6: Variables in the regression equation for patient satisfaction with physical evidence

Dependent Variable : Patient Satisfaction with Physical Evidence		B	S.E.	df	Sig.	Exp(B)
	EHPHE	2.135	0.42	1	0	8.461
	Constant	-2.196	0.17	1	0	0.111

Table 7: Variables in the regression equation for patient satisfaction with overall services

Dependent Variable :Patient Satisfaction with Overall Services		B	S.E.	df	Sig.	Exp(B)
	EHPHE	1.698	0.37	1	0	5.464
	Constant	-1.904	0.15	1	0	0.149

In all the above tables the P values corresponding to EHPHE indicate that patient satisfaction with people, physical evidence and overall satisfaction have significant dependence on efficiency of hospitals in terms of patients' health expenses. In each case patient satisfaction has positive relation with efficiency of hospitals in terms of patients' health expenses. It interprets that patient satisfaction considering all the three

dimensions i.e. process, people and physical evidence will be increasing with the increase of the efficiency of hospitals in terms of patients' health expenses (EHPHE).

Determination of impact of EHPHE in government hospitals

In the third step of analysis the hospitals of West Bengal has been classified broadly two categories on the basis of ownership. These two categories are government hospitals and private hospitals. In both categories of hospitals patient satisfaction and EHPHE scores have been determined with help of same process that has been mentioned in the research methodology section. The results related to EHPHE of government hospitals and its effect on patient satisfaction with process, people, physical evidence and overall satisfaction has been presented in the Table – 8, Table – 9, Table – 10 and Table – 11 respectively.

Table 8: Variables in the Regression Equation for Patient Satisfaction with Process in Government Hospitals

Dependent Variable : Patient Satisfaction with Process		B	S.E.	df	Sig.	Exp(B)
	EHPHE in Government Hospitals	1.748	0.44	1	0	5.742
	Constant	-1.786	0.2	1	0	0.168

Table 9: Variables in the Regression Equation for Patient Satisfaction with People in Government Hospitals

Dependent Variable : Patient Satisfaction with People		B	S.E.	df	Sig.	Exp(B)
	EHPHE in Government Hospitals	1.322	0.39	1	0.001	3.752
	Constant	-1.528	0.19	1	0	0.217

Table 10: Variables in the Regression Equation for patient Satisfaction with Physical Evidence

Dependent Variable : Patient Satisfaction with Physical Evidence		B	S.E.	df	Sig.	Exp(B)
	EHPHE in Government Hospital	2.592	0.624	1	0	13.354
	Constant	-2.66	0.306	1	0	0.07

Table 11: Variables in the Regression Equation for Overall Patient Satisfaction in Government Hospitals

		B	S.E.		df	Sig.	Exp(B)
	EHPHE in Government Hospitals	1.503	0.512		1	0.003	4.494
	Constant	-2.318	0.245		1	0	0.098

In Table – 8, it has been observed that the patient satisfaction with process depends on EHPHE and there is positive relation between efficiency of hospitals and patient satisfaction with process of health care service. Similarly, the result of Table – 9 and Table – 10 has established high positive impact of EHPHE on patient satisfaction with people and physical evidence respectively. The result of Table – 11 has also established that the overall satisfaction of patients significantly depends on EHPHE and there is positive relation between these two variables.

Determination of Impact of EHPHE in Private Hospitals:

The impact of EHPHE on patient satisfaction has been measured by applying the same method of logistic regression mentioned in the last two sections. The result of regression analysis has been presented in the Table – 12, Table – 13, Table – 14 and Table – 15.

Table 12: Variables in the Regression Equation for Patient Satisfaction with Process in Private Hospitals

Dependent Variable: Patient Satisfaction with Process		B	S.E.	df	Sig.	Exp(B)
	EHPHE in Private Hospitals	2.316	0.637	1	0	10.139
	Constant	-1.417	0.2	1	0	0.242

Table 13: Variables in the Regression Equation for Patient Satisfaction with People in Private Hospitals

Dependent Variable : Patient Satisfaction with People		B	S.E.	df	Sig.	Exp(B)
	EHPHE in Private Hospitals	2.34	0.563	1	0	10.384
	Constant	-0.872	0.178	1	0	0.418

Table 14: Variables in the Regression Equation for Patient Satisfaction with Physical Evidence in Private Hospitals

Dependent Variable : Patient Satisfaction with Physical Evidence		B	S.E.	df	Sig.	Exp(B)
	EHPHE in Private Hospitals	2.087	0.676	1	0.002	8.059
	Constant	-1.862	0.227	1	0	0.155

Table 15: Variables in the Regression Equation for Overall Patient Satisfaction in Private Hospitals

Dependent Variable : Patient Satisfaction with Overall Services		B	S.E.	df	Sig.	Exp(B)
	Efficiency in Private Hospitals	2.474	0.668	1	0	11.864
	Constant	-1.483	0.204	1	0	0.227

In all the above tables (Table – 12, Table – 13, Table – 14 and Table – 15), it has been observed that there is significant positive impact of EHPHE on overall patient satisfaction and on patient satisfaction with process, people and physical evidence in private hospitals in West Bengal.

Effect of hospital stay of a patient on EHPHE

As per the formula of determining EHPHE given in the section of research methodology, EHPHE is affected by the actual expenses of patients. If actual expense is more than expected expenses of patients then EHPHE will be decreasing. Therefore, it is important to control the actual expenses of patients to increase the level of EHPHE of a hospital. One of the reasons of increase of actual expenses is the extension of the period of patients' hospital stay. Therefore, a study has been conducted to understand how hospital stay affects EHPHE of a hospital.

Firstly, a correlation between hospital stay and EHPHE has been determined on the basis of Pearson Correlation coefficient. The result of correlation has been presented in the Table – 16. Secondly, a Z-test has been conducted to negate the H0: zero association between EHPHE and hospital stay by applying the following formula to confirm the correlation between above mentioned variables.

$$Z = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Table 16: Correlation between Hospital Stay and EHPHE

		Hospital stay	EHPHE
Hospital stay	Pearson Correlation	1	-.138
	Sig. (2-tailed)		.003
	N	474	474
Efficiency	Pearson Correlation	-.138	1
	Sig. (2-tailed)	.003	
	N	474	474

As per the result given in Table – 16, it has been established that there is a significant negative correlation between hospital stay and EHPHE. It can be interpreted that with the increase of hospital stay of a patient the EHPHE will be decreasing.

The Z test for non-zero correlation shows that the value of Z = 3.02709 which exceeds the critical value of Z = 1.96 at 0.05 level of significance. Therefore, the H0 i.e. zero association between EHPHE and hospital stay has been rejected. Therefore, once again it proves the correlation between EHPHE and hospital stay of patients. In this study, the hospital stay of a patient has been identified as one of the predictor variables on which the EHPHE depends.

5. Conclusion

In the modern age, rising health expenses has become monetary pressure for patients and patient parties. At present, it is important for any healthcare providers to consider the patients health expenses along with the quality of healthcare service to make their service more attractive in competitive environment. Therefore, determination of the Efficiency of Hospitals in terms of Patients' Health Expenses (EHPHE) has become a relevant issue in healthcare sector. The study has revealed that the EHPHE has a significant positive impact on patient satisfaction considering the three dimensions viz. process, people and physical evidence and all types of hospitals viz. government and private hospitals. The EHPHE has negative correlation with hospital stay of patients. It can be interpreted that if patients stay at hospital for longer period then EHPHE will be decreasing. The logic behind the above-mentioned correlation is the increase of actual expenses of patients with the extension of their hospital stay. Therefore, it can be concluded that efficiency of a hospital can be improved by shortening the hospital stay of patients.

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