Environment and Ecology 37 (3A) : 803—811, July—September 2019
Website: environmentandecology.com ISSN 0970-0420

Health Care Efficiency in Districts of Rajasthan

Rajesh Kumar Jangir, Yogesh Kumar

Received 11 February 2019 ; Accepted 14 March 2019 ; Published on 6 April 2019

Abstract Health is important objective of planning and policy. Health care requires high level of investment. Keeping this in mind, the present study is an attempt to evaluate the efforts made by government of India in general and specifically in the state of Rajasthan to ensure better health status of people. This study evaluates the efficiency of districts of Rajasthan in health sector using Data Envelopment Analysis (DEA). It indicate that Baran, Bikaner, Jaipur, Jaisalmer, Kota, and Sawai Madhopur districts are most efficient and Southern districts like Banswara, Dungarpur and Rajsamand are least efficient. Thus it is required that condition of efficiency need to improve in these districts.

Keywords Health, Efficiency, Expenditure, Outcome.

Introduction

There is a well-understood association that healthy citizens of a nation can directly affect the economic growth. During last few decades India has attained noteworthy economic growth but the progress in health was not achieved proportionately. The meager health infrastructure combined with depleted income level and poverty has been a major cause of the poor health achievements of the country. Health system deserve the highest priorities in any endeavor to improve the health of the people, as it provides the critical interface between life saving and life enhancing interventions and the people who need that (Sankar and Kathuria 2004).

Rajasthan belongs to the group of states which are termed as empowered action group (EAG) states, formerly referred to as BIMARU states, considering the fact that most of the population and health indicators are at a low level in the state. The infant mortality rate in Rajasthan is 49 as compared to India, that is 42 and maternal mortality rate in Rajasthan is 255 which much higher than the national average of 178. The situation of child mortality and neonatal mortality is versed in Rajasthan compared to all India level. Rajasthan government's health expenditure is quite low in absolute terms then compare to some other states of India (Chang and Ying 2006, Duggal and Nandraj 1991, Haldar and Sarkar 2009). There is much need of increasing government expenditure on health. This study aims to examine the trends of health expenditure, health access and outcome in Rajasthan.

In short health is important objective of planning and policy and requires high level of investment. Keeping this in mind, the present study is an attempt to evaluate the efforts made by government of India in general and specifically in the state of Rajasthan to ensure better health quality of people. This study evaluates the efficiency of Indian states and districts of Rajasthan in health sector using Data Envelopment Analysis (DEA). It is methodology based processes on the virtual efficiency concept as it only estimates efficiencies for any given element against other elements in the model. An efficiency index specifies that the unit is located on the production frontier, i.e.

Rajesh Kumar Jangir*
Associate Professor, Department of Economics, Government College, Jaipur, Rajasthan, India

Yogesh Kumar
Research Scholar, Department of Economics, University of Rajasthan, Jaipur, Rajasthan, India
e-mail: rajeshkanwarpura@yahoo.co.in
*Corresponding author

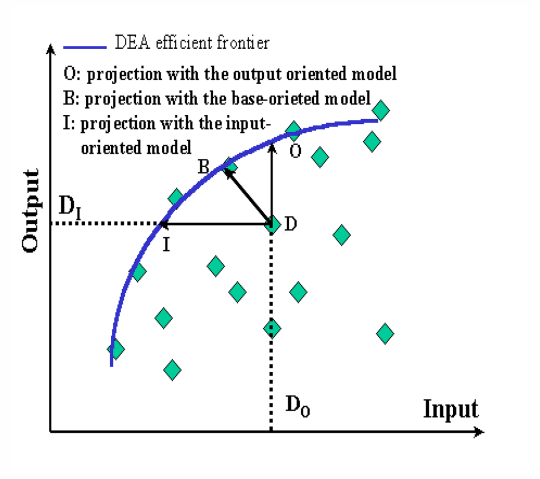

Fig. 1. DEA efficient frontier variable.

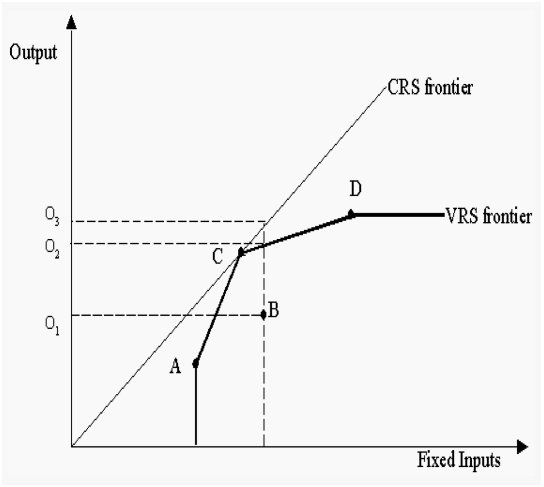

Fig. 2. Constant returns to scale.

it's a best practice unit comparative to other units in the model. Efficiency indices of less than one, indicates that the unit is less efficient than the best practice unit in the sample. The relative efficiency of health sector using DEA can be compared by determining the efficient districts or states (in health sector) as benchmarks and through evaluate the inefficiencies in input amalgamation (slack variables) in other districts or states (in health sector) relative to these benchmarks.

Figure 1 reveals that in this process point D is less efficient decision-making unit (DMU). Points I, B and O are in DEA efficient frontier. If output oriented model is used then keep inputs constant and try to maximize output and reach on point O. If input oriented model is used then keep the output constant and try to minimize inputs and reach on point I. To increase output and decrease inputs and reach on point B, base oriented model is used . In this paper output oriented model is used for evaluating efficiency of states of India and districts of Rajasthan in health sector.

DEA vs statistical regression

DEA is generally used to appraise the competence of number of decision-making units (DMUs). A distinctive empirical approach is distinguish as a central tendency approach and assesses DMUs relative to an average DMU. On the other hand, DEA is an extreme point method and evaluates each DMU with only the most proficient DMUs. Extreme points frequently recline at the edges of the data set. The extreme points in a DEA data set are the majorly efficient DMUs, they lie on the efficient edge and symbolize DMUs that have achieved 100% efficiency, relative to the other DMUs not on the efficient edge.

Table 1. Inputs and outputs for analyzing efficiency in Districts of Rajasthan. A/GMI:–Area cover by per Government Medical Institution. GMI/Pop.:–Government Medical Institution on Per Lakh Population. Beds / Pop.:–Beds in Government Medical Institution on Per Lakh Population. R.L.Sq.km.:–Road Length in per 100 square kilometers. In CDR:–Inverse Crude Death Rate. In IMR:–Inverse Infant Mortality Rate. In Neo – Natal Mortality Rate:–Inverse Neo-Natal Mortality Rate. In MMR:–Inverse Maternal Mortality Rate.

For analyzing efficiency in Districts of Rajasthan							
Inputs				Outputs			
A/GMI	GMI/Pop.	Beds/Pop.	R.L. Sq.km.	In CDR	In IMR	In Neo-Natal Mortality Rate	In MMR

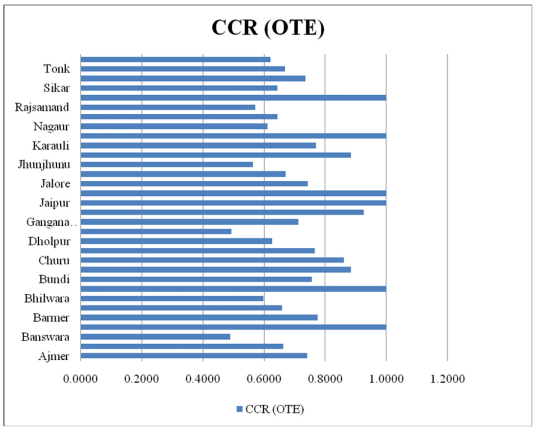

Fig. 3. Overall technical efficiency in Districts of Rajasthan. Source: Result are based on researcher calculation.

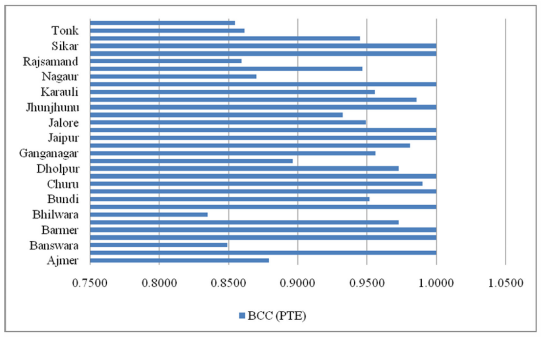

Fig. 4. Pure technical efficiency in Districts of Rajasthan.

DEA dig out information from a data set in an unusual way than a statistical model does. The purpose of statistical models is to fit the data with an optimal regression. In contrast DEA compute the efficient frontier by positioning the figures on the efficient limit (the extreme points). Precisely, the efficient frontier estimation is distinct and piecewise. Every data point that lies on the core of the proficient frontier is then optimized relative to the data points on the efficient frontier.

Both DEA and statistical models extort all the information enclosed in data set. In statistical models, the regression equation signifies the central tendency and standard error of the data set. For this cause, the data points are implicit to be characterized by the regression equation. On other hand, DEA essentially optimizes each data point. This allows information to be discovered about the real data point and related DMU instead of just getting knowledge about the central tendency and standard error of the data set. In other terms, DEA focal point is on the individual data points and supposes the individual data points which are symbolized by the central tendency and standard error of the data set. DEA and statistical models vary in their assumptions about numerical functions that represent the data. Statistical models entail and use assumptions about particular arithmetical functions. Regression models relate the independent variable(s) to the dependent variable(s) by entailing the use of a precise arithmetical function like a regression equation or a Cobb-Douglas production function. The statistical function also involves specific assumptions in relation to the distribution of the error terms for

Table 2. Health care efficiency in Districts of Rajasthan. Source: Result are based on researcher calculation.

District	CCR (OTE)	BCC (PTE)	SE
Ajmer	0.7405	0.8790	0.8424
Alwar	0.6622	1.0000	0.6622
Banswara	0.4897	0.8490	0.5768
Baran	1.0000	1.0000	1.0000
Barmer	0.7747	1.0000	0.7747
Bharatpur	0.6599	0.9728	0.6783
Bhilwara	0.5979	0.8349	0.7161
Bikaner	1.0000	1.0000	1.0000
Bundi	0.7567	0.9516	0.7952
Chittorgarh	0.8836	1.0000	0.8836
Churu	0.8613	0.9899	0.8701
Dausa	0.7659	1.0000	0.7659
Dholpur	0.6263	0.9728	0.6438
Dungarpur	0.4935	0.8961	0.5507
Ganganagar	0.7128	0.9561	0.7455
Hanumangarh	0.9254	0.9809	0.9434
Jaipur	1.0000	1.0000	1.0000
Jaisalmer	1.0000	1.0000	1.0000
Jalore	0.7420	0.9491	0.7818
Jhalawar	0.6704	0.9322	0.7191
Jhunjhunu	0.5639	1.0000	0.5639
Jodhpur	0.8830	0.9857	0.8958
Karauli	0.7696	0.9554	0.8054
Kota	1.0000	1.0000	1.0000
Nagaur	0.6120	0.8703	0.7032
Pali	0.6431	0.9465	0.6794
Rajsamand	0.5714	0.8596	0.6647
S. Madhopur	1.0000	1.0000	1.0000
Sikar	0.6439	1.0000	0.6439
Sirohi	0.7351	0.9449	0.7779
Tonk	0.6692	0.8616	0.7767
Udaipur	0.6217	0.8549	0.7273

Table 3. Descriptive statistics of Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE) of Districts of Rajasthan. Source: Result are based on researcher calculation.

Description	CCR (OTE)	BCC (PTE)	SE
Mean	0.7524	0.9514	0.7871
Mean after excluding efficient districts	0.6943	0.9221	0.7372
Min value	0.4897	0.8349	0.5507
Max value	1.0000	1.0000	1.0000

a regression equation or earning the value of the subsidiary product for a Cobb-Douglas production function. On the other hand, DEA require no use of or assumptions about exact mathematical functions. Total DEA requires that each data point lie on or below the competent frontier in order to compute the efficiency score for each data point.

Comparison of DEA and regression models

The DEA computation creates only relative efficiency scores because merely actual data points are used. DEA is intended to maximize the relative efficiency score of each data point by fabricating a set of weights. The set of weights for each data point must be accurately possible for all other data points. DEA empirically creates a distinct and piecewise competent frontier.

The efficient frontier is the maximum frontier that is accessible from the data set. In fiscal terms, the efficient frontier symbolizes the revealed best-practice production frontier. For DEA, inefficient data points lie underneath the efficient frontier. Battese and Timothy J. Coelli (1992, 1995) DEA recognizes the magnitude of inefficiency for each inefficient data point. The extent of inefficiency can be found out in one of two ways. First, the amount of efficiency could be determined by evaluating to a single data point that lies on the efficient frontier. The other way would be by comparing to a convex combination of other data points situated on the efficient frontier. A convex combination of data points on the efficient frontier is shaped like the edges of a circle or sphere. The second way also entails the convex combination

Table 4. Peers counts in CCR model in Rajasthan. Source: Result are based on researcher calculation.

Districts	Times
Baran	2
Bikaner	26
Jaipur	17
Jaisalmer	4
Kota	26
S. Madhopur	2

of data points to utilize the similar level of inputs and create the identical or greater level of outputs. Potential development for every inefficient data points can also be calculated. The potential improvement for every inefficient data point is the distance from the inefficient data point to the efficient frontier. The distance from the inefficient data point to the efficient frontier differs depending on the form of DEA model selected.

Models in DEA

There are two vital models in DEA: The CCR model, based on constant returns-to-scale (CRS) assumptions, and the BCC model, based on variable returns-to-scale (VRS). The CCR model was developed in 1978 to calculate the effects of educational programs designed to assist deprived students in US public schools. First paper on DEA appeared in the European Journal of Operational Research in 1978 (Charles et al. 1981). The CCR models were actually developed with both input and output orientation depending upon whether the objective was minimized or maximized. Here, the CCR model is developed with maximization as the objective. Numerous conventional statistical -econometric techniques were used before DEA was developed ; none of the earlier techniques was able to deal with problems where the values of the outputs were unknown or CCR assumes CRS production meaning that an increase to any input results in a corresponding and proportionate increase to the outputs. The BCC model is more flexible in terms of the frontier form and allows variable returns-to-scale ; its frontier has a piecewise linear and convex distinctiveness and does not essentially cross the origin.

Figure 2 explains the constant return to scale

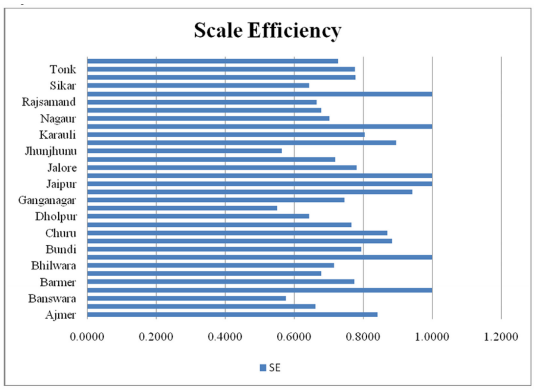

Fig. 5. Scale efficiency in Districts of Rajasthan.

(CRS) frontier and variable return to scale (VRS) frontier. CRS frontier signifies the CRR model and VRS frontier represents the BCC model. CCR model illustrates the overall technical efficiency and BCC model explains the managerial technical efficiency. In this figure, point C is on CRS and VRS, both frontier, so it proves that DMU C is overall technical efficient firm and point A and D is on VRS frontier and below to CRS frontier, so it indicates that DMU A and D are managerially efficient firms and there is scale inefficiency in those DMU's. Point B is below the CRS and VRS frontier so it reflects that managerial and scale efficiencies both need to perk up.

Model assumptions

DEA is an extreme point technique with the extreme data points situated on the efficient frontier. A basic assumption behind DEA, as an extreme point process, is that inefficient states and districts are supposed to have the prospective to function as efficient states and districts positioned on the efficient frontier, or the location of a projection from the inefficient states and district's data point to the efficient frontier.

While preferring the form of a DEA model, two assumptions need to be made: (1) the choice of returns-to-scale, and (2) the choice of orientation. An option must be made among the constant returns-to-scale of the CCR model and the variable returns-to-scale of the BCC model. For the CCR and BCC models, a second alternative must be made between an orientation of minimization or maximization.

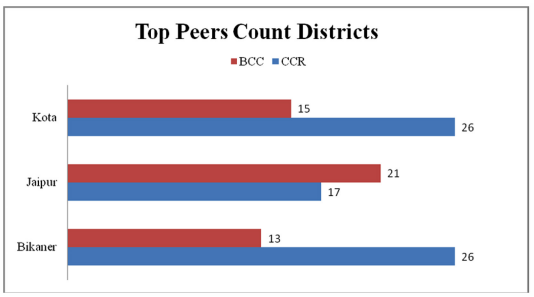

Fig. 6. Top peers count Districts of Rajasthan.

Model formulation

Data Envelopment Analysis (DEA) model is used in this paper. This statistical and mathematical model development by the Charles et al. (1981), Charles Banker et al. (1985) et al. (1984) forms of DEA. DEA is a methodology based on the relative efficiency concept since it only calculates efficiencies for any given unit against other units in the sample. Thus, efficiency measures are relative, not absolute, measures.

The calculated efficiency indices are thus based on a comparison of units within year. An efficiency index indicates that the unit lies on the production frontier, that is, it is a best-practice unit relative to other units in the sample. Efficiency indexes of less than one indicate that the unit is less efficient than the best practice unit in the sample. The lower the efficiency score means the less efficient the unit relative to other units.

Formulation of the DEA model

Output-oriented CCR model can be written as follows:

$$Maximize\ \ddot{e}_k$$

$$Subject\ to: \sum_{j=1}^{N} \lambda_j x_{ij} \leq x_{ik}$$

$$\sum_{j=1}^{N} \lambda_j y_{rj} \geq \ddot{e}_k y_{rk}$$

$$\lambda_j \geq 0$$

Table 5. Peers counts in BCC model in Rajasthan. Source: Result are based on researcher calculation.

Peers counts in BCC model Districts	Times
Baran	1
Barmer	2
Bikaner	13
Chittorgarh	3
Dausa	1
Jaipur	21
Jaisalmer	8
Jhunjhunu	2
Kota	15
S. Madhopur	1
Sikar	3

Here :
λ is a (n × 1) column vector.
ë is a scalar and 1/*ë* is the efficiency score of DMU *k* i.e. the Overall Technical Efficiency (OTE) based on CRS assumption (TE_{CRS}).
i = 1, 2, ...*m* : represents the inputs.
r = 1, 2, ...*s* : represents the outputs.
j = 1, 2,.....*n* : represents the companies.
x_{ij} = amount of input *i* used by DMU *j*.
y_{rj} = amout of output *r* produced by DMU *j*.

In output-oriented BCC model, one additional constraint is added given as follows:

$$\sum_{j=1}^{N} \lambda_j = 1$$

The LPP problem then provides us with the measure of Pure Technical Efficiency (PTE), which is based on VRS assumptions (TE_{VRS}).

From the above, we derive a measure of scale efficiency (SE) as a ratio of TE_{CRS} to TE_{VRS} given as :

$$SE = TE_{CRS} / TE_{VRS} \quad \text{or} \quad OTE / PTE$$

In this study for analyzing the efficiency, different variables are used as inputs and outputs. The health indicators such as Crude Death Rate (CDR), Infant Mortality Rate (IMR), Neo-Natal Mortality Rate and Maternal Mortality Rate (MMR) are used as an output reflects good health condition when reduce. So these variables are used in inverse form. It indicates that when inverse value of these indicators is increased than actual value is decreased (Table 1).

Table 6. Super efficiency score and ranking of districts. Source: Result are based on researcher calculation.

District	Super efficiency score	Rank
Ajmer	0.7405	16
Alwar	0.6622	21
Banswara	0.4897	32
Baran	1.4545	4
Barmer	0.7747	11
Bharatpur	0.6599	22
Bhilwara	0.5979	28
Bikaner	1.6720	3
Bundi	0.7567	14
Chittorgarh	0.8836	8
Churu	0.8613	10
Dausa	0.7659	13
Dholpur	0.6263	25
Dungarpur	0.4935	31
Ganganagar	0.7128	18
Hanumangarh	0.9254	7
Jaipur	1.0966	5
Jaisalmer	2.2143	1
Jalore	0.7420	15
Jhalawar	0.6704	19
Jhunjhunu	0.5639	30
Jodhpur	0.8830	9
Karauli	0.7696	12
Kota	1.7984	2
Nagaur	0.6120	27
Pali	0.6431	24
Rajsamand	0.5714	29
S. Madhopur	1.0226	6
Sikar	0.6439	23
Sirohi	0.7351	17
Tonk	0.6692	20
Udaipur	0.6217	26

Overall Technical Efficiency (OTE)

The OTE scores reflect the overall efficiency of government medical facilities of major Indian states. Most of the district reflected significant fluctuation in this analysis.

Pure Technical Efficiency (PTE)

The PTE scores depicts the pure Health sector efficiency excluding scale effects, shows a similar pattern

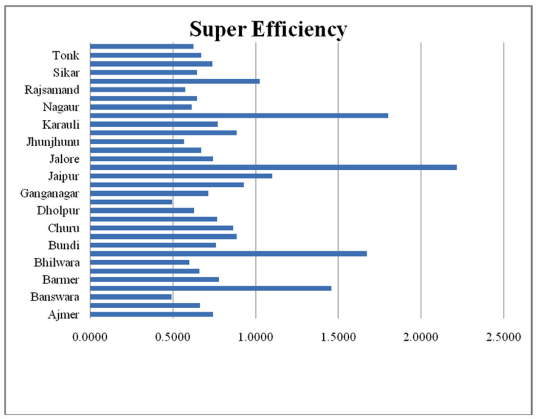

Fig. 7. Super efficiency score of districts.

of fluctuation and change to the OTE analysis. It is also known as managerial efficiency.

Scale Efficiency (SE)

Scale efficiency (SE) scores, reflect various classes of the returns to scale of health facilities and don't show any consistent pattern of change across the sectors during this period.

Health care efficiency in districts of Rajasthan

Table 2 shows that Baran, Bikaner, Jaipur, Jaisalmer, Kota and Sawai Madhopur are working efficiently in Rajasthan. Overall Technical Efficiency (OTE) score of these districts is equal to one. It depict that these districts of Rajasthan are fully efficient in health sector. Hanumangarh is also working efficiently with OTE score of 0.9254 which indicates that it is working 92% efficiently. Table also reflects that OTE score of Banswara is the lowest (0.4897) with requirement of 51% efficiency level development. Dungarpur (0.4935), Jhunjhunu (0.5639), Rajsamand (0.5714) and Bhilwara (0.5979) are also working inefficiently in health sector which requires 40% improvement in efficiency.

In this table Pure Technical Efficiency (PTE) score shows that Alwar, Baran, Barmer, Bikaner, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Kota, Sawai Madhopur and Sikar are working with full managerial efficiency with score equal to 1. It indicates that there is no managerial inefficiency. Bhilwara has low (0.8349) managerial efficiency, there is need of 17% progression in managerial efficiency. PTE score of Banswara is also very low (0.8490) which indicates 15% development in managerial efficiency. Other districts of Rajasthan also need to perk up their managerial efficiency in health care services.

Table 2 also reveals that Baran, Bikaner, Jaipur, Jaisalmer, Kota and Sawai Madhopur scale efficiency score is equal to 1. It reveals that in health sector these districts of Rajasthan are working with full scale efficiency. Hanumangarh's scale efficiency score is 0.9434 which depicts 94% scale efficiency. Table indicates that Dungarpur has the lowest (0.5507) scale efficiency in Rajasthan with need of about 45% improvement in scale in health sector. Table also reveals that Jhunjhunu (0.5639) and Banswara (0.5768) also require development, about 43% scale in health sector in Rajasthan.

Figure 3 indicates that Baran, Bikaner, Jaipur, Jaisalmer, Kota and Sawai Madhopur are working with full overall technical efficiency (OTE) in Rajasthan. Dungarpur has the lowest OTE in health sector. Figure also depicts that Banswara, Jhunjhunu and Rajsamand are less efficient districts of Rajasthan in health sector. There is need to improve overall technical efficiency in health sector especially with lower efficient Districts of Rajasthan.

Figure 4 reveals pure technical efficiency (Managerial efficiency) of Districts of Rajasthan in health sector. Completely pure technical efficient districts are Alwar, Baran, Barmer, Bikaner, Chittogarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Kota, Sawai Madhopur, and Sikar, whereas Bhilwara, Banswara, Udaipur and Tonk are very low efficient districts. Figure indicates that in these districts there is need to build up managerial efficiency in health sector.

Figure 5 depicts that Baran, Bikaner, Jaipur, Jaisalmer, Kota and Sawai Madhopur are fully scale efficient districts. Dungarpur, Jhunjhunu, and Banswara are less efficient districts of Rajasthan in health

sector. So there is need to perk up scale in these less efficient districts.

Table 3 shows the descriptive statistics of overall technical efficiency (OTE), pure technical efficiency (PTE) and scale efficiency (SE) of different districts of Rajasthan. Mean value of Rajasthan's districts in CCR model is 0.7524. It depicts that there is need to upgrade 25% for achieving full efficiency level. Table also indicates that mean value after excluding efficient districts is 0.6943. It reflects that inefficient districts need 31% enhancements in health sector. Lowest value of CCR model is 0.4897. So there is need to develop 51% in government health sector.

Table 2 also reveals the descriptive statistics of BCC model. Mean value of BCC model was 0.9514 which indicates that pure technical efficiency level is good in districts of Rajasthan. There is only 5% requirement to develop pure technical efficiency. Mean value after excluding efficient districts is 0.9221. It depicts that five percent progression is needed in managerial efficiency level in inefficient districts. The lowest value of managerial efficiency is 0.8349 and it is higher than the lowest value of CCR model. It shows that minimum efficient district need 17% improvement in managerial efficiency. In this model maximum value is one which shows that some districts were fully proficient in managerial efficiency.

Descriptive statistics of scale efficiency in districts of Rajasthan is illustrated in this table. It reveals that mean value of scale efficiency is 0.7871. It indicates that these districts of Rajasthan require 22% improvements in scale efficiency. Mean value after excluding efficient districts is 0.7372 so there are 27% segments, which need to develop scale efficiency in these inefficient districts. The minimum value of scale efficiency is 0.5507 which depicts that the minimum efficient district need to progress about 45% on scale in government health sector.

Table 4 depicts that Bikaner and Kota has the highest (26) peer count in this CCR model. It indicates that 26 districts are following of Bikaner and Kota's strategy in health sector. After Bikaner and Kota, Jaipur is 17 time peer by other districts. It depictes that 17 districts is following Jaipur's health strategy. Jaisalmer is peered by four times and Baran and Sawai Madhopur are followed by two times. It indicates that only two districts followed their health strategies.

Table 5 reveals that Jaipur has the highest (21) peer count in BCC model. It indicates that 21 districts follow Jaipur's managerial health policy. Peer count of Kota, Bikaner and Jaisalmer is 15, 13 and 8 respectively. It depicted that 15 districts follow Kota's managerial policy, 13 and 8 districts follow Bikaner and Jaisalmer's managerial health management. Baran, Dausa and Sawai Madhopur's peer count is one that shows that only one districts follows their managerial management.

In this figure top three peer count districts of Rajasthan by histogram in CCR and BCC model are depicted. It shows that Bikaner and Kota has the highest times peered districts in CCR model and Jaipur has the highest times peer districts in BCC model. Jaipur is the 3rd / highest time peered district in CCR model. Figure 6 also depicts that Kota and Bikaner are 2nd and 3rd highest peered districts in BCC model.

Table 6 explained that Jaisalmer achieved highest super efficiency value with efficiency score of 2.2143, ranking first in this analysis. It reflects that Jaisalmer is working competently in health sector. In this analysis Kota (1.7984) got 2nd rank followed by Bikaner (1.6720). These districts are working resourcefully in health sector. Baran, Jaipur and Sawai Madhopur got 4th, 5th and 6th rank respectively. As in CCR model these districts got equal efficiency score, so ranking was not possible that's why super efficiency model is used. Banswara got last i.e. 32th rank in this analysis. It indicated that Banswara is working with least efficiency. Dungarpur, Jhunjhunu and Rajsamand got 31st, 30th and 29th ranks respectively. It depict that in these districts of Rajasthan there is need to develop efficiency in health sector.

Figure 7 reflects that Jaisalmer had highest super efficiency followed by Kota, Bikaner, Baran, Jaipur and Sawai Madhopur. Figure also shows that Dholpur and Banswara achieved the highest super efficiency score in Rajasthan in this analysis.

Conclusion

In this study of efficiency in health sector of districts of Rajasthan is evaluated. Study indicates that Baran, Bikaner, Jaipur, Jaisalmer, Kota and Sawai Madhopur districts', Overall Technical Efficiency (OTE) score is equal to one. It reflect that in health sector these districts are most efficient in Rajasthan. Further it is also revealed that OTE score of Banswara was the lowest (0.4897). It depict that Banswara is working with about 51% inefficiency in health sector.

In this study Pure Technical Efficiency (PTE) score explains that Alwar, Baran, Barmer, Bikaner, Chittorgarh, Dausa, Jaipur, Jaisalmer, Jhunjhunu, Kota, Sawai Madhopur and Sikar are working with the highest managerial efficiency with score of equal to 1. It indicates that there is no managerial inefficiency whereas Bhilwara had very low (0.8349) managerial efficiency. It reveals that there is 17% need to enhance managerial efficiency in Bhilwara. Result also reflected that Baran, Bikaner, Jaipur, Jaisalmer, Kota and Sawai Madhopur scale efficiency score is equal to 1. It reveals that in health sector these districts are working with full scale efficiency whereas Dungarpur has lowest (0.5507) scale efficiency in Rajasthan. It indicates that there is need of about 45% enhancement in scale measure in health sector.

Further in this analysis it was found that Jaisalmer achieved first rank with highest super efficiency value score of 2.2143. It depicts that this district is working with high efficiency in health sector. Kota achieved 2nd rank and Bikaner achieved 3rd rank. Super efficiency score of these districts are 1.7984 and 1.6720 respectively. It signifies that in health sector these districts were working with proficiency. It was found that Banswara remained last i.e. 32th rank which reveals that this district is working with least efficiency. Results also reflect that Dungarpur, Jhunjhunu and Rajsamand achieved 31st, 30th and 29th ranks respectively in the state of Rajasthan. It depict that these districts required to improve efficiency in health sector.

Southern districts of Rajasthan like Banswara, Dungarpur, Rajsamand have lowest scale efficiency. Thus it is required that conditions of these states should be improved. Technical efficiency is also reported to be low in southern districts than other districts of Rajasthan. It indicates the need of enhancing the technical efficiency in these areas by implying effective policies by the government. Some districts of Rajasthan reported to have poor management efficiency. Thus it is required that state government should introduce skill development program in health sector to improve the management efficiency.

References

Banker RD, Charles A, Cooper WW (1084) Some models for estimating technical and scale inefficiencies in data envelopment analysis. Manag Sci 30 : 1078—1092.

Battese GE, Timothy J. Coelli (1992) Frontier production functions, technical efficiency and panel data: With application to paddy farmers in India. J Productivity Anal 3 : 153—169.

Battese GE, Timothy J. Coelli (1995) A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data. Empirical Econ 20 : 325—332.

Charles A, Cooper WW, Golany B, Seiford L (1985) Foundations of Data Envelopment Analysis for Pareto—Koopmans Efficient Empirical Production Functions. J Econom 30 : 91—107.

Charles A, Cooper WW, Rhodes E (1981) Data Envelopment Analysis: Approach for Evaluating Program and Managerial Efficiency—with an Application to the Program follow through Experiment in US Public School Education. Manag Sci 27 : 668—697.

Chang K, Ying YH (2006) Economic Growth, Human Capital Investment and Health Expenditure: A Study of OECD Countries. Hitotsubashi J Econ 47 : 1—16.

Duggal R, Nandraj S (1991) Regulating the Private Health Sector. Medico Friend Circle Bulletin, pp 173—174.

Haldar Sushil Kr., Sarkar Debaprasad (2009) Health, Income and Health Expenditure in Indian States: A Search for Causal Explanation. Contemporary issues in development economics, pp 121—148.

Sankar Deepa, Kathuria Vinish (2004) Health Performance in Rural India: Efficiency Estimates Across States. Econ Polit Weekly 39 : 1427—1433.