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Determinants of Hospital Performance under Variable Ownership Pattern: A Two-Stage Analysis

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Abstract

Background: Providing high-quality healthcare services at low or no cost, especially in a densely populated country like India, is an enduring challenge. Thus, the efficacy of government-run hospitals and healthcare instructions has become critical for developing and developing countries.

Aim: The current study aimed to investigate the relative performances under variable ownership patterns and scrutinise whether the differences in performances are significant or not to explore determinants of the performance of the hospitals.

Methods: The study has been conducted in East and West Bardhaman, West Bengal, India. Data envelopment analysis measures hospitals' performance under variable ownership patterns. The Mann-Whitney U Test is employed to examine whether the performance differences among these hospitals are significant. Finally, Censored Tobit Analysis is used to gain insight into the determinants of their performance. Hospitals are categorized according to their ownership pattern: government hospitals owned by the state government, public hospitals owned by public sector undertakings, and private authorities.

Results: Considering the input-output variables, relative performances have been measured. The hospitals under government ownership show the best performance, followed by public hospitals owned by public sector undertakings and private authorities. This performance level has significant determinants like the size of the hospital, bed occupancy rate, and the management and authority of the hospitals.

Conclusion: In a developing or underdeveloped nation, all healthcare service providers need to be efficient enough to attain the health of the masses. This study has revealed that the vision of 'health for all' can be reached through the mission of 'healthcare inclusion' strategy by including all hospitals on the supply side regardless of their motive, ownership pattern, or other phenomenon.

Keywords: Hospital Performance, DEA, Technical Efficiency, Tobit Analysis, Mann-Whitney U Test

Introduction

The healthcare along with its access and usage is a constant cognitive matter of the social thinkers. The Alma-Ata declaration in 1978 followed the objective of 'health for all'. The declaration expanded its scope in 1998 and included: "to attain health security for all, to achieve global health equity, to increase healthy life expectancy and to ensure access of essential healthcare of good quality for all" (WHO, 1998). It is believed that good health of the citizens of a country also contributes in wealth building for that country. Equitable access to fundamental healthcare services for every citizen is a basic demand for all countries (Clements et al, 2011). In the eight Millennium Development Goals (MDGs), the United Nation and its members expressed major focus on basic health issues; immense responsibility has been taken to provide a better healthcare and superior standard of living. The need of both quantitative and qualitative healthcare infrastructure required to be strengthened. The performance of the healthcare

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providers has also become crucial and critical. Performance of the healthcare institutions in the form of their efficiency can directly help state to achieve the goal of providing basic healthcare service to their citizens. Though it is important to find quality of the healthcare service (Chatterjee et al, 2019) but fulfilling the basic health demand also need to be quantified to obtain the maximum level of output. In many third world countries, resource constraint in healthcare sector is a very common agenda. The higher management and the administrators are thus in search of optimal allocation of resources to produce maximum output for their patients. A good cluster of patients are also ready to spend by their own, but the amount not always properly valued; reason is the inefficiency in hospital operation. This affects badly to the patients and also to the society in large. The health indicators show a poor picture for the developing and underdeveloped countries not only because of resource constraint, also the inefficient deployment, usage and operation contribute in such failure. The Indian Constitution also has the provision for providing basic healthcare to its citizens (Bajpai et al, 2005). In Five Year Plans, importance has been given to this healthcare issue, but the unequal distribution causes disparity in access of the healthcare service (Kumar et al, 2011); unequal distribution also varies in the supply side of the healthcare service through geographical jurisdictions (Chatterjee et al, 2016). A large part of population also shifts to the private healthcare service provider due to shortage of public healthcare service in India (Raman et al, 2012). At this point, the healthcare institutions with varied motives under alternative ownership patterns need to work together to realize the holistic vision of 'health for all' that may be achieved by putting them all together through a 'inclusive healthcare' strategy.

The first hospital efficiency related empirical literature has been discussed in 1980s (Procházková et al, 2011). Performances under different management categories of hospitals were estimated. The economic aspects of hospitals are examined with this performance and efficiency analysis. Different researchers have conducted their study in this aspect (Sun et al, 2017; O'Neil et al, 2008; Garcia-Lacalle et al, 2010; Rosko et al, 2011; Grosskopf et al, 2004; Lee et al, 2008; Blank et al, 2010; Nedelea et al, 2013 etc.). Researchers also have observed the determinants of the hospital performances (Rezaee et al, 2015; Shettian et al, 2017; Li et al, 2019; Leleu et al, 2018; Saquetto2019 etc). Though the researchers have enriched the hospital specific performance study, but the districts of the state of West Bengal have not witnessed such type of study with alternative distinct categories of hospitals. In the district level, very few studies have been conducted in the state of West Bengal, India (Sheet et al, 2013; Roy, 2014); but the nature of the study is different. Thus in the district of Purba and Paschim Bardhaman in the state of West Bengal, India, a scope has been observed to conduct performance and efficiency related study that may represent the hospital performance status under different ownership styles in a developing nation. Thus, a gap can be identified, which provides the scope to conduct research work in this area.

The outline of the study is as follows. The background of the study has been postulated in the next section. The objectives of the study have been framed in the third section. The methodological discussion has been carried out in the fourth section. The fifth section deals with the result and discussion part. The concluding remarks are given at the end.

Research Gap

Though the researchers have enriched the hospital specific performance study, but the districts of the state of West Bengal have not witnessed such type of study with alternative distinct categories of hospitals. In the district level, very few studies have been conducted in the state of West Bengal, India (Sheet et al, 2013; Roy, 2014); but the nature of the study is different. Thus in the district of Purba and Paschim Bardhaman in the state of West Bengal, India, a scope has been observed to conduct performance and efficiency related study that may represent the hospital performance status under different ownership styles in a developing nation. Thus, a gap can be identified, which provides the scope to conduct research work in this area.

The study's objectives were to explore the relative performance of three distinct categories of hospitals, scrutinize whether the differences in performances among the three hospital categories are significant, and retrieve the determinants of the hospitals' performance.

Methods

Data Source

There is cross-country evidence of hospital-specific comparative performance or efficiency studies (Fazria*et al.,* 2021; Alatawi*et al.,*2020; Botega*et al.,* 2020; Jing *et al.,* 2020; Küçük*et al.,* 2020; Ahmed *et al.,* 2019; Miguel *et al.,* 2019; Jat*et al.,*2013). This study has been conducted in the districts of Purba and PaschimBardhaman in West Bengal, India. Hospital-specific data has been collected from hospitals in the districts of Purba and PaschimBardhaman in West Bengal, India. These two districts can be termed undivided Bardhaman districts, which have been considered for the study because they may represent a broader geographical periphery. The undivided Bardhaman districts have been recently divided into Purba and PaschimBardhaman, which has a population of 7,723,663 per the 2011 census and ranked seventh out of 640 districts of the country.

Except for the capital city of the state of West Bengal, these districts jointly have a maximum number of hospitals, which is in all three categories of hospitals, which also ranked third considering the population covered per hospital among the districts of the state. The study has been carried out with twenty-five sample hospitals, which belong to three distinct categories of ownership pattern, namely, government hospitals run by state government (H_GOV), public hospitals run by public sector undertaking organizations (H_PSU) and hospitals run under private ownership (H_PVT). A structured questionnaire has been designed for this study. The hospital authorities have been asked to respond to that questionnaire. A participatory approach was followed during the entire data collection process as data reliability was highly significant in this sensitive study.

Sample Size

The population size is 72, which includes 27 government hospitals run by the state government, 26 public hospitals run by public sector undertaking organizations, and 13 hospitals run under private ownership. Stratified random sampling was used in this study, where the hospitals were divided into three strata, and almost forty per cent of each stratum was uniformly selected by random (without replacement) method. Finally, a sample size of twenty-five hospitals was pursued, comprising ten H_GOV, ten H_PSU, and five H_PVT.

Performance Measurement

The performance of the hospitals has been measured in this study in the light of relative efficiency values of the concerned hospitals. The two words, performance and efficiency have been used identically in the study. The performance or efficiency of hospitals has been measured with the econometric model, namely data envelopment analysis(DEA1). In last few decades a good number of studies have been conducted on hospital performance or efficiency with the help of data envelopment analysis methodology (Fazria et al, 2021; Ahmed et al, 2019; Jat et al, 2013; Kirigia et al, 2002; Kundurjiev et al, 2011; Kirjavainen et al, 1998 etc.). It is observed that more the efficiency value, better the performance and vice versa. The term ‘efficiency’ can be defined as the maximization of outputs with a given set of input or minimization of inputs for a given set of output. In this efficiency and performance study, the DEA has been applied by incorporating multiple inputs and multiple outputs. The technical efficiency and scale efficiency and the scale efficiency have been calculated through DEA method. If the firms (or, decision making units i.e., DMUs) under observation operate in the optimal scale then the ‘constant return to scale’ (CRS) has been applied. Coelli et al (1998) suggest that ‘variable return to scale’ can be applied in imperfect competition. In the Technical Efficiency (TE) study, the CRS and VRS assumptions permit to find the scale efficiency. Scale efficiency (SE) is the ration of technical efficiency at constant return to scale and variable return to scale. SE= TE_{CRS} / TE_{VRS}. Coelli (2002) suggests that

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a decision making unit has scale inefficiency if the value of technical efficiency under the two assumptions are different, which that inefficiency can be estimated from the difference among them.

"Let Y be an (M × N) matrix of outputs of hospitals in the sample, where the element yij represents the ith output of the jth hospital. Let X be a (P × N) matrix of inputs, in which the element xkj represents the kth input of the jth hospital and z an N-vector of weights to be defined. Elements of these vectors are z1,..., zN. The vector yj (M × 1) is the vector of outputs and xj is the (P × 1) vector of inputs of the jth hospital. The CRS input-oriented measurement of technical efficiency for the jth hospital is calculated as the solution to the following mathematical programming problem.

$\lambda^j_c = \min$,

subject to:

$$y_{1i} \geq y_{11}z_1 + y_{12}z_2 + \ldots + y_{1N}z_N$$
$$y_{2i} \geq y_{21}z_1 + y_{22}z_2 + \ldots + y_{2N}z_N$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$y_{Mi} \geq y_{11}z_1 + y_{12}z_2 + \ldots + y_{MN}z_N$$

$$x_{11}z_1 + x_{12}z_2 + \ldots + x_{1N}z_N \leq x_{1i}$$
$$x_{21}z_1 + x_{22}z_2 + \ldots + x_{2N}z_N \leq x_{2i}$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$x_{P1}z_1 + x_{P2}z_2 + \ldots + x_{PN}z_N \leq x_{Pi}$$

$z_j \geq 0$ for all j.

The scale value λ represents a proportional reduction in all inputs such that 0≤ λ ≤ 1, and λjc is the minimum value of λ, so that λjc xj represents the vector of technically efficient inputs for the jth hospital. Maximum technical efficiency is achieved when λjc equals unity. In other words, if the DEA gives the outcome λjc =1 , the hospital is operating at the best-practice and it is not able to improve its performance any further, given the existing set of observations. If λjc <1, we can conclude that the hospital is operating below the best-practice frontier.

The VRS technical efficiency for the jth hospital is computed as:

$\lambda^j_v \leq \min$,

subject to:

$$y_{1i} \geq y_{11}z_1 + y_{12}z_2 + \ldots\ldots + y_{1N}z_N$$
$$y_{2i} \geq y_{21}z_1 + y_{22}z_2 + \ldots\ldots + y_{2N}z_N$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$y_{Mi} \geq y_{11}z_1 + y_{12}z_2 + \ldots\ldots + y_{MN}z_N$$

$$x_{11}z_1 + x_{12}z_2 + \ldots\ldots + x_{1N}z_N \leq x_{1i}$$
$$x_{21}z_1 + x_{22}z_2 + \ldots\ldots + x_{2N}z_N \leq x_{2i}$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$x_{P1}z_1 + x_{P2}z_2 + \ldots\ldots + x_{PN}z_N \leq x_{Pi}$$
$$l_1z_1 + l_2z_2 + \ldots\ldots + l_Nz_N = 1$$

$z \geq 0$.

Given these two technical efficiency estimates, the input-oriented scale efficiency measure for the jth hospital is calculated as the ratio of CRS technical efficiency to VRS technical efficiency, i.e. Sj = λjc / λ jv. Suppose the value of this ratio is equal to unity (i.e., Sj = 1). In that case, the hospital is scale-efficient, meaning that the hospital is operating at its optimum size, and hence that the productivity of inputs cannot be improved by increasing or decreasing the size of the hospital. If the value of this ratio is less than unity (i.e., $S^j < 1$), the hospital is considered to be not operating at its optimum size. In the first of two possible cases, (i), if $S^j < 1$ and, $\lambda^j_c = \lambda^j_n$ the scale inefficiency results from increasing returns to scale. In other words, increasing the hospital's size helps improve its productivity and thereby reduces unit costs. In the second

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possible case, (ii), if $S^j < 1$ and $\lambda^j_c < \lambda^j_n$, the scale inefficiency is due to decreasing returns to scale, indicating that the hospital can raise its productivity and lessen unit costs by choosing a smaller size." (Nguyen et al 2004).

In this study, the input-oriented DEA method has been applied, as resources are always considered to be limited, and from the given level of limited resources, the highest level of production is generated. The details of the input variables and output variables under study are listed in Table-1, which can be observed in earlier studies (Fazria et al., 2021; Ahmed et al., 2019; Fuentes et al., 2019; Ichoku et al., 2011, etc.).

Table 1: Details of the I/P variables and O/P variables

Variable	Type	Coding	Description
O/P	Accessing	IPB	In-Patient per bed per day
O/P	Accessing	DIS	Discharge per bed per day
O/P	Accessing	DEL	Delivery per bed per day
O/P	Accessing	ECG	ECG Cases
O/P	Accessing	XRA	X-Ray Cases
I/P	HR	DR	Doctors per bed
I/P	HR	NUR	Nurse per bed
I/P	HR	PMS	Paramedical Staffs(Number)
I/P	Instrument	ECM	ECG Machines (Number)
I/P	Instrument	XRM	X-Ray Machines (Number)
NOTE: O/P: Output Variables; I/P: Input Variables; HR: Human Resource			

Considering the above mentioned input and output variables, different models, as presented in Table-2, can be drawn to find the efficiency of different categories of hospitals (i.e., government hospitals run by state government, public hospitals run by public sector undertaking organizations and hospitals run under private ownership) under input oriented DEA set-up.

Table 2: Model Designs

Coding	Variables	Type	Model(s)					
			Treatment Dimension			Diagnosis Dimension		
			A	B	C	D	E	F
IPB	In-Patient per bed per day	O/P	√		√			
DEL	Delivery per bed per day	O/P		√	√			
ECG	ECG Cases	O/P				√		√
XRA	X-Ray Cases	O/P					√	√
DR	Doctors per bed	I/P	√	√	√			
NUR	Nurse per bed	I/P	√	√	√			
PMS	Paramedical Staffs(Number)	I/P				√	√	√
ECM	ECG Machines (Number)	I/P				√		√
XRM	X-Ray Machines (Number)	I/P					√	√
√: considered								

After obtaining the efficiency values of both the dimensions (treatment and diagnosis) of different categories of hospitals, it is important to insight whether the differences among the values are significant or not; the non-parametric Mann-Whitney U Test has been applied in this connection. Instead of the two-sample t-test, the nonparametric alternative i.e., the Mann-Whitney U test is employed in this study. To run the test, the individual technical efficiency values of the two hospital types are first ranked together in ascending or descending order as belonging to a random sample. Again, the same process is performed for other hospital pairs. The equality hypothesis related to the three categories of hospitals, i.e., government hospitals owned by state

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government (H_GOV), public hospitals owned by public sector undertakings (H_PSU), hospitals owned by private authorities (H_PVT) can be described as follows in three pairs:

$$H_{01}: \mu_{H\_GOV} = \mu_{H\_PSU}$$
$$H_{02}: \mu_{H\_GOV} = \mu_{H\_PVT}$$
$$H_{03}: \mu_{H\_PSU} = \mu_{H\_PVT}$$

where, μ indicates the average efficiency of the hospitals. The test procedure then calculates the sum of the ranks assigned to the scores of the government hospitals owned by state government (R1) and the public hospitals owned by public sector undertakings (R2). Similarly, other ranks are calculated for the remaining two sets of observations. U-Test statistics are calculated as

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 .$$

The statistic has a sampling distribution with a Mean = $\mu_U = \frac{n_1 n_2}{2}$, and Standard error = $\sigma_U = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$. n_1 and n_2 are two sets of sample. Under null hypothesis it can be observed that, U is asymptotically normally distributed as $N(\mu, \sigma^2)$ i.e. $Z = \frac{U - \mu_U}{\sigma_U} = \frac{U - n_1 n_2 / 2}{\sqrt{n_1 n_2 (n_1 + n_2 + 1)/12}}$

Finally, the conclusion is reached by comparing the calculated value of Z with the critical value of Z.

Determinants of Performance

The determinants of the performance level in the form of efficiency value have been analyzed with the following measurement by adopting the censored maximum likelihood assessment. This methodology has also found in the study of earlier researchers (Jing et al, 2020; Samsudin et al, 2016; Zere et al, 2020; Ahmed et al, 2019; Fried et al, 1999 etc.).

$$TE = \gamma_0 + \gamma_1 DUMY_1 + \gamma_2 DUMY_2 + \gamma_3 LOC + \gamma_4 BS + \gamma_5 OPP + \gamma_6 BOR + \varepsilon$$

where $\gamma_{i(i=1,2,\ldots,6)}$ are coefficients

TE is the previously obtained technical efficiency

$DUMY_1$ =1 if it is a government hospitals run by state government

$DUMY_2$ =1 if it is a public hospitals run by public sector undertaking organizations

LOC =1 if it is an urban hospital and 0 if it is a rural hospital

BS is the number of available hospital beds

OPP is the number of out-patients received treatment from the hospital

BOR is the bed occupancy rate

The details of these independent variables are presented in the Table-3, which can be observed in earlier studies (Jing et al, 2020; Küçük et al, 2020; Samsudin et al, 2016; Zere et al, 2020; Saquetto et al, 2019; Rezaee et al, 2015; Ichoku et al, 2011 etc.)

Table 3: Details of Independent Variables for Finding the Determinants of Performance

Independent Variables/ Determinants	Coding	Details
Hospital size	BS	Available hospital beds (No.)
Accessibility	BOR	Bed occupancy rate
Out-patients' pressure	OPP	Out-patient's received treatment from the hospital (No.)
Hospital location	LOC	If, urban:1; rural:0

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Hospital ownership	$DUMY_1$	If, it is a government hospitals run by state government:1; otherwise:0
Hospital ownership	$DUMY_2$	If, it is a public hospitals run by public sector undertaking organizations: 1; otherwise: 0

Zere (2000) has found that the size of the hospital has a direct influence on hospital efficiency; it has also been found the BOR (bed occupancy rate) also influences the efficiency level of the hospital. This is hypothesized that the number of outpatient receiving treatment influencing the performance of the hospital. The ownership pattern and the geographical presence have been considered with importance by applying necessary dummy variables in the proposed model.

Results and discussions

Measurement of Performance: Data Envelopment Analysis

In this study, the hospital performance has been performed through the efficiency measurement model as Data Envelopment Analysis. Multiple input-output models have been formulated and estimated accordingly. Though the individual models have shown their specific expression in the assessment process, the final performance has been arrived through the overall inclusion of the considered variables which are depicted in two final models of two dimensions (Model C and F). In present study 'input orientation' assumption has been deployed; in this assumption, the inputs are considered as constant with the focus on output maximization. The 'Decision Making Units' (DMUs) which has been considered in this study are purely service organization where the forecasting of demand on peak or slack period or even in general state is considerably critical (Zeithaml, 2009). The output oriented assumption where to measure efficiency through minimization of resources for a given level of output is less effective with the present nature of study with healthcare service providing institutions.

Table 4: Measurement of Efficiency in Treatment Dimension

DMUs	No of DMUs	Average Efficiency Score TE_{VRS}
Model A		
H_GOV	10	0.797
H_PSU	10	0.365
H_PVT	05	0.276
ALL	25	0.520
Model B		
H_GOV	10	0.769
H_PSU	08	0.333
H_PVT	04	0.153
ALL	22[2]	0.498
Model C		
H_GOV	10	0.832
H_PSU	8	0.375
H_PVT	4	0.197
ALL	22	0.550

Note: DEAP statistical package has been deployed for analysis part.
H_GOV: Government hospitals run by state government; H_PSU: Public hospitals run by public sector undertaking organizations; H_PVT: Hospitals run under private ownership; TE_{VRS}: Technical Efficiency under the assumption of Variable Return to Scale

[2] Some of the resource variables and output variables are not available in few of the DMUs; so, the analysis has been conducted with 22 DMUs only. In some other models similar limitation also observed.

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The above analysis, presented in Table-4, has been conducted with the models under treatment dimension. The analysis with diagnosis dimension models have also been conducted similarly and same has been presented in the table-5.

Table 5: Measurement of Efficiency in Diagnosis Dimension

DMUs	No of DMUs	Average Efficiency Score TE_{VRS}
Model D		
H_GOV	06	0.924
H_PSU	10	0.557
H_PVT	05	0.701
ALL	21	0.696
Model E		
H_GOV	06	0.712
H_PSU	10	0.802
H_PVT	04	0.708
ALL	20	0.756
Model F		
H_GOV	05	0.690
H_PSU	10	0.890
H_PVT	04	0.757
ALL	19	0.810

Note: DEAP statistical package has been deployed for analysis part.
H_GOV: Government hospitals run by state government; H_PSU: Public hospitals run by public sector undertaking organizations; H_PVT: Hospitals run under private ownership; TE_{VRS}: Technical Efficiency under the assumption of Variable Return to Scale

Considering the performance of different categories of hospitals, both for 'treatment dimension' and 'diagnosis dimension', the final two models i.e., model C and F have been have been finalized foe carrying this study forward. From the above analysis, the technical efficiency scores have of aforesaid models has been acquired for further analysis. It has been found that the government hospitals run by the state government show high level of performance followed by public hospitals run by public sector undertaking organizations and hospitals run under private ownership as per model C of the treatment dimension; in model F of diagnosis dimension, the result is different where the public hospitals run by public sector undertaking organizations are showing the best performance, followed by hospitals run under private ownership and government hospitals run by the state government.

Significance across Differences in Performances among Hospitals: Mann Whitney U Test

The obtained values from the previous analysis for both treatment and diagnosis dimension among three categories of hospitals are now required to be confirmed whether their differences are significant or not; Mann Whitney U Test has been deployed for purpose. The result of Mann Whitney U Test is presented in Table-6.

Table 6: The Mann Whitney U Test Result

Treatment / Diagnosis	Combination	H_GOV and H_PSU			H_GOV and H_PVT			H_PSU and H_PVT		
	Hospital	H_GOV	H_PSU	Total	H_GOV	H_PVT	Total	H_PSU	H_PVT	Total
	N	10	8	18	10	4	14	8	4	12
	Mean Rank	13.3	4.8	9.5	9.5	2.5	7.5	8.3	3.0	6.5
	Sum of Ranks	133	38	171	95	10	105	66	12	78

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	Test Statistic[b]	Mann-Whitney U	2.00			.00			2.00		
		Wilcoxon W	38.00			10.00			12.00		
		z	-3.39			-2.84			-2.38		
		Asymp. Sig. (2-tailed)	.001			.004			.017		
		Exact Sig. [2*(1-tailed sig.)]	.000[a]			.002[a]			.016[a]		
	Remarks		The technical efficiency (TE) of H_GOV and H_PSU are Significantly Different			The technical efficiency (TE) of H_GOV and H_PVT are Significantly Different			The technical efficiency (TE) of H_PSU and H_PVT are Significantly Different		
Diagnosis Dimension	Combination		H_GOV and H_PSU			H_GOV and H_PVT			H_PSU and H_PVT		
	Hospital		H_GOV	H_PSU	Total	H_GOV	H_PVT	Total	H_PSU	H_PVT	Total
	N		5	10	15	5	4	9	10	4	14
	Mean Rank		6.0	9.0	8.0	4.8	5.3	5.0	8.0	6.3	7.5
	Sum of Ranks		3.	90	120	24	21	45	80	25	105
	Test Statistic[b]	Mann-Whitney U	15.00			9.00			15.00		
		Wilcoxon W	30.00			24.00			25.00		
		z	-1.46			-.26			-.89		
		Asymp. Sig. (2-tailed)	.145			.798			.376		
		Exact Sig. [2*(1-tailed sig.)]	.254[a]			.905[a]			.539[a]		
	Remarks		The technical efficiency (TE) of H_GOV and H_PSU are not Significantly Different			The technical efficiency (TE) of H_GOV and H_PVT are not Significantly Different			The technical efficiency (TE) of H_PSU and H_PVT are not Significantly Different		

[a] Not corrected for ties.
[b] Grouping Variable: Hospital

Note: The Mann Whitney U Test or Rank Sum Test has been conducted by using SPSS statistical package

The results show that the differences in performance among three categories of hospitals are significant in treatment dimension, but the same is not significant in diagnosis dimension. Thus, the performance result among these categories of hospitals in diagnosis dimension is dropped at this point. Further discussion in this study is carried forward with the results of treatment dimension among these three categories of hospitals. Figure-1, 2 and 3 show the diagrammatic representation of the average efficiency scores of the DMUS in treatment dimensions.

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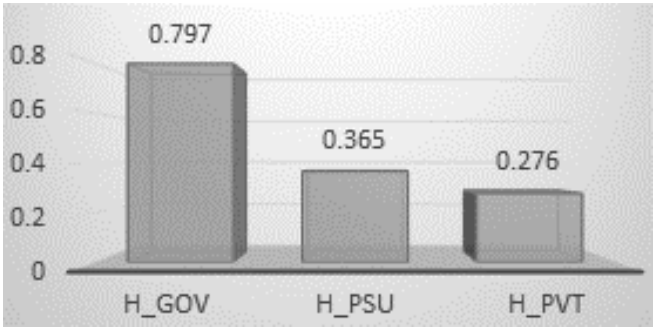

Figure 1: Measurement of Efficiency in Treatment Dimension According to Model-A

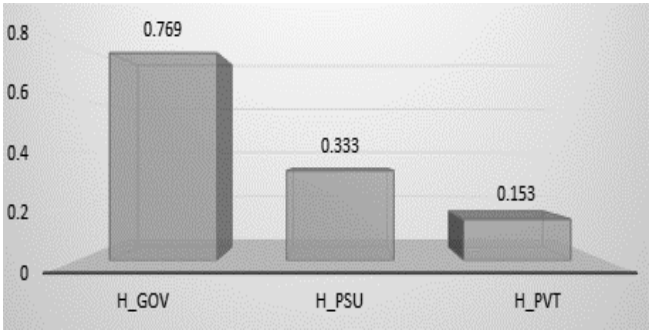

Figure 2: Measurement of Efficiency in Treatment Dimension According to Model-B

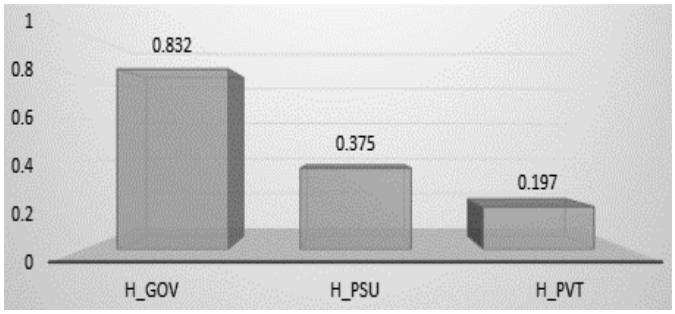

Figure 3: Measurement of Efficiency in Treatment Dimension According to Model-C

Determinants of Performance: Censored Tobit Analysis

In the second stage of this study, the discussion has been carried out with the technical efficiency values of treatment dimension which are obtained in the first stage through data envelopment analysis. The values obtained in treatment dimension are now considered as dependent variable for finding the determinants of the performance. The independent variables used in this study include bed size, bed occupancy rate, location of the hospital, pressure of patients in out-patient department and two variables (based on the ownership of the hospitals, whether as the hospital is a government hospitals run by state government or a public hospitals run by public sector undertaking organizations). The censored tobit analysis has been performed to find out the determinants of the performance of the hospitals.

Table 7: Determinants of Performance

Dependent Variable: Technical Efficiency (TE)				
Method: Maximum Likelihood - Censored Tobit				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
BS	-0.00096	0.00048	-1.99570	0.046
BOR	0.33886	0.14470	2.34185	0.019
OPP	0.10421	0.07557	1.37895	0.168
LOC	9.56E-07	6.37E-07	1.50076	0.133
$DUMY_1$	0.64505	0.07526	8.57004	0.000
$DUMY_2$	0.20721	0.06485	3.19511	0.001

 https://dx.doi.org/10.4314/thrb.v25i4.20

Note: The Maximum Likelihood - Censored Tobit has been conducted by using SPSS statistical package

The results obtained from the analysis and presented in Table-7, show that the bed size of the hospital, the bed occupancy rate and the ownership pattern of hospitals are the significant determinants of performance of different categories of hospitals. It can be opined that the smaller size hospitals in terms of bed size, the performance is on the better side. In literature, Masiye (2007) also insight on more supervision as well as control on relatively smaller sized healthcare institutions for better performance. Other studies also found that the efficiency has a inverse relationship with the size of the hospital (Alatawi et al,2020; Botega et al, 2020 etc.). When the number of in-patients is more, occupying more number of bed, the performance of the hospital also becomes better. In literature, Zere (2000) has pointed that high demand of service in terms of bed occupancy rate maximizes the use of resources of supply side and thus maximizes the performance also. The performance of hospitals also becomes better when the hospital is run by state government and also by the public sector undertaking organizations. In the existing literature, Lee et al (2009) have found that the not-for-profit hospitals are better performer than the for-profit hospitals in the United States.

Conclusion

The present study has been conducted to determine hospital performance determinants in a selected geographical jurisdiction. In the first stage of the study, the hospitals' performances in the form of efficiency estimation were conducted; in the second stage, the determinants of the obtained performance level in the form of efficiency values from the first stage were explored. So, in the first stage of the study, considering the input-output variables, different models were designed, and the relative performance was measured under two unanimous specifications, namely, treatment dimension and diagnosis dimension.

Among the three categories of hospitals, the differences in performances related to the treatment dimension are significant, unlike the performance of the diagnosis dimension. It has been found that the treatment-oriented performance level is on a larger scale in hospitals under government ownership, followed by public hospitals run by public sector undertaking organizations and hospitals run under private ownership. The performance level, which was obtained through the estimated efficiency value in the first stage, was studied, and it was revealed that the performance of these hospitals is significantly related to the size of the hospital and the bed occupancy rate. The management and authority of the hospitals also take a significant role in the performance level.

It is a long allegation to the developing and developed countries regarding the inefficient and insufficient allocation of healthcare resources in achieving the ‘health for all’ goal. The performance of any form of healthcare organization becomes crucial in this backdrop. The myth of inefficiency in government or public-owned hospitals has been revealed and discarded in this study. However, it can be said that further scope is there to improve efficiency, which may be achieved by better management in small state government hospitals and decentralized management in large state government hospitals. In a developing or underdeveloped nation, all alternative healthcare providers need to be efficient enough for the rationale of mass health profit. Thus, the other two categories of hospitals under different ownership patterns must also be better performers by achieving better efficiency values.

The hospitals owned by public sector undertakings have limited output because they cater mostly to their employees; these hospitals need better management and allow more access for patients other than their existing employees for operational justification; well-designed awareness generation among outsiders may also be very useful in this regard which not only improve their performance but also add values to the entire organization by better branding and social responsibility. The hospitals under private ownership pattern also need to attract more patients and thus optimally use the available resources for better performance; the government

floated social health insurance facilities like 'Ayushman Bharat PM-JAY' and 'SwasthyaSathi' may be given much priority to attract more everyday people and justify the utilization of the available resources in this regard. This round initiative can help a developing nation to develop its healthcare availability, which in turn may satisfy the vision of 'health for all' through the mission of a 'healthcare inclusion' strategy by including all hospitals in the supply side regardless of their motive, ownership pattern or any other phenomenon.

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