Measuring the Efficiency of Quality Health Services in Heet City

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3 authors:

Ahmad Battal
University of Anbar

Khadija Khleaf
University of Anbar

Ahmed Subhi Abdalkafor
University of Anbar

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Ahmad H. Battal
Director of the Department of Planning and Follow-up
Al-Anbar University, IRAQ
ahmedaliny@yahoo.com

Khadija K. Abdulla
Department of Basic Sciences -College of Dentistry
Anbar University , IRAQ
ahmed.battall@gmail.com

Ahmed S. Abdalkafor
Renewable Energy Research Center
Al-Anbar University of -Iraq
ahmed_abdalkafor@yahoo.com

Abstract: *The study aimed to apply the data envelopment analysis to measure the efficiency of the (20) Health care centers for period 2011-2013 in Heet City of Al-Anbar province in Iraq. We applied the output variable returns to scale (VRS), the data were analyzed using data envelopment analysis Program ver 2.1.*
The study results showed that mean efficiency is 0.81 with (VRS) method , 0.70 according to constant returns to scale during the period 2011-2013, and the results showed that only five of health care centers reach the Economic optimal size.

Keywords: *Quality .Efficiency, Health care centers, data envelopment analysis.*

Introduction: Governments noticeably have an interest in evaluating the quality and efficiency of their health institutions. In all nations, public finance is the single most important source of health system funding, so local governments have a natural requirement to ensure that finance is deployed efficiently. Therefore, it is not surprising to find that methodologies that offer insights into efficiency have attracted the attention of policy makers. In addition, in many developing countries, a sizable element of the health care sector is supplied by non-market institutions. Specified the complexity of the functions undertaken by such institutions, and in the absence of the common market signals, there is a clear need for instruments that offer insights into overall performance. The look for such methods has been increased by the almost universal concern with rising health care costs and increased public stress to ensure that expenditure on health programs is used effectively.

Statement of the Problem, health services are taking on increasing importance both domestically and internationally. In the Iraq, heath sector account for 5 percent of total government expenditure, which reach about 4700 million dollars in 2013. Because of the increasing importance of health services in the economy, a number of techniques are being developed to measure different aspects of health service performance. One area in particular where there has been a great deal of focus deals with the measurement of health service quality, While it might be argued the measurement of the quality of a physical good is relatively straightforward, this task is not so simple in the context of health services. In fact measuring heath service quality performance levels has proven to be a rather difficult task. A generic measure of health service quality that could be used in any industry has yet to emerge, however, some progress has been made. Unfortunately, less effort has been devoted to this issue and for this reason the evaluative tools currently available are still quite limited.

The purpose of this paper is to introduce a new managerial tool for evaluating and managing health service quality levels. This new approach treats service quality as an intermediate variable, not the ultimate managerial goal, and makes use of data envelopment analysis (DEA), a nonparametric technique which allows for the relative comparison of a number of comparable organizational decision making units (DMUs). **The second** contribution of this study is to offer empirical evidence of the value of this innovative technique. This will be done by collecting of the (20) Health care centers for period 2011-2013 in Heet City of Al-Anbar province in Iraq and generating performance evaluations and recommendations for improvement using data envelopment analysis.

Organization, The remainder of this paper is presented in four sections. Section two is used to review the literature related to the concepts of health service quality and efficiency. Section three discuss the data envelopment analysis. Section four discuss data and results and final section concludes.

Health services between Quality and Efficiency.

In response to the current environmental changes, hospitals have become more conscious about efficiency with quality of their operation, searching for ways to provide more cost efficient care (Harkey and Varciu,1992). As with other companies responding to similar pressures to lower their costs and improve their service quality.

Graven (1988) explain the relationship between quality improvements and efficiency in two perspectives: the product-based approach and the manufacturing-based approach. First, quality and efficiency are negatively related in the product-based approach. This approach higher quality can be obtained at higher cost. And higher cost, in turn leads to lower efficiency. Second, a positive relationship of quality and efficiency is argued in the manufacturing-based approach. This approach define quality as conformance to requirements. Once requirement has been established, a product or service that deviates from that specification is considered to be poorly made or unreliable. Improvement in quality, which are equivalent to reductions in the number of deviations, leads to lower quality costs to higher efficiency, because costs of preventing defects and scraps are less expensive than those of repairing or reworking them (Suk, 1998). Any improvement in quality directly translate into increased output. Quality and efficiency would appear to be positively correlated.

In health care, examples of DMUs include entire health systems, purchasing organizations, hospitals, physician practices and individual physicians. The DMUs consume various costly inputs (labour, capital) and produce valued outputs. Efficiency analysis is centrally concerned with measuring the competence with which inputs are converted into outputs. In general, it does not seek to explain why it exhibits a particular level of efficiency (Fried, Lovell and Schmidt 1993).

The most common concept of efficiency is ' technical efficiency' (TE) which means transferring physical inputs such as labour and capital into outputs at the best level of performance. In Health efficiency refer to 'the the ability to produce the health service at the lowest cost ' (Benson, 1987). TE is represented by a minimum combination of inputs necessary to produce specific level of output (Al-Delaimi & al-Ani ,2006). As result a high degree of TE means either the possible increasing in outputs by using specific quantity of outputs, when there is no waste. So health care center considered TE as compared to other center if it produced the same level of outputs by less input, or more of outputs by the same or less inputs.

The basic notion of efficiency is shown in Figure 1, which illustrates the case of just one input and one output. The line OC indicates the simplest of all technologies: no fixed costs and constant returns to scale. A technically efficient organization would then produce somewhere on this line, which can be thought of as the production possibility frontier (Jacobs et al., 2006). Any element of inefficiency would result in an observation lying below the line OC. For an inefficient organization located at P_0, the ratio $X_0P_0/X_0P^*_0$ offers an indication of how far short of the production frontier it is falling, and therefore a measure of its efficiency level.

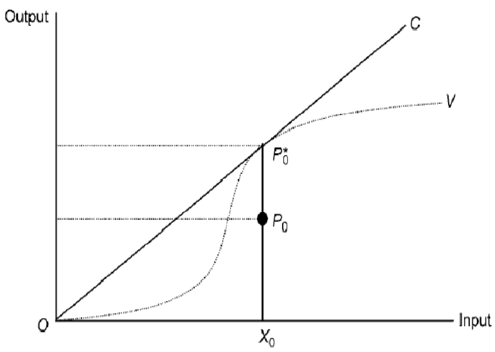

Fig 1. Efficiency measurement under constant returns to scale

Source: (Jacobs et al., 2006)

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Many other technologies are possible. For example, the curve OV indicates a frontier with variable returns to scale. Up to the point P*0, the ratio of output to input decreases (increasing returns to scale), but thereafter it increases (decreasing returns to scale).

We have so far assumed constant returns to scale. That is, the production process is such that the optimal mix of inputs and outputs is independent of the scale of operation. In practice there exist important economies and diseconomies of scale in most production processes. This is illustrated in Figure 2 for the case of one input and one output. The production frontier is illustrated by the curve OV, which suggests regions of increasing and decreasing returns to scale. The optimal scale of production is at the point P* where the ratio of output to input is maximized. Although lying on the frontier, the points P1 and P2 secure lower ratios because they are operating below and above (respectively) the scale-efficient point of production.

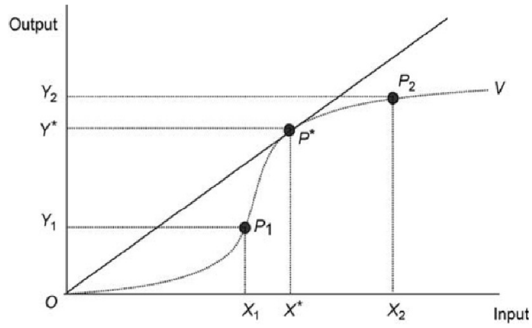

Fig.2 Economies of scale.

Source: (Jacobs et al., 2006)

The supply of and demand for efficiency analysis is increasing. However, compared with many other sectors of the economy, such as banks or schools, the development of efficiency measures in health care also poses enormous challenges, brought about by the complexity of the production process, the multiplicity of outputs produced, the strong influence of the organizational environment on performance, and the frequent absence of relevant or reliable data (Jacobs et al., 2006).

Data Envelopment analysis

Data envelopment analysis (DEA) has been a technique for measuring the relative efficiency of decision making units (DMUs) with multiple inputs and multiple outputs (Charnes et al., 1978, 1994; Banker et al., 1984). DEA was originally introduced by Charnes, Cooper and Rhodes in 1978 as a tool for non-profit and public service organizations to use for monitoring organizational performance (Austin, 1986). It is a methodology that allows management analysts to measure the relative productive efficiency of each member of a set of comparable organizational units based on a theoretical optimal performance for each organization. For this purpose, the organizational units under analysis are designated as decision making units (DMUs). These DMUs can be separate firms or institutions or they can be separate sites or branches of a single firm or agency. These DMUs can be separate firms or institutions or they can be separate sites or branches of a single firm or agency. The key advantage of DEA over other alternative methods of performance evaluation is that it allows one to consider a number of outputs and inputs simultaneously regardless of whether all the variables of interest are measured in common units (Sexton, 1986).

The basic concepts of DEA can be illustrated graphically with the simple single input, single output example represented in Figure 3

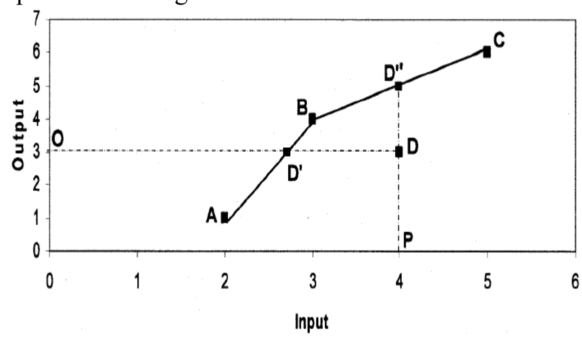

Fig. 3 single input, single output DEA example

Source :(Tamas, 2008)

Figure 3 exhibits four DMUs: A, B, C and D. DMUs A, B and C can be considered technically efficient because they each use a minimum amount of the input to produce various level of the output. Together then, DMUs A, B and C form the *efficient frontier* (solid line), Which consists exclusively of best performing units in the data set in covering inputs into outputs. DMU D, however, is not efficient because it uses relatively higher levels of input to produce the same level of output as DMUs on the efficient frontier. There are two ways that DMU D can be efficient (Tamas, 2008). One way is by reducing its input while maintaining a constant level of output (point D') Another way is by increasing its output while maintaining a constant level of input (pointD"). In fact, there are literally various kinds of DEA methods such as constant return to scale (CRS), variable return to scale (VRS), (Cooke & Zhu 2005). DEA measures the efficiency of the decision making unit (DMUs) by the comparison with best producer in the sample to drive compared efficiency. DEA submits subjective measure of operational efficiency to the number of homogenous entities compared with each other, through a number of samples unit which form together a performance frontier curve envelopes all observations. So, this approach called Data Envelopment Analysis. (Al- Delaimi & al-Ani, 2006). In this paper we adopted The output oriented model with variable return to scale to estimate efficiency score, this model developed by Banker et al. (1984):

$$\theta^* = \max_{\theta,\lambda} \theta$$

$$\begin{aligned} s.t. \quad \theta x_{io} &\le \textstyle\sum_{j=1}^{n} \lambda_j x_{ij} \quad i = 1, \ldots, m \\ y_{ro} &\ge \textstyle\sum_{j=1}^{n} \lambda_j y_{rj} \quad r = 1, \ldots, s \\ \textstyle\sum_{j=1}^{n} \lambda_j &= 1 \\ \lambda_j &\ge 0 \quad \forall j \end{aligned}$$

where x_{ij} and y_{rj} denote the levels of the ith input and rth output of the jth health care, $j = 1, \ldots, n$. The first two constraints require that the performance of a given health o in terms of its inputs x_{io} and outputs y_{ro} is located within a production possibility set defined by the envelopment of all data points. The last two constraints, where λ is an N×1 vector, allow for variable returns to scale by imposing a convexity restriction which generates a frontier in the form of a convex hull of intersecting planes.

Data and Results

4-1 Data variables

The model of this study include three inputs and three outputs of health care center in Heet city, for three years 2011, 2011 and 2013 we can describe and express them as follow:

4-1-1 The inputs:

a-No. of Staff

b- Total salary (1000 ID)

c- Area of each centre (Square meters)

4-1-2 The outputs:

a-No. of total visitors

b-No. of Pregnant women

c- No. of vaccinations

4-2 Results

In this paper we adopt the output variable returns to scale (VRS), the data were analyzed using data envelopment analysis Program ver 2.1 tab 1 and figure 4 show the summary of results of efficiency.

Table 1 summary result of efficiencies

	CRS	VRS	Scale Efficiency
2011	**0.67**	**0.81**	**0.83**
2012	**0.62**	**0.73**	**0.86**
2013	**0.83**	**0.88**	**0.93**
mean	**0.70**	**0.81**	**0.88**
% change 2011-2013	**24.01**	**9.53**	**11.96**

Source: Appendix (1)

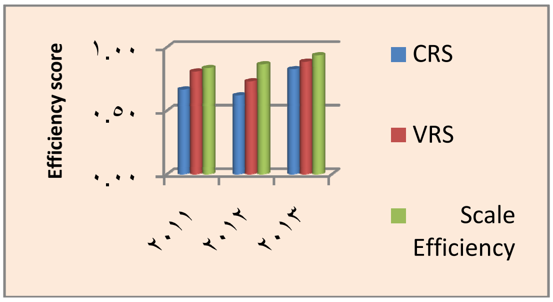

Fig 4 Efficiency Score for 2011-2013

We see from figure 4 that the mean of VRS efficiency for 20 health care were 0.67 in the year 2011 and became 0.83 in 2013, that mean there is a growth between these period reach 9.5%. In other side scale efficiency were 83% in 2011 and became 93% in 2013, with a growth rate 11.9%. Table 2 and figure 5 showe the indicators of scale efficiency for the 2011-2013.

Table 2 Scale efficiency for 2011-2013

	Increasing	Constant	Decreasing
2011	5	5	10
2012	11	5	4
2013	4	6	10

Source: Appendix (1)

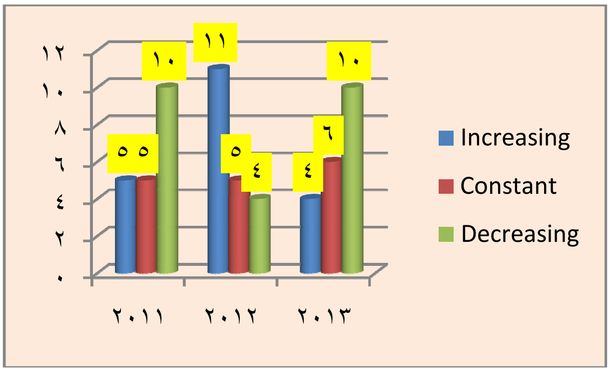

Fig. 5 scale efficiency for 2011-2013

From table 2 and figure 5 we see that five heath cares reach optimal economic size in 2011 and 2012 then became six in

2013, which mean that only about 25% of our sample study gets the economic scale. In the other hand we see that diseconomies scale are vary between increasing and decreasing return to scale for 2011-2013, but we can see that 50% of health care's exceed the optimal size in 2013. This result gives us an indication that should be expanded to build a new health care centers in Heet city.

5-Conclusions

The study aimed to apply the data envelopment analysis to measure the efficiency of the (20) Health care centers for period 2011-2013 in Heet City of Al-Anbar province in Iraq. We applied the output variable returns to scale (VRS), the data were analyzed using data envelopment analysis Program ver 2.1.

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Scale Efficiency showed that five heath care centers had economic scale in 2011 and 2012 then became six in 2013, which mean that only about 25% of our sample study gets the economic scale. In the other hand we see that diseconomies scale are vary between increasing and decreasing return to scale for 2011-2013, but we can see that 50% of health care's exceed the optimal size in 2013. This result gives us an indication that should be expanded to build a new health care centers in Heet city.

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Appendix 1

Efficiency score for 2011

DMU	Technical Efficiency Score(CRS)	Pure Technical Efficiency Score(VRS)	Scale Efficiency Score	RTS
Health Care1	0.667965	1	0.667965	Decreasing
Health Care2	0.341504	0.35736	0.955629	Increasing
Health Care3	0.467354	0.479317	0.975042	Decreasing
Health Care4	0.480897	1	0.480897	Increasing
Health Care5	1	1	1	Constant
Health Care6	0.668045	0.816355	0.818327	Decreasing
Health Care7	1	1	1	Constant
Health Care8	0.520761	1	0.520761	Increasing
Health Care9	1	1	1	Constant
Health Care10	0.191481	0.205779	0.930521	Increasing
Health Care11	0.192539	0.334649	0.575346	Increasing
Health Care12	0.608636	0.738699	0.82393	Decreasing
Health Care13	1	1	1	Constant
Health Care14	0.868898	1	0.868898	Decreasing
Health Care15	1	1	1	Constant
Health Care16	0.583173	1	0.583173	Decreasing
Health Care17	0.686214	0.956512	0.717413	Decreasing
Health Care18	0.480014	0.488922	0.98178	Decreasing
Health Care19	0.707163	0.756434	0.934865	Decreasing
Health Care20	0.849767	1	0.849767	Decreasing
mean	0.66572055	0.80670135	0.8342157	

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Efficiency score for 2012

DMU	Technical Efficiency Score(CRS)	Pure Technical Efficiency Score(VRS)	Scale Efficiency Score	RTS
Health Care1	1	1	1	Constant
Health Care2	0.386628	0.435689	0.887395	Increasing
Health Care3	0.281131	0.333485	0.843011	Increasing
Health Care4	0.312786	1	0.312786	Increasing
Health Care5	1	1	1	Constant
Health Care6	0.318905	0.383074	0.83249	Increasing
Health Care7	0.98197	1	0.98197	Increasing
Health Care8	0.51088	1	0.51088	Increasing
Health Care9	1	1	1	Constant
Health Care10	0.358946	0.43408	0.826912	Increasing
Health Care11	0.404038	1	0.404038	Increasing
Health Care12	0.360579	0.360739	0.999558	Increasing
Health Care13	1	1	1	Constant
Health Care14	0.78572	0.874131	0.898859	Decreasing
Health Care15	1	1	1	Constant
Health Care16	0.972756	1	0.972756	Decreasing
Health Care17	0.309447	0.332502	0.930663	Decreasing
Health Care18	0.233202	0.247917	0.940647	Increasing
Health Care19	0.387415	0.407814	0.94998	Increasing
Health Care20	0.765803	0.783638	0.977241	Decreasing
mean	0.6185103	0.729653	0.8634593	

Efficiency score for 2012

DMU	Technical Efficiency Score(CRS)	Pure Technical Efficiency Score(VRS)	Scale Efficiency Score	RTS
Health Care1	0.867584	1	0.867584	Decreasing
Health Care2	0.474806	0.559053	0.849305	Increasing
Health Care3	0.566484	0.579207	0.978034	Decreasing
Health Care4	1	1	1	Constant
Health Care5	1	1	1	Constant
Health Care6	0.791187	0.944924	0.837302	Decreasing
Health Care7	0.62696	0.753732	0.831808	Decreasing
Health Care8	0.745968	1	0.745968	Increasing
Health Care9	1	1	1	Constant
Health Care10	0.703249	0.717863	0.979642	Increasing
Health Care11	0.818465	0.846842	0.966491	Increasing
Health Care12	0.769029	0.832449	0.923815	Decreasing
Health Care13	0.953826	0.955217	0.998544	Decreasing
Health Care14	0.925104	1	0.925104	Decreasing
Health Care15	1	1	1	Constant
Health Care16	1	1	1	Constant
Health Care17	0.808138	1	0.808138	Decreasing
Health Care18	0.644959	0.65635	0.982646	Decreasing
Health Care19	0.814786	0.826499	0.985827	Decreasing
Health Care20	1	1	1	Constant
mean	0.82552725	0.8836068	0.9340104	