

Effect of Health Transformation Plan on the Public Hospitals Performance Indicators; a case study in Iran

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Research

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Abstract

Introduction: Health systems need constant changes and reforms in their structure in order to adapt to changing conditions and meet the needs of society. One of the fundamental changes in the health system of Iran is the health transformation plan (HTP), the effects of which must be examined from different aspects. Therefore, the purpose of this study is to investigate the effect of HTP on the performance indicators of public hospitals in the context of Yazd.

Methods: The present cross-sectional study was carried out in all public hospitals in Yazd. Six performance indicators were examined on a monthly basis and in two time periods of 12 months before and after the implementation of HTP. Data were analyzed using SPSS software program version 22, the paired T-test and the Interrupted Time Series model.

Findings: The implementation of the health transformation plan did not have a significant effect on the bed rotation distance, average length of stay and the ratio of surgical operations to bed indicators ($p > 0.05$). However, it had a statistically significant effect on the level and trend of mortality and hospitalization rates ($p < 0.05$). Moreover, the implementation of HTP had a significant effect on the level of the bed occupancy indicator ($P < 0.05$), but did not have a significant effect on the trend of this indicator ($p > 0.05$).

Conclusion: Based on the research findings, all the selected indicators changed to some extent after the implementation of HTP, which in a way showed the effect of this plan on the performance of hospitals. Therefore, the continuation of such a plan, provided that sustainable financial resources are planned and human and physical resources are organized properly, can be an important step towards achieving universal health coverage and increasing justice in access to services.

Introduction

Today, various countries around the world are constantly searching for innovations and reforms in health systems aimed at strengthening public access, quality, equality and equity in health (1, 2). In several countries that have committed to public health care reform, research on health systems has played an important role in guiding reform and monitoring progress. Over the past decades, many countries have introduced reforms aimed at improving access to medical services and increasing financial support against catastrophic health care expenditures (4). For example, in 2003, major reforms were implemented in the health system in Turkey, aiming to expand primary health care through changes in organizations and health financing and providing services to achieve universal health coverage (5). In 2009, China officially launched a new health care reform. One of the main goals of this reform was to reduce the financial burden of health care expenditures on households (6). In Massachusetts, USA, reforms have been designed to achieve universal health coverage to strengthen access to services and reduce racial and ethnic inequalities in access (7). Under the 2012 Act, the UK has made structural reforms as the responsibility of the Ministry of Health and health care providers to address the need to reduce health inequalities in the health care system (1). Various African countries, such as Ethiopia, Kenya, Uganda, Tanzania, South Africa, and Lesotho, are also working to improve their health care services (8). With the aim of increasing the quality and efficiency of health services and achieving better health outcomes with a sustainable financial method, Romania has also made reforms in its health system (1).

In Iran, as in other countries, despite considerable progresses in health system and health indicators, there are still major concerns regarding reaching equity in health and access to health care services among managers and policymakers (9, 10). Therefore, in line with the changes implemented in other countries, the Ministry of Health and Medical Education of Iran, in order to achieve the vision of 2025, has designed a comprehensive transformation plan in the health system, which has been implemented since May 5, 2014 and is now ongoing (9, 11, 12, 13, 14). The transformation plan of Iran's health system began with three approaches (financial protection for the patients, improving equity in access to health services and improving the quality of services) consisting of seven programs, which can be considered the beginning of a positive and efficient change in the health system of Iran (17 – 15). Another important goal of this plan is to reduce the out of pocket health expenditures (18), which according to official statistics, the cost of out-of-pocket payments in Iran has been declining since the beginning of the health system transformation plan, from 58% in 2011 to 49% in 2013, 40% in 2014 and finally 32.46% in 2017 (19–23). As such, the purpose of the HTP is to improve people's health, reduce out-of-pocket payments and develop health indicators (26 – 24). Various methods can be used to assess the success of the health sector in achieving these goals. One of these methods is to study the performance indicators of hospitals (10, 27, 28). In fact, performance indicators are measures for evaluating performance that help the organization to assess and determine progress

in achieving goals (28). On the other hand, the information obtained from the performance indicators shows the quality of the health services and, as a guide, determines the future activities which should be followed by the hospitals. The most important functional indicators of hospitals are the bed occupancy percentage indicator, the bed rotation rate, the average length of stay, the ratio of surgeries to the bed, the mortality rate and the rate of hospitalization per bed (10, 29). The bed occupancy coefficient refers to the occupant beds that are calculated as the ratio of the occupied day bed to the active day bed over a given period of time. Bed rotation distance is the number of times that patients use a hospital bed over a period of time. The average length of stay of a patient is the sum of the total number of beds occupied at a given time in the same number of discharged and dead patients in the same period (30). The ratio of surgeries to the bed refers to the ratio of surgeries performed in a period to the day operation bed of the same period (31). The mortality rate is the number of deaths in inpatient wards after 24 hours per 1,000 discharged patients. The number of patients hospitalized is the number of patients admitted per thousand population of the region in hospitals (32).

Numerous studies around the world have examined the effect of reforms on the functional indicators of the health system, including the studies carried out by Shen et al., in China (33), Yasar in Turkey (34) and Sommers in Massachusetts, USA (35).

In addition, Dadgar, Rezaei, Mousavi Rigi, Zarei, Ghazizadeh, Yusefi, Hashemian and Kasiri, et al., separately examined the effect of health transformation plan on performance indicators in different hospitals in Iran and concluded that the implementation of health system transformation plan has led to significant improvements in the performance indicators of hospitals, so that after the implementation of the plan, the indicators have been in a better position than before (36, 25, 28, 10, 29, 37, 38, 39). Although several studies have been conducted in different parts of Iran regarding the impact of the implementation of the health system transformation plan on the performance indicators of hospitals, so far no studies have been done in this regard in Yazd hospitals, which are known as referral hospitals for southern and southeastern regions of Iran. It should be highlighted that many people from the southern and southeastern provinces of Iran come to these hospitals for their health needs, so considering the importance of this issue in future planning and policy of the health system, this study aims to investigate the effect of the health system transformation plan on the trend of changing the performance indicators of the public hospitals in Yazd.

Methods

The present study is a cross-sectional research using the interrupted time series method to investigate the impact of the implementation of the Iranian health transformation plan (HTP) on the trend of changes in the performance indicators of public hospitals in Yazd in 2019. The research population includes all public hospitals in Yazd, as HTP was implemented in the public health sector. Performance indicators included bed rotation distance, bed occupancy rate, average length of stay of the patient, mortality rate, patient hospitalization rate and the ratio of surgeries performed to the bed, and the data related to these indicators were collected in the form of Excel sheets and on a monthly basis in the two periods of 12 months before and 12 months after the implementation of HTP from medical statistics and nursing units of each hospital and also the deputy of treatment of the Yazd University of Medical Sciences. Data regarding the above indicators were collected and interred into the SPSS software version 22, Using the paired t-test, the average of each indicator for the year before and after the plan was compared with each other. Then, using the interrupted time series analysis method, the data in the two periods before and after HTP were considered as an interrupted time series and the effects of the transformation plan on both the level of indicators and the trend of changes of the indicators after the plan were examined. In the interrupted time series model, two variables show the effect of a policy or intervention; the first one is level which determines the immediate effect of the intervention and the second is the trend variable that indicates the long-term effect of the intervention. The passage of time in the present study refers to the months that have passed since the implementation of the HTP, in which we considered 12 months after the transformation plan in addition to 12 months before the plan (although May is not included in the analysis). Using this method, we can find out what changes (immediate and short-term changes) the level of indicators has experienced at the beginning of the project, i.e. in the 13th month and also how the trend of each indicator has changed over the time (month by month). To estimate the ITS model, according to the use of time series data, first to prevent the false regression estimation of static data, the data of the indicators were examined using the root test of the Dickey-Fuller unit. Accordingly, the null hypothesis stating that there is a single root for all indicators is rejected. ($P < 0.05$) and the time series is static for all indicators. Then, for each of the indicators, the following regression pattern is estimated:

$$Y = \beta + \beta T + \beta X + \beta XT + \epsilon$$

where Y represents the value of each indicator per month. T, X, XT and ϵ indicate time, interference, the interaction of time and interference and part of the error, respectively. Since the month of the intervention (i.e. health transformation plan), X1, which is an imaginary variable, takes the value of 1 and before that the value of zero. β_0 , β_1 , β_2 , and β_3 indicate a constant value, time trend without considering intervention, immediate effects of the intervention on the level of selected indicators and continuous effect of the intervention on the trend of indicators, respectively. This research was approved by the ethics committee in the research of Shahid Sadoughi University of Medical Sciences in Yazd based on the approval of IR.SSU.SPH.REC.1397.136 on 2/2/2019.

Results

The findings of the study are presented in the form of three tables and one figure.

Table 1
Hospitals surveyed by hospital type, number of beds and total number of hospitalized individuals

Variable Hospital	Number of fixed beds		Number of active beds		Total number of hospitalized individuals	
	12 months before the implementation of the plan	12 months after the implementation of the plan	12 months before the implementation of the plan	12 months after the implementation of the plan	12 months before the implementation of the plan	12 months after the implementation of the plan
Shahid Sadoughi	582	582	387	428	30705	34540
Rahnamoun	200	200	152	152	6857	11277
Afshar	220	220	155	144	10572	14952
Total	1002	1002	694	724	48134	60769

Table 1 show that the total number of active beds as well as the total number of hospitalized individuals to the studied hospitals has increased after the implementation of the health transformation plan.

Table 2

Average and standard deviation of performance indicators before and after the implementation of the health transformation plan

Indicator title	Average		Standard Deviation	
	12 months before the implementation of the plan	12 months after the implementation of the plan	12 months before the implementation of the plan	12 months after the implementation of the plan
Bed occupancy coefficient	71.89	79.86	7.513	6.833
Bed rotation distance	1.556	0.856	0.6385	0.4246
Average patient stay	3.889	3.433	0.3823	0.4014
Mortality rate	25.19	24.22	13.223	15.355
Patient's hospitalization rate	1420.44	1688.03	837.429	886.678
The ratio of surgical operations to bed	3.1111	5.2514	1.02086	2.37526

Table 2 shows that the average of performance indicators in the period of 12 months after the implementation of the health transformation plan has changed compared to the same period before the implementation of the plan, so that the average number

of "bed occupancy coefficient", "patient's hospitalization rate" and "the ratio of surgical operations to bed" has increased and " bed rotation distance", " average patient stay" and " mortality rate" has decreased after the implementation of the transformation plan.

Table 3
Evaluation results of ITS model for the effect of health transformation plan on the performance indicators of public hospitals in Yazd

Indicator title	Variable	Coefficient	p-value
Bed occupancy coefficient	Level change due to intervention (β_2)	4.447	0.000
	Procedure change due to intervention (β_3)	- 0.006	0.932
Bed rotation distance	Level change due to intervention (β_2)	-0.291	0.880
	Procedure change due to intervention (β_3)	-0.007	0.918
Average patient stay	Level change due to intervention (β_2)	0.287	0.769
	Procedure change due to intervention (β_3)	-0.058	0.397
Mortality rate	Level change due to intervention (β_2)	-4.828	0.000
	Procedure change due to intervention (β_3)	0.258	0.000
Patient's hospitalization rate	Level change due to intervention (β_2)	-136.5	0.000
	Procedure change due to intervention (β_3)	31.41	0.000
The ratio of surgical operations to bed	Level change due to intervention (β_2)	1.517	0.359
	Procedure change due to intervention (β_3)	0.063	0.120

Table 3 shows the results of the interrupted time series analysis for the performance indicators of the studied hospitals. According to Table 3, the coefficient of the level indicates the immediate effect of the health transformation plan on each indicator, and the coefficient of the trend indicates the continuous effect of the HTP on the trend of each of the indicators. The trend of changes in the performance indicators of the public hospitals in Yazd, 12 months before and 12 months after the HTP, is shown in Fig. 1. According to the results of interrupted time series analysis, the implementation of the HTP did not have a significant effect on the level and trend of bed rotation distance, average patient stay and the ratio of surgeries performed to bed ($p > 0.05$). The implementation of the health transformation plan has had a statistically significant impact on the level and trend of mortality and patient admission rates ($p < 0.05$). Moreover, the implementation of the health transformation plan has had a significant effect on the level of the bed occupancy indicator ($P < 0.05$), but did not have a significant effect on the trend of this indicator ($p > 0.05$).

In other words, after the implementation of the health transformation plan, the level of bed occupancy and the average stay of the patient indicators immediately increased, but the trend of these two indicators has decreased, so that the health transformation plan has instantly increased the bed occupancy and the average stay of the patient rates, but over time, the transformation plan has reduced the trend of these two indicators. Beyond, after the implementation of the plan, the level of mortality and hospitalization indicators immediately decreased, but the trend of these two indicators has increased. Similarly, the health transformation plan does not have a significant effect on the bed rotation distance and the ratio of surgeries to bed indicators.

Discussion

According to the research findings, after the implementation of the health transformation plan, the patient hospitalization rate has significantly increased. In his study, Ghazizadeh confirmed the positive nature of the transformation plan and the increase in the number of hospitalized patients in hospitals based in East Azerbaijan (29). The reason for this increase can be attributed to the goals of the transformation plan, such as reducing patient payments and financially protecting patients with expensive and hard-to-cure diseases (36). According to the Ministry of Health and Medical Education, due to the implementation of the transformation plan, patients coinsurance has decreased from 37–4.5% on average, which in turn increases people's access to health services, especially for the poor; this has resulted in an increase in hospital admissions (29). Shen et al., examined the effects of the health transformation plan on the performance of hospitals in China from 2001 to 2005 and concluded that the new health reform policy

had positive effects on reducing patients' economic burden (33). The present study was consistent with the study of Faridfar, Zarei, Ghazizadeh and Shen et al. (9, 10, 29, 33). In this study, the bed rotation distance after the implementation of the transformation plan has been increasing. In his study, Faridfar concluded that the implementation of the health transformation plan had a growing positive impact on hospital productivity and the use of beds (9). The reason for this situation can be attributed to the increase in the turnover of hospitals with the implementation of the health transformation plan (40). Additionally, according to Hashemian's study, the average of this indicator in university centers of Isfahan province has increased from 70.2 times in 2012 to 71.2 in 2013, 73.9 in 2014 and 76.4 times in 2015 (38). The present study was consistent with the studies of Yusefzadeh, Faridfar, Rezaei, Kasiri, Hashemian and Mousavi Rigi (41, 9, 25, 39, 38, 28). With the implementation of the health transformation plan, the bed occupancy indicator has increased, but over time, the trend or slope of this indicator has decreased. In his study, Rezaei confirmed the positive implementation of the transformation plan and the increase of this indicator in Hamedan hospitals (25). Yasar also showed in his study that the implementation of the transformation plan in the Turkish health system has filled hospital beds and, as a result, increased the bed occupancy rate (34). The reasons for this increase can be rooted in the goals of the transformation plan, such as reducing patient payments, retaining physicians in disadvantaged areas, the presence of specialist physicians in hospitals affiliated with the Ministry of Health and Medical Education, improving the quality of hospital services, improving hospital hoteling services, and financial protection of patients with expensive and so-called hard-to-cure diseases (42). In addition, according to Yusefi's study, the average of this indicator in public hospitals based in Shiraz has increased by 8% and has improved from 72.7 to 80.55 (37). The present study was consistent with the studies of Rezaei, Yasar, Yusefzadeh, Dadgar, Zarei, Anderson and Yusefi (25, 34, 41, 36, 10, 43, 37). In this study, the ratio of surgeries performed to bed has increased significantly after the implementation of the transformation plan. This increase indicates that the treatment of patients who needed surgery was performed in a timely manner by specialist physicians present at the hospital. Moreover, increasing the quality of hospital visit and hoteling services after the implementation of the transformation plan can justify this increase (25). In a study that examined the program of the transformation plan in Turkey, the effect of the plan on increasing the number of surgeries was significant (44). Additionally, according to Yusefi's study, the average of emergency surgeries in public hospitals in Shiraz has reached from 189.18 to 208.43 and the average of elective surgeries increased from 517.95 to 637.71 (37). The present study was consistent with the study of Sahin, Yusefi, Dadgar, Zarei, and Faridfar (44, 37, 38, 10, 9). The present study showed that with the implementation of the health transformation plan, the average stay of the patient has increased, which, of course, has not been statistically significant. This finding is inconsistent with the results of Rezaei's study carried out in Hamadan hospitals (25). Numerous studies in Isfahan hospitals have shown that this plan has increased the length of stay of patients and led to problems such as lack of beds and ultimately the inefficient use of beds by patients (39). One of the reasons for the increase in the length of stay in Lorestan hospitals is the increase in the number of expensive surgeries, which require longer care in the hospital and therefore increase the length of the patient's stay (36). Moreover, according to Hashemian's study, the average patient stay for all hospitals studied between 2012 and 2015 was 2.8, 3, 2.8 and 2.9, respectively (38). The present study was consistent with the studies conducted by Kasiri, Dadgar, Ghazizadeh, and Yusefi (39, 36, 29, 37). In the present study, the mortality rate has significantly decreased after the implementation of the health transformation plan. In his study, Sadeghifar showed that the mortality rate indicator for target hospitals was favorable (45). Sommers found that health care reform in Massachusetts was associated with a significant reduction in mortality in all cases and mortality due to acceptable causes in health care (35). In contrastive and comparative studies, the mortality rate is a good indicator of the quality of care. Of course, it should be noted that factors such as time, place and person are also involved in the mortality process and one cannot judge solely on the basis of the number obtained (45). The present study was consistent with the study of Sadeghifar and Sommers (45, 35).

Conclusion

Based on the research findings, it was revealed that the performance indicators of the studied hospitals have improved after the implementation of the health transformation plan. Given that the bed occupancy rate and bed rotation distance increased further after the implementation of the transformation plan, it can be assumed that this increase was related to patients who needed treatment but due to high out-of-pocket payments before the implementation of the transformation plan, they discontinued treatment or did not have access to specialist physicians and so pursued their treatment after the implementation of the transformation plan, the reduction of the amount of coinsurance, as well as greater access to specialists (36). Continuation of such plans, provided that sustainable financial resources are planned and adequate human and physical resources are available, will be an important step towards the realization of universal health and justice coverage (29). In addition, it should be noted that the

present study only examines the indicators mentioned in the text, and judging the final effects of the health transformation plan is subject to more extensive research and the use of more indicators (36). Finally, it is suggested that health officials should support HTP and all its phases, both financially and politically. Continuous monitoring of the plan and redesign to cover weaknesses and continuous analysis of the achievements can also ensure the continuity of the plan. In the case of those performance indicators that may not have the desired trend, continuous and purposeful monitoring can be done in order to identify weaknesses and use corrections, if necessary. It is important to note that the key to the success of a health transformation plan is the integration of the health system, joint ventures, targeted planning, the adoption of correct and enforceable policies, and the strengthening of hospital infrastructure.

Limitation of the study

Although this study attempted to consider the effect of distorting variables in the analysis model, there may be other factors simultaneously with the implementation of the health system transformation plan that have affected the trend of hospital indicators and these effects have not been observed in this research.

Declarations

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Author's contributions

MR, HJ, MB, MP and VP designed the research; MR and VP conducted it; VP and MB extracted the data; MP and MB analyzed data; MR, HJ, MB, MP and VP prepared the manuscript.. All authors read and approved the final manuscript.

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Availability of data and materials

Not applicable

Ethics approval and consent to participate

This research was approved by the ethics committee in the research of Shahid Sadoughi University of Medical Sciences in Yazd based on the approval of IR.SSU.SPH.REC.1397.136 on 2/2/2019.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

HTP: health transformation plan

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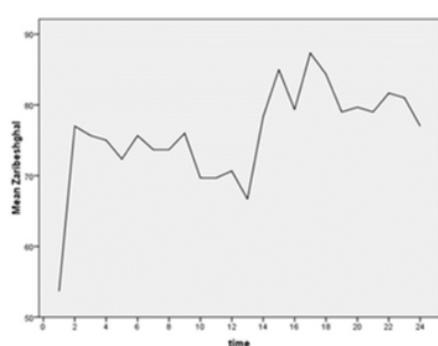
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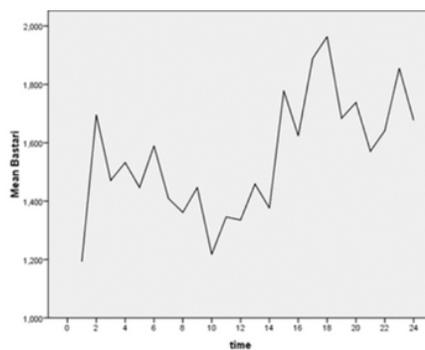
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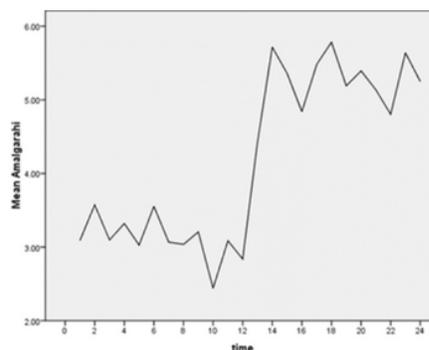
Figures



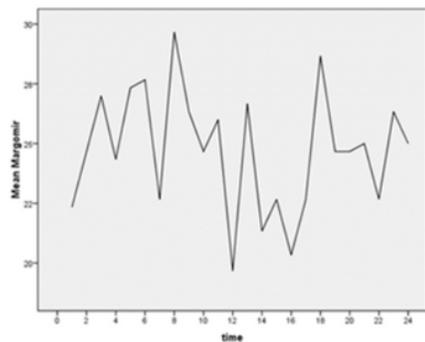
Bed occupancy coefficient



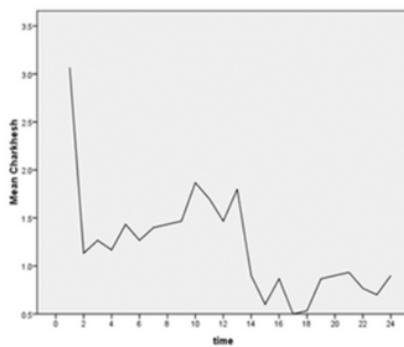
Patient's hospitalization rate



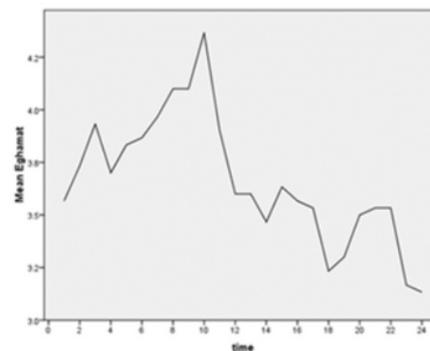
The ratio of surgical operations to bed



Mortality rate



Bed rotation distance



Patient's hospitalization rate

Figure 1

The trend of changes in the performance indicators of public hospitals in Yazd during the research period