

The Relationship between Information Systems and the Effectiveness of Performance Measurement Systems in Educational Hospitals of Tehran

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Abstract

As one of the most important sub-systems of management, performance evaluation is an integral part of every executive operation and activity. Given the necessity of efficiency and optimum use of resources and facilities, qualitative and quantitative assessment of hospitals is inevitable in the healthcare sector. This research was aimed to improve the mechanism of information systems of performance measurement in educational hospitals. The present quantitative study is applied and cross-sectional. The main tool of data collection was a questionnaire, using which 32 hospitals in Tehran located Iran, were examined by random sampling method. The obtained data were analyzed using descriptive and inferential statistics such as average and Pearson correlation coefficient using SPSS version 21. The study results show strong, significant positive correlations between the use of information systems in hospitals and the effectiveness of performance measurement systems. Also, the findings of comparative study of the three universities reflect differences in the application method of information systems in their subsidiary educational hospitals. Paying attention to information systems can result in the effectiveness of performance measurement in hospitals.

Keywords: Hospital, Performance Measurement, Effectiveness, Information Systems.

1. Introduction

Health care centers are among the fundamental structures of health system of each country and reforming the health system will not be possible without addressing, improvement and upgrading these centers [1].

On the one hand, due to restrictions in hospitals, late-efficiency [2], the need to maximize the use of available resources [3], and the need to provide high quality services and quality improvement [4], the application of a correct approach to evaluate its performance and improvement is critical. Because, the realization of the goals of the hospital will not be possible without a comprehensive model for assessing and reviewing the plans and they cannot apply their effective management on the execution of plans regardless of the facts and results of the operations. It is evident that the provision and application of such an approach can direct the operations of hospitals and bring about clear perspectives and horizons [5].

In Iran, although policymakers have encouraged health centers to improve quality beyond national standards and making efforts to meet the

international standards in Section XII of standard procedure [6] of the evaluation criteria, it seems that there has been made a little progress in performance measurement approaches of the public health sector [7]. So that some studies indicate the inefficiency of Hospital assessment methods based on Iranian Ministry of Health's paradigms [8] and some also refer to inefficient use of the health sector resources [9]. This is despite the fact that emphasis on the new tools and systems of quality improvement has greatly increased in all the organizations around the world and many of them use information systems to achieve their own goals [10]. Therefore, the current study examined the information systems in educational hospitals of Tehran and investigated the relationship between the frequency and method of their application and effectiveness of performance measurement. Here, effectiveness means the benefits of quality improvement systems reported by the respondents in educational hospitals of Tehran.

2- Methodology

In terms of objective, the current quantitative study is applied and in terms of correlation and time, it had a cross-sectional application. In order to achieve the objectives of the research, first a part of the research was carried out by library-based studies and then the results of this research were investigated as field studies. Given the broad range of the studied subject in public hospitals of the country and also the important role of educational hospitals in the health system [11], it was decided to concentrate the study on educational hospitals of Tehran. Due to the limited resources and time constraints of the study, it was more practical and attainable. Therefore, the study population consisted of 35 educational hospitals in Tehran.

Due to the limited number of hospitals, the number of samples had approximately the same size of the studied population. However, since it was expected that due to geographic dispersion, managers' involvements and also the public administrative system, the collection of information become faced with problems in some hospitals, based on the Table of Krejcie and Morgan [12] and Cochran's correction formula for the finite sample size [13], the sample size was determined as 32 hospitals. This study primarily focused on the status of the most important quality improvement systems in the research population and finally evaluated the relationship between the frequency of applied systems and effectiveness of the operation of hospitals.

According to the Iranian public organizations, a questionnaire was chosen as the primary means of collecting data [14]. In this regard, some parts of Houqe and Azhar's questionnaire [11] were used with some changes to become useable for the research population. The items about the effectiveness of performance were evaluated using five options Likert-scale, so that 5, 4, 3, 2 and 1 points were assigned to the very high, high, average, low and very low items, respectively. It should be noted that the mentioned instrument had 30 items and the reliability and validity of its different parts were confirmed using Cronbach's alpha coefficient greater than 0.7 and applying the experts' opinions.

For data collection, the questionnaires were provided to senior managers by researchers' referring to all hospitals and after their completion, they were collected in person. The accuracy of responses was also approved during interviews with

the authorities and also according to the data on their websites. The research was carried out during the last three months of 2010 and the first five months of 2011 in Tehran. Thus, after the official correspondences with the Ministry of Health and Medical Education and heads of Shahid Beheshti, Iran and Tehran Medical Universities, sixty questionnaires were distributed among 32 educational hospitals in Tehran and despite the lack of cooperation of two hospitals, the data from the fifty returned questionnaires were analyzed. First descriptive statistics methods were used to analyze the data and Pearson's correlation test was used to examine the relationship between the number of quality improvement systems and effectiveness of performance. It should also be noted that SPSS v.21 was used to analyze the data.

3-Results

A total of 50 questionnaires were completed by respondents in 32 educational hospitals of Tehran and the questionnaires return and response rate was calculated to be 83.33% that with regard to the administrative problems and public nature of studied centers, it seemed to be a reasonable rate. According to the literature of study, the primary subjects of the questionnaires were managers and authorities of hospitals. But because of hard works and delegation of authorities, five questionnaires (10%) were answered by the experts of centers.

During library and field research, all activities and processes in hospitals about collecting, analyzing and distributing performance data were considered. According to Table 1, our results indicate that using the traditional methods of data collection are the most common approach in educational hospitals of Tehran with an average score of 3.69 out of 5. Also using the computer networks within the hospital (2.53) and official automations with the ability to access data and information via the Internet (2.37) were introduced as the second and third approaches with low usage, respectively.

The second section refers to the systems used by hospitals for storing and distributing the performance data to examine the data management method. Given the averages of the four studied items, the observed procedure seems to be expectable. The use of spreadsheet software such as Excel or SPSS was reported as the most used approach (3.47) for storage and analysis of data and then the hospital information system (2.72) and customized software for hospitals (2.50) with low

to average points were in the next ranks. Also, the use of special software of performance measurement such as Dashboard and/or the applications associated with implementation of balanced score card received very low points (1.34). It is noteworthy that the total score of 2.46

was obtained for data management indicating low utilization of modern software and systems for storage, analysis and distribution of data in the studied hospitals.

Table 1: Evaluation of data management (collection, storage and distribution)

| Management of the data | | | Options | | | | |
|--|---|-----------------------|----------------|--------|---------|--------|-----------|
| | | | Very low/ none | low | Average | high | Very high |
| 1-Data collection method | | | | | | | |
| a | Recorded manually on paper (Reversed Scores) | Percentage | %3.1 | %3.1 | %25 | %59.4 | %9.4 |
| | | Cumulative percentage | %3.1 | %6.3 | %31.3 | %90.6 | %100 |
| b | Electronic archives (with no remote access) | Percentage | %12.5 | %37.5 | %37.5 | %9.4 | %3.1 |
| | | Cumulative percentage | %12.5 | %50 | %87.5 | %96.9 | %100 |
| c | On line (via the Internet) | Percentage | %37.5 | %15.6 | %18.8 | %28.1 | %100 |
| | | Cumulative percentage | %37.5 | %53.1 | %71.9 | %100 | |
| 2- storage and distribution of performance data | | | | | | | |
| d | spreadsheet software (such as Excel) | Percentage | 3.10% | 3.10% | 50% | 31.30% | 12.50% |
| | | Cumulative percentage | 3.10% | 6.30% | 56.30% | 87.50% | 100% |
| e | Hospital Information system(HIS) | Percentage | 12.50% | 12.50% | 65.60% | 9.40% | 0% |
| | | Cumulative percentage | 12.50% | 25% | 90.60% | 100% | |
| f | special software systems of performance measurement | Percentage | 65.60% | 34.40% | 0% | 0% | 0% |
| | | Cumulative percentage | 65.60% | 100% | | | |
| g | customized software for hospitals | Percentage | 12.50% | 40.60% | 34.40% | 9.40% | 3.10% |
| | | Cumulative percentage | 12.50% | 53.10% | 87.50% | 96.90% | 100% |

compared to Tehran University and Shahid Beheshti University.

However, in terms of using the Internet and online networks for data collection, according to Table (3), Tehran University has a better condition than its counterparts.

In order to better understand how data are managed in the studied academic centers, a comparative study was carried out for them. As shown in Table 2, of Iran University's educational hospitals have the best conditions in using electronic archives

Table (2): The use of electronic archive based on the University

| | The use of electronic archive | | | | | Total percentage |
|--------------------------|-------------------------------|-------|---------|-------|-----------|------------------|
| | Very low/ none | low | Average | high | Very high | |
| Tehran University | 14.3% | 42.9% | 28.6% | 14.3% | -- | 100% |
| Iran | -- | 37.5% | 50% | 12.5% | -- | 100% |

| University | | | | | | |
|-----------------------------------|-------|-------|-------|------|------|-------------|
| Shahid Beheshti University | 20% | 30% | 40% | -- | 10% | 100% |
| Total | 12.5% | 37.5% | 37.5% | 9.4% | 3.1% | 100% |

Table (3): The use of the Internet and on-line networks for each of the universities

| | The use of the Internet and on-line networks | | | | | Total percentage |
|-----------------------------------|--|-------|---------|-------|-----------|------------------|
| | Very low/ none | low | Average | high | Very high | |
| Tehran University | -- | -- | 35.7% | 64.3% | -- | 100% |
| Iran University | 62.5% | 25% | 12.5% | -- | -- | 100% |
| Shahid Beheshti University | 70% | 30% | -- | -- | -- | 100% |
| Total | 37.5% | 15.6% | 18.8% | 28.1% | -- | 100% |

To have a closer look at the issue, t test of average equity was carried out for Tehran University and the two other universities. Significance level of 0.000, with the assumption of inequality of variances indicate rejection of the null hypothesis of equality of averaged usage of on-line networks in Tehran University compared to the two other universities of Iran and Shahid Beheshti. It can also be simply attributed to the support of the University authorities for balanced development of

infrastructures in all its subsidiary hospitals. Also, the studies carried out on the three universities about the deployment of special systems for measuring performance showed no remarkable and significant difference and the associated hospitals of all the three universities had low and very low levels of usage for the above applications. Concerning the use of customized software, as data of table (4) shows, 87.5% of the respondents had average or lower usage for the above systems.

Table (4): the use of customized based software on universities

| | The use of customized software | | | | | Total percentage |
|-----------------------------------|--------------------------------|-------|---------|-------|-----------|------------------|
| | Very low/ none | low | Average | high | Very high | |
| Tehran University | 7.1% | 50% | 37.5% | -- | 7.1% | 100% |
| Iran University | -- | 50% | 37.5% | 12.5% | -- | 100% |
| Shahid Beheshti University | 30% | 20% | 30% | 20% | -- | 100% |
| Total | 12.5% | 40.6% | 34% | 9.4% | 3.1% | 100% |

Regarding the use of enterprise resources planning systems that have been reflected in the form of information systems in hospitals, Table (5) shows the relatively good situation of Tehran University

hospitals. The next ratings were related to the educational hospitals of the University of Shahid Beheshti and Iran, respectively. The results indicate an acceptable status of these systems in medical and educational centers of Tehran such that 75% of responses were in the range of medium and high.

Table (5): the use of information systems based on the universities

Generally, the resulting points represent the mean of 2.50 for the data management component in the statistical population that does not seem very good. As shown in Table (6), the three subjects of reassessing the strategy of hospitals, the method of selection of indicators and benchmarking method were taken into consideration to study the status of analysis in implementation of performance measurement approaches such as EFQM, ISO and

analyses (e.g., correlation and regression analyses) were used to a very low extent (1.91) and qualitative analyses (3.06) such as personal interviews and observations could suffice most of the times. In the last section, table information indicates that the three methods of attention to national and public standards (3.09), using data of the previous periods (3.06) and specifying the minimums and the necessities (3.03) were

| | the use of information systems | | | | | Total percentage |
|-----------------------------------|--------------------------------|--------|---------|--------|-----------|------------------|
| | Very low/ none | low | Average | high | Very high | |
| Tehran University | -- | -- | 100% | -- | -- | 100% |
| Iran University | 25% | 25% | 37.50% | 12.50% | -- | 100% |
| Shahid Beheshti University | 20% | 20% | 40% | 20% | -- | 100% |
| Total | 12.50% | 12.50% | 65.60% | 9.40% | -- | 100% |

BSC. In this context, the first part represents the average score of 2.59 that means low monitoring of strategies when deviated from the expected results. In comparison with the scores proposed in strategy evaluation previously, this is expectable.

The second part of the table checks the validity of indicators. According to the reported data, the difference between the two general proposed approaches is quite evident. So that the statistical

respectively taken into consideration as the most used modeling approaches, when compiling the indicators. However, the standards for private hospitals (1.69) and the standards of the same facilities in other countries (1.87) have received the lowest usage in policy-making, when defining the indicators. The overall score of 2.53 also shows the relatively poor analysis of performance data in health care and educational centers of Tehran.

Table 6: Evaluation of the Performance Measurement Data Analysis Method

| Performance Measurement Data Analysis | | Options | | | | | |
|---|---|-----------------------|--------|---------|--------|-----------|------|
| | | Very low/ none | low | Average | high | Very high | |
| 1- review of strategy | | | | | | | |
| a | decision-making on the strategies when deviating from the expected and planned results | Percentage | 12.50% | 37.50% | 28.10% | 21.90% | 0% |
| | | Cumulative percentage | 12.50% | 50% | 78.10% | 100% | |
| 2-the instrument of reliability of indices | | | | | | | |
| b | Statistical Analysis (regression, correlation, etc.) | Percentage | 31.30% | 53.10% | 9.40% | 6.30% | 0% |
| | | Cumulative percentage | 31.30% | 53.10% | 9.40% | 6.30% | 100% |
| c | Qualitative Analyses (e.g., interviews, personal observations, etc.) | Percentage | 0% | 21.90% | 50% | 28.10% | 0% |
| | | Cumulative percentage | 0% | 21.90% | 71.90% | 100% | |
| 3- Comparison and Benchmarking | | | | | | | |

| | | | | | | | |
|----------|--------------------------------------|-----------------------|--------|--------|--------|--------|-------|
| d | data of previous periods | Percentage | 0% | 31.30% | 34.40% | 31.30% | 3.10% |
| | | Cumulative percentage | 0% | 31.30% | 65.60% | 96.90% | 100% |
| e | minimums and requisites | Percentage | 0% | 28.10% | 43.80% | 25% | 3.10% |
| | | Cumulative percentage | 0% | 28.10% | 71.90% | 96.90% | 100% |
| f | national and public standards | Percentage | 6.30% | 21.90% | 31.30% | 37.50% | 3.10% |
| | | Cumulative percentage | 6.30% | 28.10% | 59.40% | 96.90% | 100% |
| g | hospitals in other countries | Percentage | 43.80% | 34.40% | 15.60% | 3.10% | 3.10% |
| | | Cumulative percentage | 43.80% | 78.10% | 93.80% | 96.90% | 100% |
| h | private hospitals | Percentage | 50% | 31.30% | 18.80% | 0% | 0% |
| | | Cumulative percentage | 50% | 81.30% | 100% | | |

Table 7 shows the comparative study of the three medical universities on how to analyze the performance data in their educational and health care associated centers. The resulted data show a relatively higher average for Shahid Beheshti University (2.75) as compared to universities of

Iran (2.61) and Tehran (2.35). Also, the standard deviation and column chart (4-7) indicate a greater consistency among the educational hospitals associated with Tehran University, compared to the two other universities.

Table (7): analysis of the performance measurement data based on the university

| | Standard deviation | Mean | Average | Maximum | Minimum | Number of subjects |
|-----------------------------------|---------------------------|-------------|----------------|----------------|----------------|---------------------------|
| Tehran University | 0.45 | 2.19 | 2.35 | 3.25 | 1.75 | 14 |
| Iran University | 0.72 | 2.63 | 2.61 | 3.88 | 1.75 | 8 |
| Shahid Beheshti University | 0.63 | 2.81 | 2.75 | 3.75 | 2 | 10 |
| Total | 0.59 | 2.44 | 2.54 | 3.88 | 1.75 | 32 |

According to Table (8), the investigation of eighteen cases of the possible benefits indicates that the effectiveness of performance measurement systems of educational hospitals in Tehran has a mean value of 2.56 which is a low to average value. By the same token, increased responding to customers including citizens and patients have been declared as the most important benefit of using the

new approaches to assess the performance of the respondents. Such that, 75% of them have declared that this increase had as an average value or more. Also both the increased support for applied research and increased coordination with other government agencies acquired a low score (2.09) and therefore they became isolated from the others.

Table (8): Assessing the effectiveness of performance measurement systems

| Advantages | Options | | | | |
|--|-----------------------|------------|----------------|-------------|------------------|
| | Very low/ none | low | Average | high | Very high |
| Proper appreciation and encouragement of employees | 3.10% | 46.90% | 43.80% | 6.30% | 0% |

| | | | | | |
|---|--------|--------|--------|--------|-------|
| Increased awareness of the factors affecting the performance results | 3.10% | 46.90% | 31.30% | 18.80% | 0% |
| Increases response to customers | 0% | 25% | 53.10% | 15.60% | 6.30% |
| Increased quality of service | 0% | 37.50% | 43.80% | 12.50% | 6.30% |
| Increase communication with the community on organizational performance | 9.40% | 50% | 34.40% | 0% | 6.30% |
| Improved availability of services | 3.10% | 37.50% | 43.80% | 12.50% | 3.10% |
| Changes in strategies to achieve goals | 6.30% | 40.60% | 37.50% | 12.50% | 3.10% |
| Improvement of Hospital Materials and Equipment Maintenance Management | 0% | 34.40% | 56.30% | 9.40% | 0% |
| Knowledge management development | 12.50% | 46.90% | 28.10% | 12.50% | 0% |
| Increased health and safety of emolyees | 6.30% | 31.30% | 53.10% | 9.40% | 0% |
| Reduced Duplications | 6.30% | 46.90% | 37.50% | 9.40% | 0% |
| Further support of applied research | 28.10% | 40.60% | 25% | 6.30% | 0% |
| Increased coordination with other public agencies | 25% | 46.90% | 21.90% | 6.30% | 0% |
| Reasonable costs and economic savings | 9.40% | 25% | 50% | 15.60% | 0% |
| Improve cooperation and coordination with other organizations | 9.40% | 50% | 34.40% | 6.30% | 0% |
| Increased efficiency of hospital resources resources | 0% | 50% | 37.50% | 12.50% | 0% |
| Reduced vulnerability due to environmental changes | 15.60% | 56.30% | 21.90% | 3.10% | 3.10% |
| Increase motivation and satisfaction of employees | 6.30% | 37.50% | 40.60% | 12.50% | 3.10% |

Also, the study of the relationship between information systems and the effectiveness of performance measurement in the studied sample using Pearson's correlation coefficient showed the coefficient of 0.740 for the two-tailed significance level of 0.000 that indicates a strong positive relationship between the two.

5. Conclusion

On the one hand, due to restrictions in hospitals, late-efficiency [2], the need to maximize the use of available resources [3], and the need to provide high quality services and quality improvement [4], the application of a correct approach to evaluate its performance and improvement is critical. By the same token, the current research results show a strong, positive and significant correlation between the effectiveness of performance measurement, data systems and knowledge-based systems in the research population.

As observed in this study educational hospitals of Tehran city are not ready for implementing this

systems and it seems that more efforts should be made in this regard. Due to the above, and considering the strengths and weaknesses, it seems that the statistical results were not unexpected.

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