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Shipra Bansal
Research Scholar, Department of Economics, Panjab University, Chandigarh, India

Dr. Madhur M Mahajan
Assistant Professor, Department of Economics, GGDSD College, Chandigarh, India

Corresponding Author:
Dr. Madhur M Mahajan
Assistant Professor, Department of Economics, GGDSD College, Chandigarh, India

A systematic review of the efficiency in health care in India

Shipra Bansal and Dr. Madhur M Mahajan

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Abstract
Background: Huge investment has been made in improving health status of India. But still India has not achieved satisfactory results in terms of health outcomes. This calls for an assessment of the efficiency in health care system.
Objective: To conduct a critical review of the literature on efficiency measurement in health care in India
Methods: A comprehensive literature review was conducted to address the study objective.
Results: A total of eleven articles from different regions on India met the study inclusion criteria. All those studies which are based on health efficiency in terms of health outcomes in India both state wise and district wise are included. The studies found that relevant disparities are prevalent in India both state wise and district wise
Conclusion: The Body of literature gave a composite picture on the difference in the efficiency in health system performance in India both state wise and district wise. There is a need that government should frame health policy in such a way to reallocate resources from states which have abundant resources to those states that are efficient but poor in their health outcomes.

Keywords: Systematic, efficiency in health, India

Introduction

Background: The World Health Organization defined human health in a broader sense in its constitution as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Health is believed to be a primary ingredient of human welfare and an engine of economic growth (Tigga and Mishra, 2015) [24]. Health supports development process; it spurs economic growth and is a good measure of human well-being. Enhancement of health of the people is one of the major aims of the process of development (Kapur, 2011) [13].

Health systems deserve the highest priorities in any endeavour to improve the health of the people, as they provide the critical interface between life-saving and life-enhancing interventions and the people who need them (Kathuria and Sankar, 2005) [14]. The World Health Organisation in 2000 has rightly emphasized that the primary goal of a health system should be to provide better health in a responsive manner and with a fair financial distribution. However, how well a health system accomplishes this goal is reflected through existence of efficiency in the health system.

As per Human Development Index (HDI) 2017, India ranked only at 130th place out of 189 countries in terms of health, wealth and education. According to the Millennium Development Report 2015, Government had taken huge steps to improve health condition in India. But still India seems to be lagging behind of Millennium Development Goals (MDGs) target values in terms of health attainments. According to the National Health Profile 2010 of Central Bureau of Health Intelligence, morbidity and associated mortality in terms of communicable and non-communicable diseases remains very high though the absolute number of cases and deaths seem to be declining. MMR also remains far above the ground. To propel the process of structural transformation, rejuvenation of healthcare facilities is imperative which in turn calls for increased health expenditure (Arun and Kumar, 2013) [2].

The central budgetary allocations have not been reduced in the health sector, be it at the per

capita level or per rupee of GDP or even as a ratio of total revenue budgetary allocations (Kadekodi and Kulkarni, 2006) [12]. In fact, invariably they have shown an increasing trend, however marginal it may be. But the expenditure on health varied substantially between states. Moreover, inadequate allocation of public health resources and its unequal spread across different states have resulted in inequitable health status (Bhatia and Dhindsa, 2008) [4]. Thus any financing strategy to human development aiming at reducing disparities should also take into account not only overcoming inadequacy but also inefficiency in allocation and utilization of health care inputs (Purohit, 2012) [19]. The present study presents a critical review of the literature on the efficiency measurement in health in Indian states. The aim of this study is to analyze the factors behind differences in efficiency in health outcomes in Indian states.

Methods

A comprehensive literature review on the efficiency measurement in health care in India was conducted in February 2018 following the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines.

Search Strategy

Searches were performed for all papers published up to March 2018 in relevant databases (PubMed, Science Direct and EBESCO). Reference lists in the papers included in the review were searched to identify further eligible articles.

Search Terms

Search terms and their combinations are presented in Table1. Databases were searched using the primary term in combination with one term associated with efficiency (column2, table 1) and one term associated with health (column 3, table1).

Table 1: Search Terms

	Combined with (individually)	Combined with (individually)
India	Efficiency Technical Efficiency Data Envelopment Analysis Stochastic Frontier Approach	Production of Health Health Care resources Health Care system Health Outcomes Health care sector Health system performance

Study Selection and inclusion criteria

The search started by finding the titles and abstracts of all articles found in the initial search from the databases. Then duplicate articles were removed after screening of titles and abstracts and then relevant studies were selected for further review, which involved examining the content of their full text. In next stage, those papers were included which provided original research work on health efficiency in India. The review included only peer-reviewed articles that were reported in the English language and excluded abstracts, reports, expert opinion, narrative reviews, etc. Those articles were not included which include research work other than in India and also other than health efficiency like energy efficiency, bank efficiency and Environment efficiency. Moreover those studies were not included in which outcomes were based on particular diseases like tuberculosis, malaria, etc. Thus, only those peer-reviewed papers which presented a work on efficiency measurement in health outcomes pertaining to Indian states, published in English during 2001 to 2016 were considered eligible for full review.

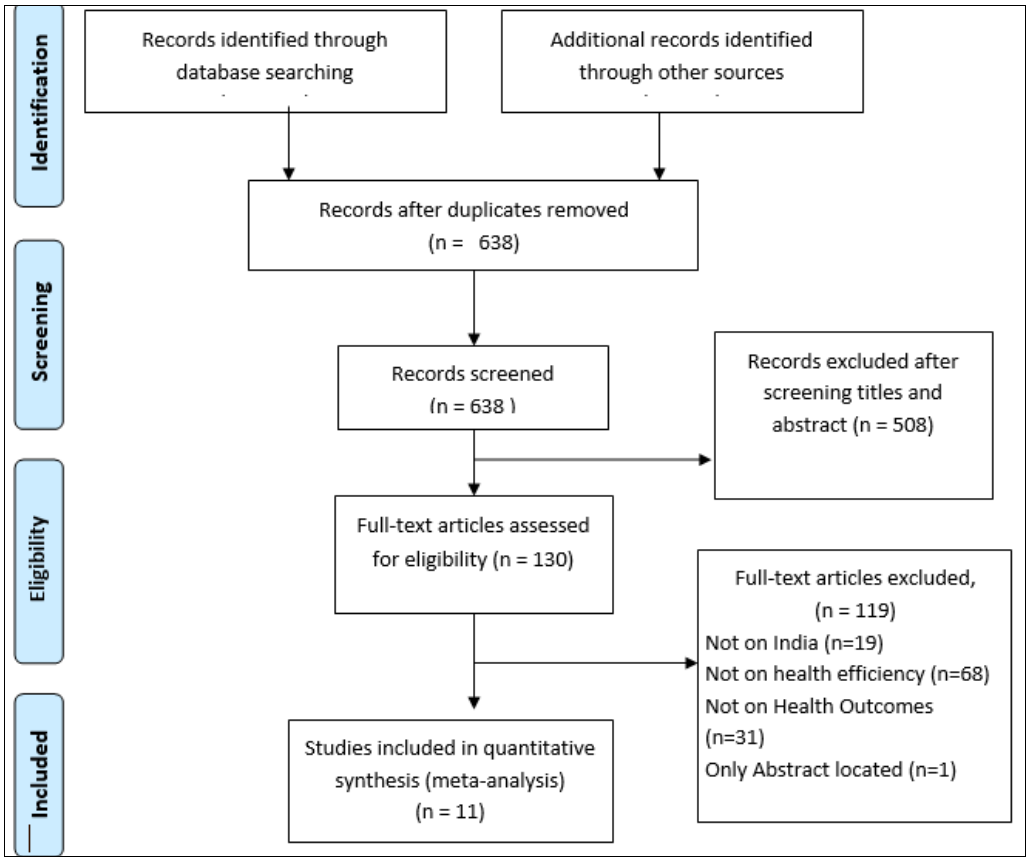

Fig 1: Flow Diagram showing study selection

Table 2: Study characteristics of included articles

Ref No	Author (s)	Year	Data collection Period	Region
5	Chakrabarti	2003	1986 -1995	Kerala, Maharashtra, West Bengal, Punjab, Bihar, A.P., Tamil Nadu, Karnataka, Haryana, Gujarat, Rajasthan, U.P., M.P., Odhisa
22	Sankar and Kathuria	2004	1986-1997	Andhra Pradesh, Assam, Bihar, Gujarat, Haryana. Himachal Pradesh, Karnatka, Kerala, Maharashtra, M.P., Odhisa, Punjab, Rajasthan, Tamil Nadu, U.P., West Bengal
7	Dash, Vaishani and Muraleedharan	2008	2001	Tamil Nadu
21	Purohit	2008	2004	West Bengal
20	Purohit	2010	1991 and 2004	Karnataka
23	Shetty and Pakala	2010	2001-02	Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, M.P., Maharashtra, Odhisa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttaranchal and West Bengal
17	Prachitha and Shanmugam	2012	2000-2009	Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Karnatka, Kerala, M.P, Maharashtra, Odhisa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttaranchal and West Bengal
8	P. *et al*.	2012	5th to 10th Five-Year Planning periods of India	Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Haryana, Karnataka, Kerala, M.P., Maharashtra, Odhisa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal
24	Tigga and Mishra	2015	2012	Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Haryana, Jharkhand, Karnataka, Kerala, M.P., Maharashtra, Manipur, Meghalaya, Mizoram, Odhisa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal
21	Purohit	2016	2012-13	Gujarat
15	Mohanty and Bhanumurthy	2018	2002-15	Andhra Pradesh, Assam, Bihar, Chattisgarh, Gujarat, Haryana. Himachal Pradesh, Jammu and Kashmir, Karnatka, Kerala, Maharashtra, M.P., Odhisa, Punjab, Rajasthan, Tamil Nadu, U.P., Uttarakhand and West Bengal

Findings

Out of the previous studies it was found that despite their dissimilar contexts and techniques these studies share a common step-by-step empirical procedure that determines first the choice of frontier efficiency measurement approach, second the specification of inputs and outputs to be used in the selected approach, and finally, the method used to explain efficiency differences and the factors thought to be associated with these differences. This common process, as depicted in Figure 2, forms a convenient framework for the following review.

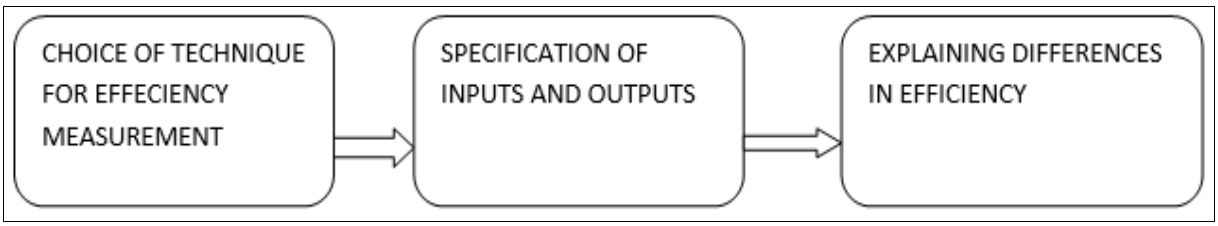

Fig 2: Steps in Measuring and Analysing Healthcare Efficiency

Choice of technique for efficiency measurement

The literature on the measurement of technical efficiency provides two competing, though conceptually similar approaches for estimating the relative efficiency across firms using best-practice frontier: i) non-parametric frontier approach; and ii) parametric frontier approach. Data envelopment analysis (DEA) based upon non-parametric frontier approach was developed by Debreu (1951) [9], Farrell (1957) [11] and later elaborated by Banker, Charnes and Cooper (1984) [3], Färe, Grosskopf and Lovell (1985) [10] and others to measure the technical efficiency via estimating a production frontier. DEA, based on linear programming techniques, does not require specification of the functional form.

However, the another approach is based upon the parametric estimation of frontier and known as Stochastic Frontier Analysis (SFA) developed independently by Aigner, Lovell and Schmidt (1977) [1], Meeusen and van den Broeck (1977) [16]. Stochastic frontiers are based on econometric regression techniques and therefore require specification of a particular functional form.

Using DEA technique, a deterministic frontier is derived, such that all deviations from this frontier are assumed to be the result of inefficiency. That is, no allowance is made for noise or measurement error. A number of studies had used DEA analysis to estimate the efficiency of healthcare institutions. These include Dash *et al*. (2008) [7], Shetty and Pakala (2010) [23], Tigga and Mishra (2015) [24] and Purohit (2016) [18]. On the contrary, SFA technique allows a disturbance term representing noise, measurement error, and exogenous shocks beyond the control of the production unit. This in turn permits the decomposition of deviations from the efficient frontier into two components, inefficiency and noise. Few studies have used SFA technique to estimate the efficiency of healthcare institutions. These include Chakrabarti (2003) [5], Sankar and Kathuria (2004) [22],

Kathuria and Sankar (2005) [14], Purohit (2008) [20], Purohit (2010) [21], Prachitha and Shanmugam (2012) [17] and Sarma and Kamble(2017). The selection of any particular approach is likely to be subject to both theoretical and empirical considerations. The emphasis is not on selecting a superior theoretical approach, as it should be emphasized that the mathematical programming and econometric approaches address different questions, serve different purposes and have different informational requirements.

Table 3: Technique of efficiency used in reviewed articles

Ref No	Author (s)	Year	Technique used
5	Chakrabarti	2003	SFA
22	Sankar and Kathuria	2004	SFA
7	Dash, Vaishani and Muraleedharan	2008	DEA
21	Purohit	2008	SFA
20	Purohit	2010	SFA
23	Shetty and Pakala	2010	DEA
17	Prachitha and Shanmugam	2012	SFA
8	P. *et al.*	2012	DEA
24	Tigga and Mishra	2015	DEA
18	Purohit	2016	DEA
15	Mohanty and Bhanumurthy	2018	DEA

Specification of Inputs and Outputs

Within the broad scope of healthcare services, frontier efficiency measurement techniques have been applied to different states with different inputs and outputs. The articles so included in our study had used either Infant Mortality Rates (4 studies) or Life Expectancy at Birth (3 studies) or both (3 studies) as their output variables (table 4). Only studies by Tigga and Mishra (2015) [24] and Mohanty and Bhanumurthy (2018) [15] considered Infant Survival Rate instead of Infant Mortality Rate (IMR) as its output variable. The study justified this as in the case of IMR; the lower the level better is the state's performance. But in case of DEA which is an output-oriented approach, augmented level of output, indicates better performance of the concerned state.

As far as input variables are concerned, almost all studies used Per capita state income, Per capita state health expenditure, Literacy Rate, Public Health Centers and Number of Doctors, Hospitals, Beds and Percent of Institutionalised Deliveries (table 4). One study by Purohit (2016) [18] and instead of using all the input variables, applied principal component analysis of these input variables to select the factors for DEA. Only those variables were considered for further DEA calculation which had eigen value greater than one indicating how many factors to retain.

Table 4: Inputs and output variables used in reviewed articles

Ref No	Author (s)	Year	Input Variables	Output Variables
5	Chakrabarti	2003	Per capita primary health care centre Per capita hospital Health expenditure as a % of NSDP Births in institution Births in home by trained practitioner Per capita net state domestic product	IMR
22	Sankar and Kathuria	2004	Number of primary health centres (Phcpc) Number of doctors (Drpc), Number of paramedical staff (Parapc) Number of hospital beds available (Bedpc) and Percent of institutionalised deliveries (Totalbir)	IMR
7	Dash, Vaishani and Muraleedharan	2008	Real per capita GDP Literacy Rates Degree of Urbanization Total Beds Total no of doctors	Life expectancy Infant Mortality Rates
11	Purohit	2008	Per capita Hospital beds per capita number of PHC doctors per capita paramedical staff per capita	Life expectancy
20	Purohit	2010	Per capita Hospital beds per capita number of PHC doctors per capita paramedical staff per capita	Life expectancy
23	Shetty and Pakala	2010	Per capita state health expenditure Health Centre Per Million Populations Percentage of population Below Poverty Line Literacy Rate	Life expectancy Infant Mortality Rates
17	Prachitha and Shanmugam	2012	Per capita state income Per capita state health expenditure	Life expectancy

			Literacy Rate Phcs and SCHs Doctors	
8	P. *et al.*	2012	Number of registered doctors available per 1 (lac) population Registered general nursing midwives (GSM) per 1 lac population Number of hospitals (includes government, local bodies, private and voluntary organizations) per 1 lac population Number of beds (includes government, local bodies, private and voluntary organizations) per 1 lac population.	Female Life expectancy Under five Mortality Rates
24	Tigga and Mishra	2015	health workers per 1,000 population (doctors, nurses and paramedical staff) health centres per 1,000 population (PHCs, CHCs and SCs)	Infant Survival Rates Percentage of institutional deliveries
18	Purohit	2016	Medical and paramedical personnel. Tribal beds, community health centers (CHCs) sub-divisional hospital ANC registered Percentage of ANC 3 checkup against ANC registered Delivery in governmental institutions and home delivery	Infant Mortality Rates
15	Mohanty and Bhanumurthy	2018	Health expenditure to GDP ratio Non-health expenditure to GDP ratio	Life expectancy Infant Survival Rates

Explaining Differences in Efficiency

A number of empirical studies had examined the determinants of the efficiency of healthcare institutions across different states in India. Various states faced the critical issue of determining whether the desirable outcomes from increased medical spending, driven primarily by the global demand for such service, advanced technology, do result in expected and adequate returns.

Table 5 shows the efficiency scores calculated by various researchers either by using DEA or SFA techniques. The relative efficiency score of the health systems indicates that given its health investment, how much the state is efficient in producing health outcomes. It is possible that the states having poor health outcomes may lie on frontier due to their low health expenditure. It shows only the relative performance and do not indicate any hierarchy in actual health outcomes. A score of 1.0 or 100 is considered to be efficient, thus lying on the efficiency frontier, while scores below 1.0 or 100 indicate inefficiency which lies below the frontier. Higher the efficiency score, better the state is using its health resources to produce health outcome.

Table 5: State wise efficiency scores

States	SFA			DEA			
	Chakrabarti	**Sankar and Kathuria**	**Prachitha and Shanmugam**	**Shetty and Pakala**	**P. *et al.***	**Tigga and Mishra**	**Mohanty and Bhanumurthy**
Andhra Pradesh	0.750	76.94	65.8	0.7583	0.632	0.95	0.51
Arunachal Pradesh	-	-	-	-	-	0.94	-
Assam	-	-	-	1	0.454	0.78	0.54
Bihar	0.793	81.13	89	1	0.551	1	0.53
Chhattisgarh	-	-	72.2	0.6406	-	0.55	0.55
Goa	-	-	-	-	-	1	-
Gujarat	0.699	74.58	78.4	0.8053	0.499	0.98	0.95
Haryana	0.718	71.56	72.5	0.7213	1	0.86	1
Himachal Pradesh	-	76.47	-	0.7263	-	0.64	0.49
Jammu and Kashmir	-	-	-	-	-	0.76	0.39
Jharkhand	-	-	79.4	1	-	0.85	0.64
Karnataka	0.737	74.82	75.7	1	0.641	0.94	0.67
Kerala	0.951	100	92.8	1	1	1	1
Madhya Pradesh	0.339	72.38	43.1	0.6289	0.471	0.98	0.59
Maharashtra	0.902	82.16	85.7	1	0.66	1	1
Manipur	-	-	-	-	-	0.76	-
Meghalaya	-	-	-	-	-	0.45	-
Mizoram	-	-	-	-	-	0.82	-
Odhisa	0.230	68.62	40	1	0.460	0.83	0.55
Punjab	0.882	76.09	80.4	1	0.645	0.71	0.84
Rajasthan	0.640	76.97	47	1	0.577	0.89	0.63
Sikkim	-	-	-	-	-	0.82	-
Tamil Nadu	0.745	74.98	85	1	0.637	1	0.82

Tripura	-	-	-	-	-	0.84	-
Uttar Pradesh	0.403	74.90	56.6	0.5985	0.411	1	0.48
Uttarakhand	-	-	84.4	0.778	-	0.66	0.65
West Bengal	0.899	82.66	87.1	1	0.684	0.76	0.84

Source: Compiled by author

It can be seen from table 5 that there exist inter-state disparities in terms of health efficiency scores calculated by different researchers. Tigga and Mishra (2015) [24] found that out of the 27 states only six states' health system is efficient, that is, they have the right mix of inputs to achieve the existing output levels seen in output approach. Similarly, Prachitha and Shanmugam (2012) [17] found that in 7 out of 17 states, the mean efficiency was below the average mean efficiency. Chakrabarti (2001) [6] found that Kerala, the state with a widely recognised commitment towards the development of its social sectors and Maharashtra, the state with the fastest growing per capita real income were the two best performers in terms of efficiency in production of health. The efficiency score of Kerala was either 1 or 100 or closet to highest efficient value (table 5). Maharashtra and West Bengal emerged as next best efficient states after Kerala. Their efficiency score was between 0.90 to 0.80 (table 5).

Apart from Kerala and Maharashtra, Kathuria and Sankar (2005) [14], Shetty and Pakala (2010) [23] and Tigga and Mishra (2015) [24] found that Bihar was one of the efficient states. The study also found that Bihar had a relative efficiency score of 81.13, which indicates that given its health investment, Bihar had attained a little over 81% of its potential in reducing the IMR. However, it is important to note that, even at the most efficient levels, Bihar could have reduced its IMR only to 66 and not to a lower and more desirable level like that of other efficient States such as Kerala and West Bengal. This was due to the lower health inputs used in Bihar as compared with these other States. Table 5 shows that Bihar efficiency score ranges between 0.80 to 1, which means that Bihar was also among efficient state. However, P. *et al*. (2012) [8] and Mohanty and Bhanumurthy (2018) [15] described Bihar as inefficient state in terms of U5MR, Female life Expectancy and Infant Survival Rates.

There are some states which were efficient but had poor health performance. Shetty and Pakala (2010) [23] explained that both Assam and Odhisa were using lower health inputs and as a result they had poor health performance. Similarly, Dhar and Bhattacharya (2012) [8], P. *et al*. (2012) [8] and Mohanty and Bhanumurthy (2018) [15] showed that due to inadequacy of health infrastructure and manpower some states like Madhya Pradesh, Orissa, Assam and Uttar Pradesh were inefficient. It was therefore important to increase allocation on health care facilities in the country, and spending should be diverted more to the states where outcomes are poor. The same was supported by table 5 which shows that the least efficient states were Assam, Odhisa, Madhya Pardesh, Uttar Pradesh and Chhattisgarh as their efficiency scores ranges below 0.50. But this is not necessary that only inefficient health input was the only reason for poor health performance. Chakrabarti (2001) [6] found that Rajasthan, which recorded a high mean value of Health Expenditure and achieved above-average rates of growth of PHC, NSDP and Literacy, still features among the bottom state. He found that ineffective utilization of the available health facility is one of the reason of prevalence of regional disparity in India.

Table 6: District wise efficiency scores

DEA				**SFA**			
Gujarat (Purohit (2016))		**Tamil Nadu (Dash, Vaishani and Muraleedharan (2008)) [7]**		**Karnatka (Purohit (2010))**		**West Bengal (Purohit(2008))**	
Ahmadabad	0.9178	Chennai	100	Bagalkot	86.82	Darjiling	95.59
Amreli	0.7568	Kancheepuram	100	Bangalore Rural	91.31	Jalpaiguri	88.64
Anand	0.5656	Thiruvallur	91	Bangalore Urban	88.04	Koch Bihar	78.76
Banas Kantha	1.0000	Cuddalore	100	Belgaum	89.09	Uttar Dinajpur	100.00
Bharuch	0.6390	Villupuram	100	Bellary	92.28	Dakshin Dinajpur	92.12
Bhavnagar	0.9291	Vellore	100	Bidar	92.25	Maldah	81.25
Dohad	0.8541	Tiruvannamalai	96	Bija pur	89.44	Murshidabad	92.65
Gandhinagar	0.5968	Salem	100	Chamarajnagar	93.82	Birbhum	85.17
Jamnagar	0.3354	Namakkal	92	Chikmaglur	91.17	Barddhaman	97.07
Junagadh	0.7815	Dharmapuri	100	Chitradurga	89.10	Nadia	87.94
Kachchh	0.6764	Erode	88	Dakshina Kannada	98.87	North 24 Parganas	100.00
Kheda	0.8214	Coimbatore	100	Davangere	90.92	Hugli	96.79
Mahesana	0.4171	Nilgiris	94	Dharwad	93.92	Bankura	93.09
Narmada	0.6172	Trichy	84	Gadag	93.82	Puruliya	85.97
Navsari	0.4337	Karur	98	Gulbarga	84.34	Medinipur	95.88
Panch Mahals	0.7950	Perambalur	100	Hassan	90.21	Haora	100.00
Patan	0.7332	Thanjavur	96	Haveri	89.58		
Porbandar	1.0000	Tiruvarur	92	Kodagu	97.09		
Rajkot	0.9852	Nagapattinam	100	Kolar	86.70		
Surat	0.9926	Pudukkotai	100	Koppal	92.63		
Surendranagar	0.9144	Madurai	100	Mandya	87.40		
The Dangs	0.5636	Theni	94	Mysore	87.99		
Vadodara	0.4982	Dindigul	100	Raichur	92.05		
Valsad	0.7836	Ramnad	100	Shimoga	95.99		

		Virudhunagar	100	Tumkur	88.22		
		Tirunelveli	100	Udupi	98.52		
		Sivagangai	100	Uttara Kannada	89.99		
		Thoothukudi	98				
		Kanyakumari	95				

***Source*:** Compiled by author

Table 6 explains the district wise analysis of studies conducted in four states of India. Purohit (2007, 2010 and 2016) [18-21] had conducted three separate studies on three states of Gujarat, Kartnatka and West Bengal. Similarly Dash, Vaishani and Muraleedharan (2008) [7] had examined the efficiency in use of health resources in Tamil Nadu state only. These studies found that there exist inter- district disparity in efficiency of health outcomes. This is owing to differentials in availability and utilization of inputs such as the per capita availability of hospitals, beds, and manpower, which adversely affects health outcome.

Conclusion

Following PRISMA guidelines, 11 articles had been selected and reviewed to assess the efficiency measurement in health care sector in India. With the prevailing inter-state disparities in health outcomes in India, there is an urgent need to concentrate efforts to reduce these inequalities. In the end, it can be seen that more or less ranking of the states are same. Kerala, Maharashtra, West Bengal, Bihar and Karnatka are comparatively efficient in utilizing health inputs whereas Uttar Pradesh, Madhya Pradesh, Assam, Odhisa and Chhattisgarh are last five states in the operational efficiency of health outcomes. Thus the results should be viewed bearing in mind the fact that States differ in their health-system inputs and health outcomes. It could be said that (i) lack of real investment in the health sector (ii) not-so-efficient performance of the rural health systems are the reasons for low levels of health outcomes and achievements.

It can be viewed from the studies that it is not necessary that the states with high health expenditure are efficient in generating health outcomes. The government or policy makers need to find out the reason for such disparities, whether it is due to inefficiency in utilizing health inputs or low health expenditure. States like Rajasthan, Haryana, Punjab are the states with high health expenditure but inefficient in generating health outcomes. Such states need to follow the best practices adopted by other better performing states like Kerala.

The states like Assam, Bihar, Odhisa and West Bengal are the states with low health expenditure but are efficient performers, should allocate more funds so that with more inputs they will generate better health outcomes. As resources are limited, government should frame health policy in such a way to reallocate resources to those states that are efficient but poor in their health outcomes.

It was evident from the review analysis that both SFA and DEA model techniques had similar outcomes vis-à-vis health efficiency and performance of states. It was however, difference in variables (in the respective studies) that affected the outcome. The studies measured the efficiency of health performance by taking one indicator of health output only, i.e. Infant mortality rates (IMR) or Life Expectancy at Birth (LEB). But IMR or LEB were alone insufficient as a proxy of health output, since there were other health output indicators like Crude Death Rate (CDR), Crude Birth Rate (CBR), under five mortality rate (U5MR), Maternal Mortality Rate (MMR) and Total Fertility Rate (TFR) which were ignored by previous studies. The absence of such indicators while estimating efficiency of health system is an important limitation. Due to the availability of large number of health output indicators, it is necessary to conduct a study explaining efficiency on the basis of all indicators. Therefore, it would be advantageous to conduct a comprehensive study based on all health output variables while assessing efficiency of health system.

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