

# Impact of Outsourcing Medical Equipment Department on Costs and Profits: A Case Study of a University Hospital in Tehran, Iran

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Received 2021 March 07; Accepted 2021 March 30.

## Abstract

**Background:** Medical equipment plays a key role in diagnosis, treatment, and medical education. Outsourcing is delegating a part or all activities of an organization to a party (e.g., individuals or organizations) outside the organization, which has an important role in the organization's productivity.

**Objectives:** The current study aimed to investigate the effect of outsourcing the department of medical equipment of a university hospital in Tehran, Iran, by emphasizing costs, profits, and performance.

**Methods:** This was a descriptive-analytical and cross-sectional study. This study investigated the documents and financial records of the Financial Office to calculate costs and revenues. Additionally, a researcher-developed questionnaire was used to evaluate the effect of outsourcing on employees' performance and financial performance. A total of 36 subjects were randomly selected, following the sampling formula (the response rate: 72%). The Kolmogorov-Smirnov test was applied to test for a normal distribution. As the data were not normally distributed, the Wilcoxon test was used. Furthermore, the t-test and analysis of variance were used to study the difference in the effect of outsourcing and age, gender, and educational level. The data were analyzed using SPSS software (version 19).

**Results:** According to the findings, there was a significant difference before and after outsourcing in the costs and revenues of the Medical Equipment Department. Concerning the effect of outsourcing on the performance, the "human resources" factor obtained the highest mean (3.37), which indicated the poor perspective of the staff in this aspect. Moreover, the lowest score was related to the "cost-effectiveness" (2.96), which was an average score. There were weak scores concerning the dimensions of management (3.28) and quality of services (3.36).  
**Conclusions:** Considering the importance of staff in the hospital, it is necessary to pay serious attention to the impact of different types of reforms intended to increase the revenues and reduce the costs of hospitals on the staff of the organization by emphasizing managerial and human resources dimensions, which not only will increase the efficiency of the organization and satisfaction of the staff but also translated into better quality.

**Keywords:** Outsourcing, Medical Equipment Department, Costs and Profits, Performance

## 1. Background

Medical equipment plays a key role in diagnosis, treatment, and medical education. Medical equipment-related errors are substantial every year, and this deficiency might lead to loss of efficiency. As a result, hospitals allocate a substantial part of their budgets to maintain medical equipment, which means a scientific and economic loss to the country's health system. The term "medical equipment" refers to a wide range of devices, such as stethoscopes, which are simple devices, to complex equipment, such as blood dialysis devices. Medical equipment, such as medicines and other health technologies, are essential for patient treatment and today are an integral part of the health sector. Therefore, a close association is established between the quality and efficiency

of health services and the quality, efficiency, and safety of medical equipment. The medical equipment market is estimated at over \$150 billion, which since 2009, its size has increased by an annual rate of 4-5% and reached nearly 186 billion. Expenditures on medical equipment's research and development affect treatment costs, which translates into a financial burden on health insurance systems and patients (1, 2).

Hospital managers have a crucial role, as they are dealing with human lives and health, and medical equipment plays a crucial role in this line. Access to sufficient and high-quality medical equipment and skilled staff helps hospital managers to provide the best healthcare services, including fast and appropriate diagnostic services (3). Outsourcing medical equipment is a common



strategy all around the world. Outsourcing, which these days is considered a method for transferring a part of activities to a hired party (either inside or outside the organization), can be a helpful strategy, similar to any other method. However, in the absence of defined and clear standards, it might result in huge losses (4). According to global statistics, more than 90% of companies have outsourced at least one of their activities. Additionally, based on the latest data, about 30% of them declared their dissatisfaction after 2 years. More than 80 criteria are available for the evaluation of outsourcing, indicating how companies achieved a logical combination of planning and implementation. Measurements and methods applied for outsourcing in well-known companies, such as General Electric, General Motors, IBM, and Microsoft, are in this line (5).

## 2. Objectives

The current study aimed to investigate the effect of outsourcing a Medical Equipment Department on the financial indicators of a university hospital in Tehran, Iran, by emphasizing costs and profits.

## 3. Methods

This was a descriptive-analytical and cross-sectional study. The data on costs and profitability of the Radiology Department of a university hospital located in Tehran both before and after outsourcing were collected and analyzed using the documents available in the financial office of the hospital. Moreover, a researcher-developed

questionnaire was used to evaluate the effect of outsourcing on employees' performance. The dimensions of the performance included management, human resources, effectiveness, and quality of services. The validity of the questionnaire was evaluated by experts. In addition, the test-retest method was used to evaluate the reliability of the questionnaire. A Cronbach's alpha of 0.86 was obtained for all the items of the questionnaire, indicating appropriate reliability. A total of 36 subjects were randomly selected, following the sampling formula (the response rate: 72%).

The Kolmogorov-Smirnov test was applied to test for a normal distribution. As the data were not normally distributed, the Wilcoxon test was used. Furthermore, the t-test and analysis of variance were used to study the difference in the effect of outsourcing and age, gender, and educational level. The data were analyzed using SPSS software (version 19).

## 4. Results

According to the findings, all the costs, including those related to the medical supplies and medicines, administrative materials, human resources, depreciation of fixed assets, repair and maintenance of medical equipment, overhead, and housing, were reduced after outsourcing; nevertheless, an increase was observed in the revenues of the department. In other words, the profitability of the Medical Equipment Department was increased after outsourcing. It is worth noting that for all the cost and revenue dimensions, except for the depreciation of fixed assets, the difference was significant (Table 1).

**Table 1.** Costs and Revenues of the Medical Equipment Department Before and After Outsourcing

Months	Costs		Revenues		Difference	
	Before	After	Before	After	Before	After
Aug-14	1,642,909,290	1515570533	1283576853	2547592745	-359332437	1032022212
Sep-14	1,536,603,162	1153441516	985302604	2765489354	-551300558	1612047838
Oct-14	1,470,474,325	1209586599	1195397443	2987453287	-275076882	1777866688
Nov-14	1,523,163,336	1194250902	1095463723	2867298544	-427699613	1673047642
Dec-14	1,867,183,834	1455940231	1247398453	2654729485	-619785381	1198789254
Jan-15	1,864,981,305	1271318995	1098563884	3098542176	-766417421	1827223181
Feb-15	1,307,846,613	1098060062	1193455403	2543698725	-114391210	1445638663
Mar-15	2,436,601,617	1875572343	1288705613	2867945275	-1147896004	992372932
Apr-15	1,530,379,479	1225603801	1313648256	2676589435	-216731223	1450985634
May-15	1,780,525,764	1311279137	1393087587	3198563287	-387438177	1887284150
Jun-15	1,627,738,115	1309052013	1093658259	2895647352	-534079856	1586595339
Jul-15	1,903,298,821	1784075156	1194683656	2998743562	-708615165	1214668406
Sum	20491705661	16403751288	14382941734	34102293227	-6108763927	17698541939
P-value	0.0001		0.0001		0	

As shown in Table 1, for the whole study period, the total cost of the Medical Equipment Department decreased after outsourcing, compared to that before outsourcing,

which this difference (i.e., cost reduction) was statistically significant. In other words, outsourcing had an impact on the total cost of the department ( $P = 0.0001$ ). In

addition, concerning the revenues, for all months, the revenue of the department increased after the outsourcing, which this difference was statistically significant. In other words, outsourcing had an impact on the total revenue of the department ( $P = 0.0001$ ).

Before outsourcing, the profitability of the department was negative. However, after the implementation of outsourcing, a significant increase in the revenue occurred, which was statistically significant (reporting  $P$ -value = 0).

As previously mentioned, outsourcing has had a positive impact on the costs and revenues of the department. In other words, outsourcing not only has resulted in a

significant reduction of costs in most cases but also increased revenues. However, other aspects should also be evaluated to extend our knowledge about the possible impacts of the program. Furthermore, the perspective of human resources should also be considered, particularly regarding their crucial role in the success of plans. Therefore, in this study, the staff's perspectives on managerial aspects (i.e., management, human resources, cost-effectiveness, and service quality) were evaluated to assess their impacts on the outcome of outsourcing programs.

According to the findings, of 36 employees, 33% and 67% were male and female, respectively (Table 2).

**Table 2.** Number of Hospital Staff Separated by Gender

Gender	Frequency	Percentage
Male	12	33.3
Female	24	66.7
Total	36	100

Of 36 participants, 20 (41.7%) subjects were engaged in managerial affairs. On the other hand, one (2.8%) of the

participants was in charge of research affairs. More information is provided in Table 3.

**Table 3.** Administrative Positions of the Participants

Type of Activity	Frequency	Percentage
Managerial	15	41.7
Clinical	20	55.5
Research	1	2.8
Total	36	100

As shown in Table 4, the highest mean was related to the "human resources factors" (3.37), indicating the weak perspective of staff regarding outsourcing. On the other hand, "cost-effectiveness" obtained the lowest score

(2.96), which was an average score. Weak scores were also obtained for management (3.28) and service quality (3.36) aspects (for more information, refer to Table 4).

**Table 4.** Perspectives of Staff of the Radiology Department of the Hospital on Outsourcing, Separated by Dimensions a

Aspect	Management	Human Resources	Cost-effectiveness	Service Quality
Mean	3.28	3.37	2.96	3.36
Standard deviation	0.70	0.84	0.84	0.96
Percentage	57	59	49	59

<sup>a</sup> Comparing score (1 - 5)

## 5. Discussion

According to the findings, outsourcing had a positive effect on the costs and revenues of the Radiology Department, indicating that it reduced costs and increased revenues, which is consistent with the literature (6, 7). In addition, a study conducted in Singapore also reported similar findings (8). In the same vein, another study conducted in the United States on the impact of outsourcing a Radiology Department also reported similar findings (9). Studies conducted in Iran regarding the impacts of outsourcing also reported that outsourcing had a positive impact on the efficiency of hospitals and medical centers. In a study titled "Comparing the Efficiency and Ef-

fectiveness of Pharmacy of the Firoozgar Hospital Before and After Outsourcing in 2009", it was reported that after outsourcing, the pharmacy could save considerable resources in human resources and medicines dimensions after outsourcing (10). Another study conducted in Imam Sadiq Hospital in Aligudarz, Iran, mentioned the positive effect of outsourcing the laboratory and Radiology Departments to the private sector, particularly regarding the costs and revenues (11).

Considering the role of staff in hospitals, this study also evaluated the effect of outsourcing on their performance. Based on the findings, the outsourcing of the Medical Equipment Department affected the managerial indicators of the hospital, which is consistent with the results of

a study by Tourani et al. (2009) (10). The aforementioned study investigated the efficiency and effectiveness of the Pharmacy Department of Firoozgar Hospital before and after outsourcing and reported a significant difference concerning the time spent by managers. The findings are also consistent with the findings of a study by Hosseini and Rahimi (2013), which investigated the effectiveness of outsourcing projects of Islamic Azad University as a cultural institution and reported that outsourcing saved the managers' time, accelerated the speed of work, and resulted in better control over activities. Consequently, based on the findings, it can be argued that outsourcing could accelerate the workflow of the department, providing more resources for service provision, reduce the complexity of the workflow, and decrease the burden of less important activities (12). In addition, managers had more time for other affairs.

In addition, based on the findings of the current study, outsourcing had an impact on the human resources indicators of the department (i.e., outsourcing could not improve the indicators related to human resources), which is consistent with the results of a study by Zhirafar et al. (2012), who investigated the association between management contract and employee satisfaction in hospitals affiliated to Tehran University of Medical Sciences. They reported that the implementation of management contract methods reduced the satisfaction of staff (3). However, the findings are not consistent with the findings of a study by Hosseini and Rahimi (2013), which investigated the effectiveness of outsourcing projects of Islamic Azad University as a cultural institution. They stated that outsourcing resulted in the use of technical skills and reduced the need for human resources in the university (11). The observed difference can be attributed to the lower number of new ideas, the inability of contractors to establish sufficient relations, the low awareness of contractors about new knowledge, the low levels of information exchange and specialized knowledge with contractors, and the low skill of staff employed by contractors.

Furthermore, according to the findings, outsourcing a Medical Equipment Department negatively affected the effectiveness of hospital costs, which is not consistent with the results of a study on the Phoenix Headquarters (2008) in Arizona, the United States, which investigated the effects of outsourcing the Walgreen pharmacy in the Maricopa area and reported that after outsourcing, the costs were decreased (10). Additionally, the findings are not consistent with the findings of a study by Tourani et al., which investigated the efficiency and effectiveness of the Pharmacy Department of Firoozgar Hospital before and after outsourcing and reported that it improved the financial status of the pharmacy, because not only the hospital does not pay any budget for the pharmacy but also has created an appropriate income source (10).

The above-mentioned differences can be attributed to the increased total expenditures of hospitals, lack of investment in other main functions of hospitals (com-

pared to the past), lack of investment in specialized training for core activities, insufficient efforts to adapt human resources to new technologies, and employment of less staff, compared to those of the past. The present study demonstrated that outsourcing had a positive effect on the costs and profitability of the Medical Equipment Department. However, concerning the functional dimension, the staff did not have a positive perspective on outsourcing. With regard to the importance of staff in the hospital, it is necessary to pay serious attention to the impact of different types of reforms intended to increase the revenue and reduce the costs of hospitals on the staff of the organization by emphasizing managerial and human resources dimensions, which not only will increase the efficiency of the organization and satisfaction of the staff but also, in turn, translates into better quality.

#### Acknowledgments

This study is a part of a thesis proposal for an MSc in health care management in Islamic Azad University, Science and Research Branch of Tehran.

#### References

- Noori Tajer M, Dabaghi F, Mohamadi R, Haghani H. A survey of maintenance and cost of medical equipment in hospitals associated of Iran university of medical sciences and health services (2000-2001). *Razi J Med Sci.* 2002;9(30):445-54.
- Ministry of Health and Medical Education. [Regulations of the General Directorate of Medical Equipment of Iran's Ministry of Health and Medical Education.]; 2007 Contract No.: Document Number].
- Zhirafar M, Vatankhah S, Seyedein SH. [Relationship Between Contract Management and Staff Satisfaction in Hospitals Affiliated to Tehran University of Medical Sciences] *Payavard Salamat.* 2013;6(4):311-8.
- Madhoushi M, Koohkan MA. Survey The Role of Outsourcing Strategy on All Organization's Productivity. *J Exec Manag.* 2012;4(7):99-124.
- Poormoalem N. [Outsourcing engineering in transportation]. Ministry of Roads and Transportation, Office of Technology and Safety Studies; 2011.
- Wang EJ, Chen YC, Wang WS, Su TS. Analysis of outsourcing cost-effectiveness using a linear programming model with fuzzy multiple goals. *International Journal of Production Research.* 2009;48(2):501-23. doi:10.1080/00207540903175046.
- Linbo J. Outsourcing "Cost Savings Assumption" and Unemployment Dilemma. *Econ Res J.* 2005;1.
- Kumar A, Ozdamar L, Ning Zhang C. Supply chain redesign in the healthcare industry of Singapore. *Supply Chain Management: An International Journal.* 2008;13(2):95-103. doi:10.1108/13598540810860930.
- Wachter RM. The "dis-location" of U.S. medicine: The implications of medical outsourcing. *N Engl J Med.* 2006;354(7):661-5. doi:10.1056/NEJMp058258. [PubMed:16481632].
- Tourani S, Maleki M, Ghodousi-Moghadam S, Gohari M. [Efficiency and effectiveness of the Firoozgar teaching hospital's pharmacy after outsourcing, Tehran, Iran]. *J Health Admin.* 2010;12(38):59-70.
- Rooiantan A, editor. [Management improvement and use of resources with outsourcing to private sector in Aligoodarz health care grid]. [Proceedings of the 1st Nationwide Conference of Resource Management in Hospitals]; 2002; Tehran, Iran. *J Health Admin.*
- Hossieni GA, Rahimi A. [Outsourcing Projects Effectiveness in Islamic Azad University as A Cultural Institution; A Case Study Islamic Azad University, South Tehran Branch]. *J Cult Manag.* 2011;5(1):34-43.