
Technical, Allocative and Economic Efficiency of Public Hospitals of Punjab (Pakistan): A Data Envelopment Analysis

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This study analyzes the performance of 25 DHQs hospitals of the Punjab province of Pakistan, during the two time periods i.e. 2006-2010 (pre-decentralization era) and 2011-2015 (post-decentralization era). Data envelopment analysis (DEA) has been used to estimate the economic efficiency (EE) of DHQs for the above mentioned two time periods. Our empirical results indicate that the average level of EE of 25 DHQs increased from 0.57 in the first period to 0.67 in the second period. An improvement in the performance of 76% of hospitals has been noted after the decentralization.

Introduction

Pakistan, a less developed country in the South Asian region, has been facing serious issues in its public health care system. The health system of Pakistan ranked 122 out of 191 countries of the world in terms of performance of the health sector (Ansari, et al. 2016). Access to healthcare facilities is one of the most major issues in Pakistan. More than 60 percent of its population lives in rural areas which are deprived of better healthcare services due to urban biased healthcare policies (Khalil, et al., 2017). An increase in healthcare resources has not been sufficient to cater to the growing needs of healthcare due to which the situation of the health sector has worsened. The ability of a country's health care system to meet the health care demands of the citizens has been further deteriorated by its extensive inefficiency. Therefore, Pakistan's performance has been dismal in terms of its health indicators such as maternal, infant and neonatal mortality rates (Khaliq and Ahmad, 2016). The quality of the provision of health care services depends upon an efficient combination of human resources, financial resources and timely distribution of

healthcare services (Akashi, et al, 2004). To ensure good governance in the healthcare sector, the efficient delivery of health care services and accountability of health professional for their actions is essential. In Pakistan, the governance of the health sector is identified with poor and inefficient healthcare service delivery (Ejaz, et al., 2011). The ineffective regulatory mechanism, lack of transparency and accountability, government ineffectiveness and corruption are obstacles to good governance in this sector. Healthcare facilities are also substandard as there are only 78 doctors available per 100,000 people. Public health care spending has been merely between 0.6% and 0.9% of GDP over the last 10 years whereas WHO recommends that at least 6 percent of GDP should be spent on health. More than 70 percent of this limited healthcare budget of the country is consumed by the public sector hospitals. It means that public sector hospitals are the most important component of the health care system in Pakistan and the availability of good quality health care services depends upon the performance of these hospitals. Therefore, there is a need to evaluate the performance of public hospitals in Pakistan to improve the health condition in Pakistan. This paper is an attempt to analyze the performance of public hospitals situated in Punjab; the largest province of Pakistan with respect to a population where more than half of the country's population lives.

To the health sector's performance, efficiency is considered as an important tool for which different measures are used (Peacock, Efficiency can be understood .(2001 as the optimum input utilization at the lowest cost. This definition suggests reducing or avoiding wastage of important economic resources as a result of underutilization and misallocation of labor and capital. The efficiency concept generally mentions to the input utilization. Therefore, efficiency is nearly synonymous with cost restraint. This study focuses on reducing the cost of public hospitals at a given output level. For this purpose, measurement of economic (cost) efficiency of public hospitals is important. Economic efficiency is the product of technical efficiency and allocative efficiency (Farell, 1957). Technical efficiency tells the level of wastage of resources and allocative efficiency indicates the level of misallocation. The cost-minimizing inputs level is determined by economic efficiency. The values of efficiencies fall in the range 0 to 1. The hospitals with efficiency score 1 will be efficient and with 0 inefficient. The level of inefficiency in the hospitals is found as one minus efficiency score (1-ES). This paper not only measures the performance of public hospitals during the last decade but also try to capture the effect of fiscal decentralization 2010 on their performance. After this policy provincial government in Pakistan are independent in their decision regarding health sector.

Literature Review

For public hospitals, efficient utilization and allocation of health resources are necessary for containing their cost and improving the quality of their services. Therefore, the efficiency analysis is important for improving the performance of the hospitals. After the most valuable work of measuring hospital efficiency by Wagstaff (1989), an extensive literature has tried to measure the efficiency of hospitals with the application of DEA method. Technical, allocative, and economic efficiency of the public as well as private hospitals are measured in different countries like Australia (Assaf, et al., 2009), Zimbabwe (Maredza, 2012), South Korea (Kang and Kim, 2014), Ethiopia (Mann, et al., 2016), and Slovene (Blatnik, et al., 2017). In Pakistan, only two studies of Abbas, et al. (2011) and Raashid, et al., (2014) based on just technical efficiency have been found related to the health sector efficiency. There is lack of research based on efficiency analyses related to public hospitals in Pakistan. To fill this gap, this paper estimates the technical, allocative and economic efficiency of Public hospitals.

Methodology

Data Envelopment Analysis is a nonparametric approach. It is suitable for efficiency measurement of the hospital because it can handle the multiple outputs and multiple inputs (Emrouznejad, et al., 2017). The DEA, linear programming approach, based information on inefficiencies of output and surplus inputs can be significantly used for the monitoring of the hospitals and health systems performance. First technical efficiency is measured by using the DEA method. After measuring TE, The AE can be measured by the ratio of economic efficiency and technical efficiency. While economic efficiency is the ratio of the total minimum cost to the observed cost mentioned. The detail of methodology is given in the paper of Coelli, (1996)

Data and Variables

The data comprises 25 District Headquarter Hospitals (DHQs) of Punjab from 2006 to 2015. The teaching DHQs hospitals are excluded in this analysis. Data collected from the Punjab Health Department and Account General Office. This study used three variables as labor input that is a total number of doctors, nurses and the total number of other paramedical and non-paramedical staff. For capital, most studies considered 'the number of beds' as a proxy of capital inputs. Therefore, the number of beds used as a capital input in this study. Salaries of hospitals staff, medicine cost, depreciation and current non-development expenditure used as input prices.

Results and Discussion

It is observed that on average 21% (TE-0.79) resources in the DHQs of Punjab are wasted during the period 2006-10 is 0.79. The higher level of wastage is found in the hospital of Sheikhpura as shown in Table-3. The hospitals of Mundi Bahudin and Kasur are found fully efficient technically with 0% wastage (TE-1.00). While in 2011-15, only 14% (TE-0.86) resources are wasted in the DHQs hospitals of Punjab. It means after 2010, the wastage of resources is declined from 21 percent to 14 percent. The higher level of wastage of resources is found in the hospital of Jhelum in 2011-15. The hospitals of Muzaffargarh, Narowal, Chakwal, and Bhakar are fully efficient 2011-12. If the provincial government cut down 14% resources of these hospitals, there will be no effect on their services. The level of resource reduction in the DHQs hospitals is found by 1 minus TE score of each hospital.

In the case of allocation of resources, it is observed that 30% (AE-0.70) of resources are misallocated in the DHQs hospitals of Punjab before 2010. In 2011-15, the mean value of AE, 0.76, indicates the 24 percent misallocation of resources in the hospitals. The hospital of Nankana Sahib has the higher level of misallocation in both time periods. Similarly, only one hospital of Mundi Bahudin has full allocative efficiency in both times. There is only 6 percent improvement in the allocation of resources is found in the DHQs after 18th constitutional amendment.

Level of wastage and misallocation increases the cost of these hospitals. From this analysis, 43% (EE-0.57) resources are found as cost-increasing inputs in the DHQs hospitals of Punjab during 2006-10. There is 10% (EE-0.67) improvement in the economic efficiency of DHQs hospitals after 2010. It means after 2010, the cost of the hospitals in Punjab is somehow reduced. The most costly hospital is of the district Nankanasahib. While the hospital of Mundi Bahudin is most economical in both time period. It can be summarized that the level of efficient utilization of resources is higher as compare to the allocation in the hospitals of Punjab and overall the DHQs hospitals are the most costly unit of healthcare delivery system in Punjab. The average values of efficiencies cannot be determined the level change in efficiencies after the 18th amendment. Therefore, the Wilcoxon signed rank test (a non-parametric test) is used to capture the effect of fiscal decentralization on efficiencies. By using test, the null hypothesis tested that the medians of the two samples are identical (fiscal decentralization has no effect on efficiencies). The result in Table 1 shows that variation inefficiencies are significant at 5 percent. Therefore, the null hypothesis is rejected and determines that there is a change in TE, AE, and EE after the 18th amendment. However, the change in performance of DHQs hospitals of Punjab is not up to the desired level.

Table-1: TE, AE, and EE of 25 DHQs Hospitals of Punjab, 2006-10 and 2011-15.

DHQs	TE		Change	AE		Change	EE		Change
	2006-10	2011-15	TE2-TE1	2006-10	2011-15	AE2-AE1	2006-10	2011-15	EE2-EE1
Bahawalnagar	0.76	0.57	↓ -0.19	0.62	0.72	0.1	0.49	0.41	↓ -0.08
Layyah	0.55	0.62	0.07	0.83	0.79	↓ -0.04	0.46	0.47	0.01
Muzzafargarh	0.85	1.00	0.15	0.94	0.98	0.04	0.81	0.98	0.17
Rajampur	0.83	0.80	↓ -0.03	0.57	0.62	0.05	0.48	0.50	0.02
Jhang	0.97	0.98	0.01	0.90	0.96	0.06	0.89	0.94	0.05
Toba Take Singh	0.93	0.90	↓ -0.03	0.77	0.78	0.01	0.70	0.72	0.02
Chaniot	0.76	0.96	0.2	0.81	0.67	↓ -0.14	0.61	0.64	0.03
Narowal	0.95	1.00	0.05	0.78	0.71	↓ -0.07	0.78	0.69	↓ -0.09
Hafizabad	0.76	0.73	↓ -0.03	0.43	0.55	0.12	0.36	0.39	0.03
Mundibahudin	1.00	1.00	0	1.00	1.00	0	1.00	1.00	0
Kasur	1.00	1.00	0	0.92	0.90	↓ -0.02	0.92	0.90	↓ -0.02
Okara	0.85	0.70	↓ -0.15	0.74	0.87	0.13	0.56	0.63	0.07
Okara (south)	0.59	0.90	0.31	0.55	0.76	0.21	0.32	0.73	0.41
Sheikhupura	0.41	0.85	0.44	0.62	0.73	0.11	0.37	0.64	0.27
Nankansahib	0.94	0.89	↓ -0.05	0.27	0.48	0.21	0.24	0.41	0.17
Khanewal	0.86	0.86	0	0.77	0.68	↓ -0.09	0.66	0.58	↓ -0.08
Lodhran	0.75	0.94	0.19	0.45	0.60	0.15	0.33	0.56	0.23
Pakpattan	0.88	0.97	0.09	0.66	0.82	0.16	0.61	0.76	0.15
Vehari	0.87	0.66	↓ -0.21	0.75	0.86	0.11	0.62	0.56	↓ -0.06
Attock	0.65	0.67	0.02	0.60	0.73	0.13	0.35	0.47	0.12
Chakwal	0.73	1.00	0.27	0.74	0.90	0.16	0.61	0.90	0.29
Jhelum	0.70	0.55	↓ -0.15	0.66	0.81	0.15	0.40	0.44	0.04
Bhakar	0.56	1.00	0.44	0.51	0.94	0.43	0.32	0.94	0.62
Khushab	0.78	0.85	0.07	0.65	0.64	↓ -0.01	0.47	0.54	0.07
Mianwali	0.88	0.99	0.11	0.86	0.84	↓ -0.02	0.82	0.84	0.02
MEAN	0.79	0.86		0.70	0.76		0.57	0.67	
Change after (2010) 18th amendment	TE (% of DHQs)			AE (% of DHQs)			EE (% of DHQs)		
	Improvement			56%			68%		
	Fall			32%			28%		
	No change			12%			4%		
Wilcoxon Signed Rank Test									
Efficiencies	Time Period			Z-value	p				
TE	2006-2010 – 2011-2015			-1.9161	0.02743<0.05				
AE	2006-2010 – 2011-2015			-2.5	0.00621<0.05				
EE	2006-2010 – 2011-2015			-2.7	0.00347<0.05				

Source: Authors' Estimations

Conclusion and Policy Recommendations

In order to strengthen the performance of secondary health care services in Punjab, policymakers and administrator need information about how well the DHQs hospitals are utilizing and allocated the resources they receive at the given cost. For

this, the study estimates the technical, allocative, and economic, efficiency scores for 25 DHQs hospitals of Punjab during 2006–2015. Efficiency scores are summarized and found that 79 percent of healthcare resources are utilized efficiently in 2006-10 and 86 percent in 2011-15. In the allocation of resources, 70 percent of resources are allocated efficiently in the first time period and 76 percent in second. The cost-minimizing inputs level is 57 percent in the first period of the study and 67 percent in second. As for as, the effect of fiscal policy is concerned, it is found that after 2010, there is an improvement in the performance of DHQs hospitals in Punjab and it is also confirmed by Wilcoxon rank test. It is found that the optimal utilization of resources is higher in the DHQs hospitals as compared to allocation and the hospitals are failed to achieve cost minimizing inputs level. The allocation of resources is found most cost increasing factor in the hospitals. Therefore, the government should improve the management of these hospitals to improve their performance and in the case of resource distribution provincial government should focus on the most efficient DHQs hospitals. There should also be the mobilization of resources from inefficient DHQs hospitals to efficient DHQs hospitals. Further study can also be done to find the factors affecting the performance of these hospitals.

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