Performance Evaluation of The District's Primary Health Care System (DPHCS); Case Study Of Southeastern Iran

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Research

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Abstract

Background: Managers need to measure and evaluate the performance of their subordinates in order to plan, organize, and improve the performance of their organizations. In this study, the performance and efficiency of the district's primary health care system in the southeast of Iran were evaluated using the data envelopment analysis (DEA) model.

Methods: The quantitative non-parametric data envelopment analysis was used to evaluate the performance of the primary care system in the districts. On the hand, human forcess, physical facilities, and vehicles were the variables used as the inputs, and the number of services and service recipients was considered as the outputs to measure efficiency. The data were analyzed using the DEAP software, and performance and efficiency were calculated with the output maximization approach and the assumption of variable returns to scale. It was carried out as linear programming with nine scenarios for nine districts in 2018.

Results: The mean efficiency of the studied districts with the assumption of variable returns to scale was 0.76, indicating at least 24% capacity to increase efficiency in the primary care system of Kerman University of Medical Sciences without any increase in production factors. According to the mean values, Kerman and Kuhbanan were efficient while the other 7 districts were inefficient. The districts were divided into three groups: efficient, moderately efficient, and inefficient. Accordingly, the most inefficient primary health care systems were those of Shahr-e Babak, Baft, and Orzooieh.

Conclusion: The results of this study showed inefficiency in most primary health care systems of the studied districts, indicating that primary care managers can provide more health services to the community through proper management of available resources. Inefficient districts can compare themselves with successful and reference districts and eliminate their shortcomings in order to improve their performance.

Introduction

Health is considered as the basis of socioeconomic, political, and cultural development of communities and is of special importance in the development of infrastructures of different sections of any society [1, 2]. So that, one of the goals of sustainable development is definitely associated with health: "Ensuring a healthy life and promoting well-being for the people of all ages". If activities in the socioeconomic and political fields are balanced, primary health care (PHC) will play a pivotal role in achieving sustainable development. Therefore, many issues related to the goals of sustainable development can be addressed through PHC [3].

PHC is an essential part of any health system and a reliable source for reducing the global burden of chronic diseases and elderly populations [4–6]. Evidence shows that in health systems prone to PHC, there are better health outcomes, better access to health services, comprehensiveness and continuity of health services, productivity, financial stability, and greater user satisfaction and participation. However,

since health care reform does not pay enough attention to first-level services, PHC usually has a minor role and position in health systems. Hence, the World Health Organization (WHO) has urged its members to prioritize strengthening their PHC [7, 8].

Once the importance of PHC was highlighted in the Alma-Ata Declaration, Iran also reformed its health care system to meet the "Health for All by 2000" global goal. The declaration was approved by the Cabinet and the Parliament of Iran in 1984 and led to the development of the health network [9]. Providing PHC through district health networks (DHNs) is one of the main strategies in Iran to achieve universal health coverage (UHC) and reduce the gap between health outcomes in rural and urban areas [10, 11]. The Iranian health care delivery system has a cascading order, at the highest level of which, the Ministry of Health and Medical Education (MOHME) is responsible for overseeing and coordinating the health care system. At the middle level, medical universities throughout the province monitor the DHNs and support the service delivery units. At the lowest level are the DHNs there that are the smallest independent units of the country's health system. The DHNs consists of urban healthcare units, health-working schools, urban health centers, rural health centers, health bases, and health homes. The health homes in villages and the health bases in cities are subsets of urban and rural health centers [12, 13].

However, one of the health threats to developing countries, including Iran, is the inefficient use of resources. Thus, resource management and more effective and efficient use of the resources play a vital role in strengthening PHC [14]. Therefore, evaluating and improving the health system is inevitable [15], and efficiency measurement is one of the ways to evaluate and improve health systems. Knowing about the efficiency levels of the health centers helps policy makers and managers of the health system to play their roles more effectively and efficiently [16–18]. Although PHC has always been considered both in terms of social welfare and resource use, and has doubled the importance of research on the efficiency of PHC systems, a review of the related studies shows that most efficiency studies focused on hospitals, and the efficiency of PHC systems and health centers received less attention [19].

On the other hand, given that investment in reforms based on PHC can lead to sustainable development of the health system, policymakers around the world are trying to improve the effectiveness and efficiency of PHC delivery [20, 21]. Due to the fact that no study had examined the performance and efficiency of the district’s primary health care system (DPHCS) in Iran, it was needed to fill the information/knowledge gap. Therefore, the present research was conducted to evaluate the performance and efficiency of the DPHCS in Iran.

Methods

The performance and efficiency of nine districts affiliated to Kerman University of Medical Sciences (KMU) (the largest university in southeastern Iran) in 2018 were analyzed in this applied retrospective study. A field method was used to collect the data, and the researcher gathered the data on the inputs and outputs from the vice-chancellor for health at KMU.

The variables used in this study included two categories of inputs and outputs. First, a list of the variables was made using the available resources. Then, due to the limitations of the DEA method and the incomplete data of some indicators, the indicators were monitored and screened by the health and health economics experts. In the DEA method, the number of firms studied had to be equal to or larger than 3 times the sum of the variables [22]. Given that there were nine firms (DPHCS) to be evaluated in this study, a maximum of three variables could be used to measure the efficiency of the DPHCS. However, as five variables were considered to measure efficiency, the efficiency of the DPHCS was examined using different scenarios and combinations of variables (Table 1). The input variables included human forces, physical facilities, and vehicles, and output variables were the number of service recipients and the number of services provided.

Table 1. Scenarios for measuring the efficiency of the DPHCS covered by KMU

Variables / scenarios	inputs			outputs	
	human forces	physical facilities	vehicles	number of service recipients	number of services provided
A	*	*			*
B	*		*		*
C	*			*	*
D	*	*		*	
E	*		*	*	
F		*		*	*
G		*	*	*	
H		*	*		*
I			*	*	*

Thus, the required data for measuring efficiency were first collected through a field method and using the statistics available in the Integrated Health System (SIB) of the Health Deputy of KMU. Then, the data were analyzed using the DEAP software and the efficiency was measured. In this study, the performance and efficiency of the DPHCS covered by KMU were calculated through the nonparametric method of DEA based on outputs maximization and the assumption of variable returns to scale as the following linear programming:

$$Max\ z = \theta$$

St:

$$\sum_{j=1}^{n} \lambda_j x_{ij} \geq x_{i0} \qquad (r=1,2,...,s)$$

$$\sum_{j=1}^{n} \lambda_j x_{rj} \geq \theta y_{r0} \qquad (i=1,2,...,m)$$

$$\sum_{j=1}^{n} \lambda_j = 1 \qquad (j=1,2,...,n)$$

$$\lambda_j \geq 0 \qquad \theta \text{ Free on mark}$$

m is the number of inputs, s is the number of outputs, and n is the number of firms.

One of the main reasons for choosing the outputs maximization model (output oriented) was the importance of health services and the need for public health coverage. In other words, the ultimate goal was to provide PHC services to more people.

Results

The efficiency of the DPHCS in nine districts affiliated to KMU in 2018 was calculated using the comprehensive data analysis method with an output-oriented approach. Table 2 shows the value of each variable for measuring the efficiency of the DPHCS in the intended districts in 2018. According to this table, Kerman and Kuhbanan districts had the highest and lowest inputs and outputs, respectively.

Table 2
Amounts of inputs and outputs of the DPHCS covered by KMU in 2018

Variables	inputs			outputs	
Districts	human forces	physical facilities	vehicles	number of service recipients	number of services provided
Orzooieh	94	40	28	80204	518009
Baft	150	50	30	98972	924089
Bardsir	162	41	32	161492	1237093
Rabor	60	26	23	68586	434296
Ravar	80	20	14	67613	408508
Zarand	267	73	67	285354	1891664
Shahr-e Babak	190	37	25	131088	948842
Kerman	1033	148	115	1183492	8126767
Kuhbanan	50	11	12	49779	370356
Average	231.77	55.49	44.38	236286.67	1651069.33
MAX	1033	148	115	1183492	8126767
MIN	50	11	12	49779	370356

The results showed an average efficiency of 0.76 for the studied districts with the assumption of variable return to scale (BCC), which indicated at least 24% increase in the output capacity of the DPHCS in KMU without any changes in the inputs. According to the mean values of the scenarios, Kerman and Kuhbanan districts were totally efficient, but other districts were inefficient and obtained the scores of 0.802 to 0.555 (Average of scenarios). Based on the obtained data, the districts were classified into three groups: efficient, moderately efficient, and inefficient. Table 3 shows the ranking of the studied districts in 2018 for different scenarios. In addition, the mean rank of each city, the range of rankings, and the number of visits to three efficient and three inefficient districts were reported. The districts were arranged according to the mean ranks, so that the lowest rank indicated the highest efficiency and the highest rank represented the lowest. According to the results, no fluctuations were observed in the different scenarios of two districts (Kerman and Kuhbanan), but most districts experienced relative fluctuations in their rankings.

Table 3
Ranking of the DPHCS covered by KMU in 2018

Districts Variables	A	B	C	D	E	F	G	H	I	Average ranking	Number of times in top 3	Number of times in bottom 3
Kerman	1	1	1	1	1	1	1	1	1	1	9	0
Kuhbanan	1	1	1	1	1	1	1	1	1	1	9	0
Bardsir	3	5	3	6	5	5	4	3	5	4.33	3	0
Rabor	4	1	4	1	7	8	1	7	8	4.56	3	4
Ravar	8	6	7	4	3	3	8	4	3	5.11	3	3
Zarand	5	4	5	5	6	7	5	6	7	5.56	0	2
Shahr-e Babak	9	8	9	8	4	4	9	5	4	6.67	0	5
Baft	6	9	6	9	8	6	6	8	6	7.11	0	4
Orzooieh	7	7	8	7	9	9	7	9	9	8	0	9

Table 4 shows the optimal values and the capacity of increased outputs of the health system of the studied districts in 2018. On average, the highest increase capacities in terms of "the number of service recipients" were found in Baft and Orzooieh districts with 56.8% and 54.8%, respectively, and the lowest were found in Ravar and Bardsir with 21.7% and 30.2%, respectively.

Also, on average, the highest increase capacity in terms of the "number of services provided" was found in Orzooieh (57.4%) and Rabor (47.4%), respectively, and the lowest was obtained for Bardsir (22.6%) and Ravar (32.7%), respectively. On average, the number of service recipients and the number of services provided by the DPHCS of KMU had respectively 22.36% and 21.32% increase capacity without any changes in resources (Table 4). The optimal level and the increase capacity of the outputs are presented in the appendix separately by the scenarios.

Districts with the efficiency score of < 1 had reference districts for achieving the optimal state. For example, Kerman, Kuhbanan, and Rabor were the models for determining the efficiency path of the health system of Orzooieh District in different scenarios. However, reference districts also had priority over each other based on their coefficients, and a reference with a higher coefficient was a more appropriate model. The references and their coefficients are shown in the appendix.

Table 4
The average optimal level and the amount of increase capacity to the outputs of the DPHCS covered by KMU in 2018

Districts	number of service recipients		number of services provided	
	Optimal level	Increase capacity (%)	Optimal level	Increase capacity (%)
Orzooieh	177362	97158 (54.8)	1216812	698803 (57.4)
Baft	229291	130319 (56.8)	1584718	660629 (41.7)
Bardsir	231212	69720 (30.2)	1597340	360247 (22.6)
Rabor	120229	51643 (43)	824970	390674 (47.4)
Ravar	86348	18735 (21.7)	607047	198539 (32.7)
Zarand	449696	164342 (36.5)	3084878	1193214 (38.7)
Shahr-e Babak	211582	80494 (38)	1473400	524559 (35.6)
Kerman	1183492	0	8126767	0
Kuhbanan	49779	0	370356	0
Average	304332.34	68045.67 (22.36)	2098476.44	447407.1 (21.32)

Discussion

Optimal use of physical resources, human forces, and technologies is one of the main motivations for evaluating the performance of organizations. Determining the efficiency of organizations and service providers is one of these tools [23]. Thus, the present study was conducted to evaluate the efficiency of the PHC system in the Iranian districts. The results of this study can help to make better use of resources in the health systems of districts and contribute to the expansion and development of health services to the populations covered.

According to the results, the performance of the DPHCS in Kerman and Kuhbanan during 2018 was more favorable than other districts. For instance, the results indicated that with 57.4% of the available inputs, the health managers of Orzooieh district had the potential of increasing the provision of health services to the community. In other words, the DPHCS of Orzooieh was using only 42.6% of its capacity. Thus, the health managers of Orzooieh district could use proper planning to provide more services to the covered population. Otherwise, they had to reduce and adjust the inputs to improve efficiency. The same analysis can be used for other districts.

The results showed that the efficiency of the DPHCS of Ravar and Rabor districts fluctuated more in different scenarios. It means that according to the classification carried out, they were considered as efficient districts in some scenarios and inefficient in others. For example, the district of Rabor was quite efficient in three scenarios, but achieved the efficiency score of < 0.4 in the others. An examination of the

inputs and outputs used in the scenarios shows that human forces and service recipients were respectively the common inputs and outputs in three scenarios in which the district of Rabor was quite efficient. But in the four scenarios in which the district achieved low efficiency, human forces was not an input. Therefore, the available human forces in this district had been probably used well, but the other two inputs had not. Another reason might be the nature of primary care services that is work- intensive (not capital- intensive), so the human forces are not expected to be ignored. This result indicates that some scenarios do not reflect performance well. This is why designing appropriate scenarios for thematic performance evaluation is of great importance. The results also highlighted the limitations of one-dimensional (one-scenario) performance studies and showed that performance appraisal based on a single scenario was not an accurate basis for managerial decisions. Therefore, it is recommended to first pay special attention to the selection of inputs and outputs, and then evaluate and analyze the efficiency of firms in different scenarios.

Thus, it is necessary for districts health managers to consider the limitations and work in accordance with their conditions in order to improve their efficiency levels. Health managers can improve their efficiency by modifying the inputs, but the importance of access (to) and utilization (from) health services should not be overlooked because one of the main goals of the health system is public access to health services, equity and strengthening it. Yazdi et al. Also pointed out the importance of paying attention to equity and access along with improving efficiency and effectiveness [24]. Therefore, it is more appropriate for health managers to prioritize the improvement and expansion of service delivery in their area of responsibility over the modification of the inputs. To increase the outputs, not only service providers (Supply side) should be encouraged to provide quality and effective services, but the covered population and service recipients (Demand side) should also be encouraged to use health services in PHC centers. A study by Marschall et al. also showed that improving access to primary care facilities had a significant impact on their efficiency. Hence, managers and policymakers must remove the barriers to the demand for access to PHC [25]. By conducting cultural, promotional, and educational activities, health managers can encourage people to use primary care services and expand the provision of the services to all people covered [26].

Using the obtained results, the health managers of inefficient districts can carry out further investigations to identify the factors affecting efficiency and take actions to remove the obstacles in order to provide the conditions for improving efficiency and providing quality services. Many primary care professionals have divided the determinants of health center performance into two categories: external factors such as population size, access to the health centers, and access to the nearest hospital, and internal factors such as staff skills and behavior or managerial competence. They believe that the first category (external factors) has greater importance and affects efficiency to a higher degree [27]. In general, inefficiency can be affected by various factors such as environmental, structural, and organizational ones [28].

In the study by Oikonomou et al. in Greece, two factors including population coverage and distance to the nearest health center in the city were identified as structural factors affecting efficiency. In their study, efficient centers had a relatively large population and were located near large districts [27]. In other

countries, the role of structural factors in determining the efficiency of primary care units has been emphasized [25, 29]. In this regard, the lack of appropriate mechanisms to evaluate the performance of primary care units is considered as the cause of clinical and administrative deficiencies in primary care services [27, 30]. Therefore, conducting further research and evaluations in highly inefficient units can help identify the weaknesses and failures and guide efforts to eliminate the barriers to proper performance. On the other hand, investigating relatively efficient units can facilitate the identification and dissemination of appropriate operational procedures as well as the monitoring of progress towards objectives. This process may lead to increased productivity in both inefficient and inefficient units [27]. The results of a study by Cordero et al. indicated that environmental factors had a significant and negative effect on the performance, quality, and efficiency of primary health care providers [31].

Meanwhile, the DHN in Iran, especially in rural areas, has developed based on population. Therefore, factors such as migration and changes in the population pyramid affect the number of services provided and the number of people in need of services, because migration of young people from rural to urban areas or from small towns to large cities provides the basis for changing the age pyramid of such areas towards adulthood and aging, and decreases the population at reproductive ages. This will reduce the demand for major services provided by health centers, including vaccinations, maternity and postpartum services, etc. In their study, Ali Mohammadi Ardakani et al. also acknowledged that the number of people in need of health services depended on the covered population and its age composition, and these characteristics would directly affect the number of services provided and would thus affect efficiency [26]. According to Zare Ahmadabadi et al., non-referral and the covered population structure were the reasons for the fluctuation of the efficiency of health centers. They suggested that in order to increase the efficiency of efficient centers, health officials and managers needed to change the geographical areas covered, to float the working hours of the specialized personnel in health centers, and to apply zoning [32]. Rahimi et al. also considered migration and demographic transition as two social trends affecting the performance of the Iranian health system in the coming years [33].

Thus, in order to have an efficient system, it is necessary to provide health services based on the macro and current policies of the country, the age composition of the society and their health needs. For example, due to the policy of reducing childbearing in Iran, contraceptive services were once widely provided in health centers. However, in response to the rapid trend of declining fertility in Iran, pregnancy incentive policies have been on the agenda since 2014, limiting the provision of contraceptive services in health units and increasing the importance of pregnancy care. Even now, due to the change in the age pyramid and the movement towards increasing the elderly population [33], it is necessary for the health system to develop and provide appropriate services for this population group. Another factor that can affect efficiency is the population density and dispersion of villages around some districts and their type of settlement (permanent or nomadic). For instance, 78% of the population in Orzooieh district, which had the lowest efficiency, was rural population, part of which consisted of the nomads who migrated to the neighboring province (Hormozgan) in cold seasons. To eliminate the effect of residence (urban or rural), Ali Mohammadi Ardakani et al. suggested that the calculation of efficiency in terms of urban or rural health units would be more accurate and helpful [26].

However, dealing with inefficiency is not possible only by taking actions at operational and executive levels, because inefficiency is mainly associated with the weaknesses of the PHC system in management and policy-making areas such as budgeting and service purchasing, human resource planning and development, targeting, performance management, quality improvement, coordination, evaluation, monitoring, and control. Therefore, a new culture must be built through the implementation of structural, governance, service, and financial reforms in the health system, and the centers must be allowed to operate autonomously, effectively, and productively. In this regard, the most important measures to improve efficiency are the ones that improve accountability, information exchange, and responsibility [27]. In general, it can be acknowledged that in order to improve the efficiency of the PHC system at districts level, an integrated and more comprehensive health care system must first be develop through the expansion of family medicine (not family physician), better management of limited resources, and updating organizational policies and goals. Meanwhile, building the culture of using first-level preventive services should be promoted and strengthened at the community.

It is worth noting that investigating and analyzing the efficiency of health centers (unlike hospitals) and identifying the factors affecting it has been somewhat neglected or done limitedly in Iran. Therefore, it is necessary for health officials and researchers to focus on this issue and identify the factors affecting inefficiency in primary health centers in order to eliminate them. Of course, this is not the case only in Iran, but around the world, and the majority of health efficiency studies are focused on hospitals. One reason for this can be the clear boundaries of hospitals and their processes from admission to discharge. But the primary care system is an open, community-based system with no clear boundaries, which makes it more complex to do economic analyses [34].

Unlike previous studies that evaluated the efficiency of healthcare units in a single mode, the present study evaluated the efficiency of the DPHCS in different scenarios. In other words, the use of different scenarios as an analysis scenario led to carrying out the sensitivity analysis of change in the inputs and outputs in the performance of the healthcare units, which is not usually seen in performance evaluation studies. This can enable health managers to identify their weaknesses and improvable qualities more effectively and take measures to address them. Furthermore, this study was the first research that evaluated the efficiency of the PHC system at the level of the districts in Iran. The limitation of the present study was the limited number of the variables, which is one limitation of the DEA method. The smaller the number of firms studied, the more limited variables we had to use. However, this was somewhat resolved by using different scenarios.

Conclusion

This study showed a picture of the efficiency of the primary care system in the districts of a southeastern province in Iran. The inefficiency of the primary care system was evident in most of the studied districts. A general interpretation of the results suggests that the shortage of resources is not always a problem in countries, and in some cases, organizations have inappropriate performance. Therefore, evaluating and monitoring the performance of organizations can lead to a higher level of service production without

increasing the resources. This study indicated that depending on the variables used in the analyses, different levels of efficiency might be seen. Thus, it is recommended to study the efficiency of various systems in several scenarios to clearly identify their weaknesses.

Abbreviations

WHO: World Health Organization **PHC:** Primary Health Care **DPHCS:** District's Primary Health Care System **DHN:** District Health Network **DEA:** Data Envelopment Analysis **UHC:** Universal Health Coverage **KMU:** Kerman University of Medical Sciences **MOHME**: Ministry of Health and Medical Education

Declarations

Ethics approval and consent to participate: Not applicable.

Consent for publication: Not applicable.

Availability of data and materials: all data generated or analyzed during this study are included in this published article and in the appendix.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions

HR and SNH designed and managed the project. HR collected the data. HR and RG analyzed and interpreted the results. HR writing the manuscript. RG and AAH revised the manuscript. All authors read and approved the final manuscript.

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