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Health System Efficiency in Iran and Its Influencing Factors

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ABSTRACT

Background: Given the importance of public health, evaluating the performance of the health system and striving to address its shortcomings is a concern for policymakers and health officials. The aim of this study is to examine the health system efficiency in Iran and investigate the impact of economic variables on the health system efficiency.

Methods: In this study, the Stochastic Frontier Analysis (SFA) method was used to evaluate the health system efficiency in Iran, using data from Iranian provinces in 2016. The Stata software was used to evaluate the health system efficiency and investigate the impact of economic variables on the health system efficiency.

Results: According to findings, the highest level of efficiency belonged to Alborz and Mazandaran provinces, while the lowest level of efficiency belonged to Sistan and Baluchestan and Ilam provinces. Regression estimates using the Tobit method indicated that the coverage of social insurance and the private sector share of healthcare costs have a positive effect on efficiency, while per capita production has a negative effect on the health system efficiency. Also, the coefficients obtained for GDP per capita, the population covered by insurance and the share of the private sector were -0.00049, 0.00602, and 0.00640, respectively.

Conclusion: The average health system efficiency in the provinces varies significantly, suggesting that there is a considerable gap from optimal efficiency. It is recommended to expand the coverage of social insurance, which includes healthcare insurance, in order to improve the health system efficiency, so that more people can benefit from its services. The second suggestion is to pay more attention to the private sector in the health sector.

Keywords: Health System, Efficiency, Stochastic Frontier Analysis, Tobit, Iran

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Introduction

All organizations and companies strive to examine the efficiency of their subsidiaries by monitoring their performance and addressing existing shortcomings, while also preserving and strengthening existing strengths (1). In general, health systems around the world have three main objectives, which include improving the overall health of the community, providing services equitably, and being responsive to questions regarding the performance and effectiveness of the system (2).

Evaluating healthcare systems performance and efficiency is a key focus of development programs. By analyzing various indicators, we can determine if the healthcare system meets its goals. This assessment includes the role of human resources and facilities in affecting the population overall health (3). With the increase in the efficiency of the healthcare system, the quality of health for individuals in society improves and leads to increased citizen satisfaction. Increasing efficiency is an important economic and social goal. This goal will be achieved by considering human resources and other accessible facilities. The expectation from the healthcare system is to assess the level of achieving the intended goals and address any shortcomings found (4).

There is abundant evidence that inefficiency is a major problem in healthcare systems in most countries worldwide. Health policymakers consider efficiency as one of their primary concerns and strive to reduce inefficiency through sound decision-making. Inefficiency can lead to negative consequences for society and jeopardize the health status of individuals in the community. Furthermore, inefficiency in the healthcare system can divert resources from other productive sectors of the economy, thereby having a doubly negative impact (5). Kang et al. (2023) calculated efficiency using data envelopment analysis (DEA) and stochastic frontier analysis (SFA) methods for China and ASEAN countries. Using the Tobit regression model, they estimated factors affecting the efficiency of the health care system in these countries. The results showed that GDP per capita has a positive effect on efficiency, while urban population has a negative effect on efficiency in these countries (6). Gong et al., in their study, first calculated the efficiency of China health system after the reforms, then using Tobit regression, they calculated the effect of various factors on efficiency. The results showed the negative effect of public hospitals and social health and higher education costs on the efficiency (7). Khan and Nasrulddin (2022) examined the move towards privatization and its impact on the hospitals efficiency. The results show that private hospitals achieve a more appropriate ratio of efficiency (8). Ismaeili et al. (2019) investigated the efficiency of the healthcare sector of the Social Security Organization during 1387 to 1394 using the SFA method. The results showed that the average efficiency in the studied units was 0.816. The analysis of the impact of variables on efficiency indicated that the number of insured individuals and the number of healthcare centers had a significant relationship with efficiency (9). In the study by Sadeqi et al. (2019), the efficiency of Iran healthcare system was compared to that of member countries of the Organization for Economic Cooperation and Development. The results showed that the most efficient countries were Canada and Chile, while the least efficient countries were Slovakia and Hungary. Iran healthcare system performed relatively well compared to these countries (10). Godarzi et al. (2017) estimated hospitals efficiency in Kerman province using the SFA method. The results showed that the average efficiency of hospitals in Kerman province was 64.8, indicating that there is potential to improve efficiency in these hospitals by 35.2 (11).

Considering the importance of the subject, several studies have been conducted to examine the efficiency of the healthcare system. These studies have investigated the efficiency of the healthcare system using various methods and have examined the impact of different variables on its efficiency. Despite the conducted studies, the influence of variables such as the level of health insurance coverage and the private sector on the

efficiency of the healthcare system in Iran has received less attention. In this study, the efficiency of the healthcare system in Iranian provinces was first obtained using SFA, and then the impact of variables such as the level of health insurance coverage, per capita production, the share of the private sector in healthcare expenditures, and so on, on the efficiency of the healthcare system was estimated.

Methods

The present study falls into the category of applied research. The required data was collected from the database of the Statistical Center of Iran. The data used in this study was cross-sectional data of the provinces of Iran in 2016. The main objective of this study was to examine the effects of variables such as the level of coverage by social insurance, per capita income, the share of the private sector in healthcare, etc. on efficiency.

Stochastic frontier analysis

SFA is an econometric technique that is widely used in health system efficiency studies. The difference between the actual output and the estimated maximum potential after accounting for random variation indicated the level of inefficiency in production. In the context of health production, efficiency was defined as the ratio of the actual health outcomes achieved to the maximum potential achievable with the resources used (12).

In the SFA method, by considering the frontier production function that represents the efficient firms' geometric locations and using econometric models, the efficiency of firms was estimated. In this method, the difference between actual production and frontier production was due to inefficiency and the other part was due to random factors. Generally, the stochastic frontier production function can be represented as Equation (13).

$Yi = \beta' X_i + v_i - u_i$

So that

$v_i \sim N(0, \sigma^2 v)$

$u_i = |u_i|$, $u_i \sim N(0, \sigma^2 u)$

In this equation, ui represents the inefficiency values of firm i. Yi represents the amount of production produced by firm X. β is the parameter vector, and vi shows the disturbance term. In estimating the stochastic frontier function, the error term consists of two components; one is the stochastic error term vi and the other is the one-sided error term ui, which represents inefficiency (13).

In the SFA method, the input and output variables need to be determined and the production function is then formed based on them. In this study, for the health production function, the life expectancy was considered as an output variable, and input variables such as the number of physicians, the number of active beds, and healthcare expenses were considered.

Factors affecting on the health system efficiency

Health system efficiency can be explained by social and economic factors. Therefore, variables such as per capita production, education, percentage of social insurance coverage, and the private sector's share of healthcare costs were considered as independent variables, and the variable of health system efficiency was considered as the dependent variable. The research equation was selected as follows based on the available data and research background.

$TE_i = \beta_0 + \beta_1 (GDPpc_i) + \beta_2 (EDC_i) + \beta_2 (SP_i) + \beta_4 (INS_i) + U_i$

TE: Efficiency achieved by SFA

GDPpc: Gross Domestic Product per capita (in million rials)

EDC: Education variable, which in this study is the capacity of medical universities in each province relative to the population of that province.

SP: Share of private sector in health expenditures.

INS: Percentage of population covered by social insurance.

In most studies examining the factors affecting the efficiency of the health and medical system, the Tobit regression model has been used. Therefore, in this research, the Tobit regression model was used to estimate the model (6, 14-16).

The Tobit regression model is the following

equation:

$\theta_{it} = z_{it}\delta + \varepsilon_{it}$

where θ_{it} denotes the technical efficiency score for i observed at time period t, z_{it} is the vector of economic variables, δ represents the vector of parameters to be estimated, and εit is the error term (17).

Results

The summary of efficiency obtained for the provinces of Iran is as follows.

Table 1. Efficiency summary

Symbol	Observations	Max	Min	STD Dev	Mean
Te	31	0.7793	0.0908	0.1493	0.4743

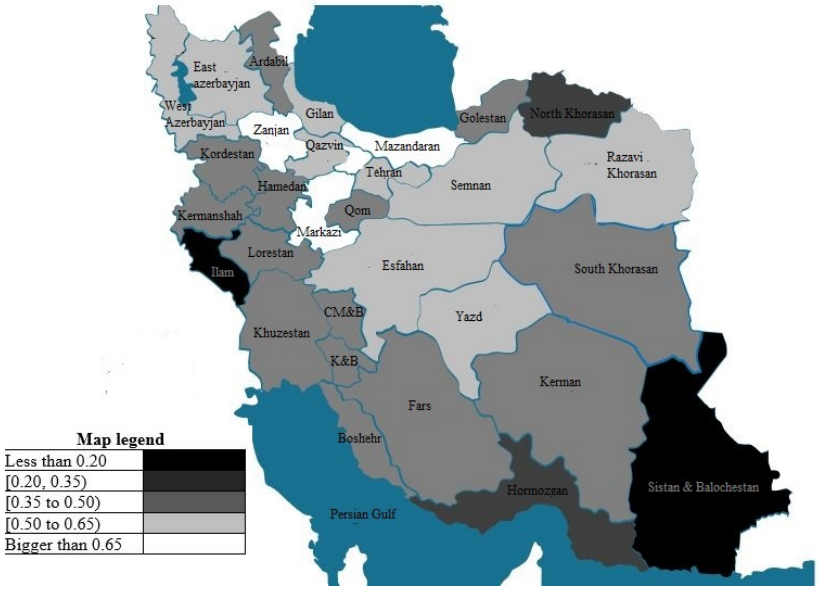

Figure 1. Map diagram of health system efficiency 1395

The average efficiency achieved in the provinces of the country was 0.4743. The lowest efficiency was related to Sistan and Baluchestan province, and the highest efficiency was related to Alborz, Mazandaran, Zanjan, and Markazi provinces.

Tobit regression results

To estimate the factors affecting the health system efficiency, the efficiency variable obtained in the previous stage was considered as the dependent variable, and the other mentioned economic factors were considered as independent variables. The Tobit method was used to estimate the model. The estimation results are as follows.

Table 2. Estimation results

Variable	Prob	T	Coef.
GDP per capita	0.096	-1.72	-0.00049
Population Covered by Insurance	0.012	2.68	0.00602
Private Sector Share of Health Expenditure	0.030	2.30	0.00640
Medical Student Admission Capacity	0.777	-0.29	-0.00020
	Prob chi2: 0.0008		Paeudo R2: 0.6824

The obtained coefficients for GDP per capita, Population Covered by Insurance and Private Sector Share of Health were significant at -0.00049 at the 90% confidence level, 0.00602 and 0.00640 at the 95% confidence level, respectively.

The results indicated that per capita production had a negative and significant effect on the health system efficiency, while the level of coverage of social insurance and the share of the private sector in healthcare costs had a positive and significant effect on the health system efficiency. Additionally, the results suggest that in this study, the variable of medical student capacity in universities did not have a significant effect on the health system efficiency.

Discussion

In this study, the efficiency of Iran health system has been calculated using the SFA method, then the effect of factors such as social security insurance, private sector, etc. on the efficiency has been investigated. According to the obtained results, provinces such as Sistan and Baluchistan and Ilam have had the least efficiency, which can be due to the difference in the low quality of medical centers and services provided in these provinces.

In this study, GDP per capita did not have a positive relationship with the health system efficiency, contrary to previous research. It is usually expected that as per capita income increases, the health system efficiency will also increase. However, an increase in per capita income can lead to an increase in demand for healthcare services, which can put pressure on the health system and reduce the quality of its services. Moreover, when healthcare resources are distributed unevenly, an increase in per capita income may not necessarily improve access to healthcare for all individuals.

On the other hand, the results showed that an increase in the coverage of social health insurance had a positive relationship with the health system efficiency, which is similar to the findings of Arhin et al. (2023), Esmaili et al. (2019), Medarevic and Vukovic (2021), and Yang et al. (2020) (9, 18-20).With an increase in the population covered by health insurance, more individuals will have access to more affordable healthcare facilities, increasing the possibility of diagnosis and treatment for insured individuals. This not only improves the overall health of society but also reduces the financial burden of diseases on individuals and families. As more people gain health insurance coverage, the existing inefficiencies in the healthcare system will diminish. This will enable health services to be provided more equitably, ensuring that a larger number of individuals have access to essential services. Additionally, an increase in income from health insurance can lead to increased investment in the healthcare sector, including treatment and prevention, thereby improving the performance of the healthcare system.

Increasing the share of the private sector in sectors such as healthcare, education, and security has both supporters and opponents. This study showed that increasing the share of the private sector in healthcare expenses has a positive relationship with the efficiency of the healthcare system, which is similar to the findings of Gong et al. (2019) and Khan and Nasrulddin (2022) (7, 8). By enhancing the involvement of the private sector in the health domain, individuals with insurance availability are presented with a broader range of health services. This expansion of options can facilitate the delivery of services that are customized to meet individual needs and

preferences. A prevalent challenge within public health systems is the extended waiting periods to access services. By boosting capacity and fostering competition within the private sector, it becomes feasible to diminish wait times and enhance accessibility to health services. By augmenting financial contributions from the private sector, the Ministry of Health can implement more initiatives focused on preventive health and educational programs, thereby mitigating the incidence of disease.

Due to the absence of recent census data in Iran, the latest available information is from 2016. As a result, the health data is somewhat outdated. This issue can doubt the validity of the results. The solution to this problem is to conduct the census on time.

In past studies, less attention has been paid to the calculation of the efficiency of the health system using data from the panels of Iranian provinces and it was mostly based on the data of hospitals. Also, in this study, the importance of health insurance and the private sector in health was emphasized.

Conclusion

Based on the research findings, increasing the population covered by social insurance, including healthcare insurance, has led to increased efficiency in the healthcare system. Additionally, increasing private sector participation and the share of healthcare and treatment costs covered by the private sector has improved the efficiency of the healthcare system. Based on the results obtained in this study, it is suggested to increase the level of coverage of social insurance, especially in deprived areas, and to take further steps to increase the private sector's share in the healthcare sector by designing necessary programs and implementing appropriate policies to enhance the efficiency of the healthcare system. The government can encourage the private sector to invest in the health sector by providing appropriate facilities and creating tax exemptions. Also, the government can help to increase the quality of services, increase efficiency, and reduce health costs by establishing joint cooperation between the private and public sectors in health.

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Conflicts of interest

There are no conflicts of interest related to this article.

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Ethical considerations

Ethical considerations were completely addressed and implemented in the study. Data used is freely available on the Internet, books or other public forum, permission for further use and analysis is implied.

Code of ethics

Maintained during the entire study.

Authors' contributions

H. A and M. K, had an equal contribution in all aspects including literature review, study design, data collection, data analysis, and manuscript preparation.

Open access policy

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