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ORIGINAL ARTICLE

# Do medical records outsourcing affect insurance deductions? An Interrupted time series in Qazvin's trauma center

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## Abstract

**Introduction:** The reform in medical records processes is recognized as one of the effective measures implemented for reducing insurance deductions. The present study aimed to evaluate the effect of outsourcing the medical records unit on the insurance deductions in Qazvin Trauma Center within 2013-2018.

**Methods:** The present study was a descriptive and analytical study which was conducted in Qazvin Trauma Center. The intervention variable was the performance of the outsourcing plan in the medical records unit. Changes in the level and trend of basic insurance deductions before and after outsourcing were at the significance level of 0.05 using the independent t-test and segmented regression model in Stata software (version15).

**Results:** The percentages of deductions before and after performing the outsourcing contract were measured at 0.038±0.112 and 0.194±0.068 for the health insurance (P <0.001), respectively. These values were reported as 0.077±0.028 and 0.031±0.126 for the social security insurance (P<0.001), respectively, and they were obtained at 0.105±0.060 and 0.124±0.087 for the armed forces insurance (P=0.369), respectively. Finally, for the relief committee insurance, these percentages were reported as 0.154±0.078 and 0.183±0.080 (P=0.209), respectively.

**Conclusions:** As evidenced by the obtained results, the level of y-intercept increased in all observations after outsourcing. Therefore, it can be concluded that outsourcing the services of the records unit did not directly affect the insurance deductions and the insurance deductions can be attributed to some other reasons, apart from the outsourced tasks.

**Key words:** Insurance deductions, Medical records, Outsourcing, Trauma centers

## Introduction

A healthcare system is efficient when its achievements outweigh resource consumption; therefore, healthcare systems require evaluation and reform (1). In recent decades, a policy called decentralization has been extensively implemented in healthcare system reforms for presenting health services. Decentralization refers to the transfer of power, authority and functions from the central to local authorities, one type of which is the privatization of management (outsourcing). In this

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method, the ownership of the healthcare center is not transferred; nonetheless, the management of the entire or a part of the center is transferred to the private sector. Alternatively, the health center buys some special services from the private sector instead of producing it (2). Outsourcing is regarded as one of the corrective strategies which help to improve the efficiency of the healthcare system (1). Outsourcing brings the government sector the advantages of private sector management, such as cost-saving, concern for efficiency, and customer satisfaction. On the other hand, it avoids the disadvantages of private sector management, such as disregard for justice and social responsibility. Based on different studies in Taiwan, India, and Turkey, outsourcing the activities offers public hospitals major advantages (3, 4). In our country, outsourcing health services was emphasized in the five-year development plans for health, therapeutic, para-clinic, and support services (5). Outsourcing in healthcare centers is effective in units with defined and completely standardized services, such as the medical documents unit, pharmacy, and medical records (1). On the other hand, the main financial sources of hospitals are supplied by presenting services to the insured people in the contracting companies. After the examination of the financial records delivered by hospitals, these organizations deduct some amounts from the total requested amount. Nonetheless, these deductions cannot realize a large amount of hospital revenue despite their provided services (6). In different studies, the most important reasons for deducing the inpatient accounts were attributed to the incorrect coding of surgical procedures, disregard for general tariff rules, miscalculation, the imperfection of documents and file, overpricing, and differences in the financial and global tariffs (7). The medical records sector of hospitals potentially deals with the massive amounts of patient information (8). Owing to the high workload and the lack of workforce, tiredness and carelessness are naturally the highest hospital deductions caused by the activity of this sector. Due to the financial bottlenecks of hospitals, high hospital deductions are not at all accepted by managers since they reduce the quality of services and patients' dissatisfaction (9). The importance of outsourcing healthcare services has given impetus to the performance of various studies in this field. A study conducted by Kim S-S in South Korea (2018) represented that some strategies are required to improve the prioritization of perceptible aspects of service quality for customers' satisfaction (10). The study performed by Jeremy G in America (2013) also considered outsourcing an important task which should be accomplished by hospitals (11). In their study, Asadi et al. (2017) reported that the substandard service quality, management systems, customer orientation, and information security had a higher effect on supplier selection (12). Moreover, the results of a study performed by Mousazadeh et al. in 2013 demonstrated that for the efficient management of sources, the implementation of outsourcing increases the quality and satisfaction of beneficiaries (13). In the study conducted by Karimi, et al. (2016), 18 reasons were recognized for deductions and 23 strategies were presented to reduce it (14). In addition, a study carried out by Safdari et al. (2013) represented that the medical personnel should be educated to reduce errors in documenting patient's files (15). Furthermore, hospital managers should take drastic measures to decrease insurance deductions. The reform in processes related to the medical records unit is one of these practical measures. In this regard, we can refer to task description which exerts significant effects on the insurance deductions, although indirectly. Moreover, outsourcing a service gives rise to efficient source management, service quality intensification, error reduction, provision of a law-based practical framework, and beneficiary satisfaction. Nonetheless, no study has been so far conducted in the field of outsourced task performance of medical records to decrease deductions. With this background in mind, the current study aimed to investigate the effect of outsourcing the medical records unit on the insurance deductions in Qazvin Trauma Center within 2013-2018.

## Methods

This is a descriptive-analytical study which has been provided longitudinally. The current research was conducted in the Trauma center of Qazvin province, Iran, within 2013-2018 (two years before outsourcing some of the tasks of the medical records sector and two years later). Since our available data were systematically accessible from 2014, we considered 2014 as the study start date. The study population was regarded as one since no sampling was performed. In this regard, a researcher referred to the hospital and used some a data collection tool which was a designed form related to the study objectives. This form included the deduction amounts of basic social security, health services, relief committee, and armed forces insurances, and the data were collected on a monthly basis.

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In the present study, the intervention variable was the performance of the outsourcing plan in some tasks of the medical records unit whose contract was carried out in May 2016. These tasks included: separation of records (medical papers and documents were separated from the patient files to be sent to the insurance organizations), analysis of the invoice (medical service costs given to the patient are analyzed in detail and the total sum is calculated), analysis of the invoice stamp (the stamp used by doctors and hospital secretariat for the records are analyzed), as well as collecting and packing records (records delivered to insurance organizations are arranged and punched in the file or patient order according to the insurance listing (record cover) and all the adjusted and arranged punches were arranged and packed based on the insurance group and admission type (outpatient-inpatient)). Moreover, in the outsourcing contract, three workforces with undetermined working times have been volumetrically used to complete a specified number of files in the specified months. Furthermore, the contract amount was 27000 Rials per analyzing, separating, and delivering the admission and temporary admission records, 2000 Rials per analyzing the outpatient records and para-clinical prescriptions and 5000 Rials per analyzing and removing stagnant medical records and 15000 Rials per analyzing, arranging, and archiving the inpatient records. On the other hand, the response variable consists of the percentage of the deduction reported by the financial sector of the studied hospital based on the basic insurances (health services, social security, armed forces, and relief committee). This percentage is reported monthly before and after the intervention (48 months).

In the current study, the paired t-test was used to compare the average deduction percentage of the basic insurances before and after outsourcing some services of the medical records unit. Furthermore, the scatter plot was used to display the effect of outsourcing during the specified time. Thereafter, the interrupted time series method and the segmented regression analysis were used for the data obtained during 48 months. The interrupted time method was applied since it has recently been extensively used to evaluate the effects of health interventions and health policy interventions (16-17). The autocorrelation condition and seasonal effects should be considered to perform this plan: autocorrelation is usually present in the time series data and it is defined as the correlation between the response variable at time t and the response variable at times t-1 and t-2 (19). If there is autocorrelation, it should be controlled in the regression model. In this respect, the Durbin Watson test was used to examine the autocorrelation. Segmented regression analysis is a powerful method for the estimation of the changes in the level and trend to assess the effect of outsourcing intervention on the percentage of basic insurance deductions. Moreover, it provides the statistical comparison of the pre-intervention and post-intervention trends to identify the changes in the level of regression line or the slope of the regression line. The segmented regression models are fitted in the form of least squares regression line. It is assumed that there is a linear relationship between the time and the response variable inside each segment (18). Segmented linear regression is expressed as follows:

$$y_t = \beta_0 + \beta_1 \times month_t + \beta_2 \times intervention_t + \beta_3 \times month\ after\ intervention_t + e_t$$

- $y_t$ response variable at time interval t
- $\beta_0$ the estimation of basic level (y-intercept) of the response variable at time zero
- $\beta_1$ estimating the slope of the response variable during the time before the intervention
- $\beta_2$ estimation of change in the level immediately after the intervention
- $\beta_3$ estimation of change in the post-intervention trend (slope), compared to the pre-intervention trend (slope)

Finally, all the mentioned processes were performed in STATA software (version 15) at a significant level of 0.05%.

Notably, the present study was approved by the Ethical Committee of Qazvin University of Medical Sciences (ethics code: IR.QUMS.REC.1397.243).

## Results

Based on the data of hospital information system, the deductions of each basic insurance were monthly recorded within the time intervals of 48 months. The deduction percentages before and after the outsourcing contract for the health insurance were reported as 0.112±0.038 and 0.194±0.068 (P<0.001), respectively. This value was obtained at 0.077±0.028 and 0.031±0.126 for the social security insurance (P <0.001), respectively, and they were obtained at 0.105±0.060 and 0.124±0.087 for the armed forces insurance (P=0.369), respectively. Finally, this percentage was measured at 0.154±0.078 and 0.183±0.080 for the relief committee insurance (P=0.209), respectively.

### *Health insurance deduction trend*

The results of segmented regression for the



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**Table 1: Estimating parameters of interrupted time series model for health insurance deductions**

| Insurance type | | Model coefficient | Standard deviation | t-statistic value | probability value | confidence interval 95% | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower bound | Upper bound |
| Health insurance | y-intercept | .125 | .026 | 4.75 | 0.000 | .072 | .178 |
| | Pre-intervention trend | -.001 | .001 | -0.78 | 0.438 | -.004 | .002 |
| | Level change after intervention | .071 | .028 | 2.49 | 0.016 | .013 | .129 |
| | Post-intervention trend change compared to pre-intervention | .003 | .002 | 1.36 | 0.180 | -.001 | .007 |
| | Post-intervention trend | .002 | .001 | 1.110 | 0.272 | -0.001 | 0.005 |

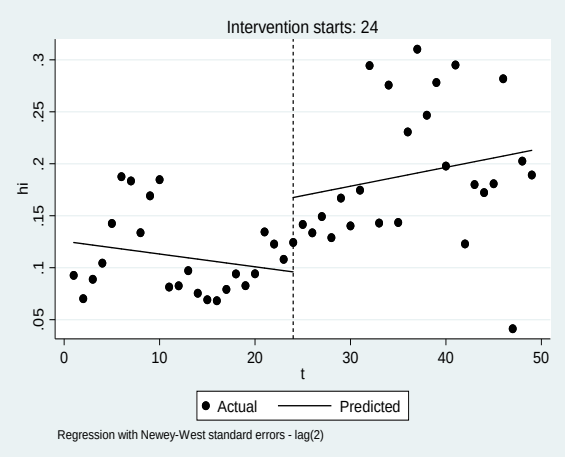


**Figure 1: Distribution of deduction percentage in the health insurance during the study process**

response variable of deduction percentage in the health insurance demonstrated that the elementary level of deduction percentage in this insurance was 0.125% (Table 1). Moreover, monthly changes in the deduction percentage were not significant for health insurance before outsourcing (P= 0.438; CI=[- 0.004, 0.002]). In the first month after the intervention, an increase of 0.071% was observed in deductions which is significant (P=0.016; CI=[0.013, 0.129]). The post-intervention deduction trend had an increase of 0.003% per month (compared to the pre-intervention trend) which is not significant (P=0.180; CI=[- 0.001, 0.007]). Moreover, in the post-intervention, the deduction percentage had an increase of 0.002 per month which is not statistically significant (P=0.272; CI=[-0.001, 0.005]).

In addition, Figure 1 displays the distribution of deduction percentage in health insurance from May 2014 to May 2018. The y-intercept level of post-intervention has increased and the trend has an ascending slope in health insurance.

### *Social security insurance deduction trend*

The results of segmented regression for the response variable of deduction percentage in the social security insurance indicated that the elementary level of deduction percentage in this insurance was 0.080% (Table 2). Furthermore, monthly changes in the deduction percentage were not significant for social security insurance before outsourcing (P=0.628; CI=[- 0.002, 0.001]). In the first month after the intervention, an increase of 0.039% was detected in the deductions which is significant (P=0.006; CI=[0.012, 0.067]). The post-intervention deduction trend had an increase of 0.002% per month (compared to the pre-intervention trend) which is not significant (P=0.130, CI=[- 0.0005, 0.004]). Moreover, in the post-intervention, the deduction percentage had an

**Table 2: Estimating parameters of interrupted time series model for social security insurance deductions**

| Insurance type | | Model coefficient | Standard deviation | t-statistic value | probability value | confidence interval 95% | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower bound | Upper bound |
| social security | y-intercept | .080 | .016 | 4.72 | 0.000 | .046 | .114 |
| | Pre-intervention trend | -.001 | .001 | -0.49 | 0.628 | -.002 | .001 |
| | Post-intervention level change | .039 | .0138 | 2.87 | 0.006 | .012 | .067 |
| | Post-intervention trend change compared to pre-intervention | .002 | .001 | 1.54 | 0.130 | -.0005 | .004 |
| | Post-intervention trend | 0.001 | 0.0006 | 2.224 | 0.031 | 0.001 | 0.003 |

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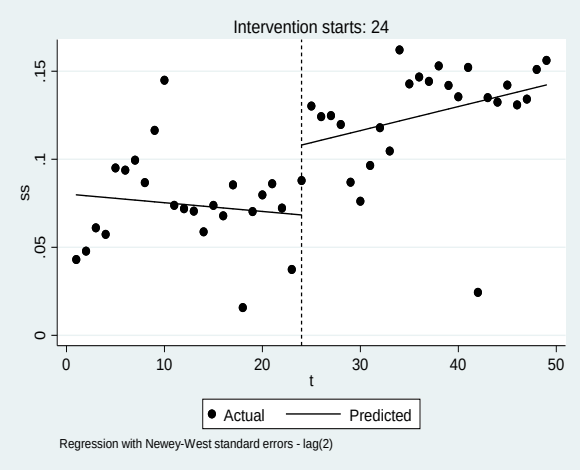


**Figure 2: Distribution of deduction percentage in social security insurance during the study process**

increase of 0.001 per month which is statistically significant (P=0.031; CI=[0.001, 0.003]).

Furthermore, Figure 2 depicts the distribution of deduction percentage in the social security insurance from May 2014 to May 2018. The y-intercept level of post-intervention has increased and the trend also has an ascending slope in the social security insurance.

***Armed forces insurance deduction trend***

The results of segmented regression for the response variable of deduction percentage in the armed forces insurance showed that the elementary level of deduction percentage in this insurance was 0.076% (Table 3). Furthermore, monthly changes in the deduction percentage were not significant for insurance before outsourcing (P=0.292; CI= [- 0.002, 0.004]). In the first month after the intervention, an increase of 0.042% was observed in the deductions which is not significant (P=0.334; CI=[0.047, 0.132]). The post-intervention deduction trend had a decrease of 0.006% per month (compared to the pre-intervention trend) which is not significant (P=0.055; CI=[- 0.012, 0.001]). In addition, in the post-intervention, the deduction percentage had a decrease of 0.004 per month which is not statistically significant (P=0.061; CI=[0.008, 0.001]).

**Table 3: Estimating parameters of interrupted time series model for armed forces insurance deductions**

| Insurance type | | Model coefficient | Standard deviation | t-statistic value | probability value | confidence interval 95% | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower bound | Upper bound |
| armed forces | y-intercept | .076 | .035 | 2.15 | 0.037 | .004 | .148 |
| | Pre-intervention trend | .002 | .002 | 1.07 | 0.292 | -.002 | .006 |
| | Post-intervention level change | .042 | .044 | 0.96 | 0.344 | -.047 | .132 |
| | Post-intervention trend change compared to pre-intervention | -.006 | .003 | -1.97 | 0.055 | -.012 | .001 |
| | Post-intervention trend | -0.004 | 0.002 | -1.921 | 0.061 | -0.008 | 0.001 |

In addition, Figure 3 displays the distribution of deduction percentage in the armed forces insurance from May 2014 to May 2018. The y-intercept level of post-intervention has increased; however, the trend has a descending slope in the Armed Forces Insurance.

***Relief committee insurance deduction trend***

The results of segmented regression for the response variable of outsourcing percentage in the relief committee insurance indicated that the elementary level of deduction percentage in this insurance was 0.106% (Table 4). Furthermore, the monthly changes in the deduction percentage were significant for the insurance of the relief committee

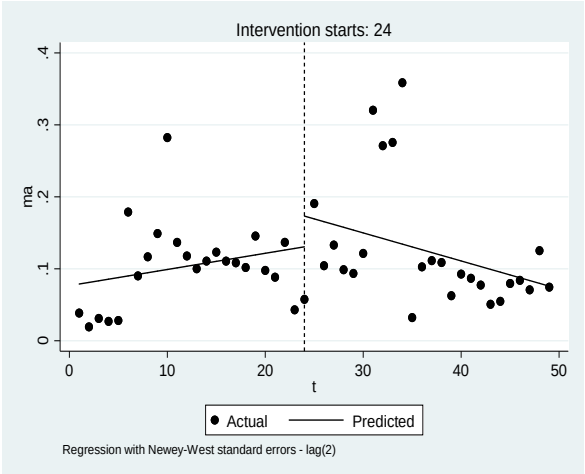


**Figure 3. Distribution of deduction percentage in the armed forces insurance during the study process**



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**Table 4: Estimating parameters of interrupted time series model for relief committee insurance deductions**

| Insurance type | | Model coefficient | Standard deviation | t-statistic value | probability value | confidence interval 95% | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower bound | Upper bound |
| relief committee | y-intercept | .106 | .024 | 4.26 | 0.000 | .056 | .156 |
| | Pre-intervention trend | .004 | .001 | 2.38 | 0.022 | .001 | .007 |
| | Post-intervention level change | .033 | .042 | 0.79 | 0.432 | -.051 | .118 |
| | Post-intervention trend change compared to pre-intervention | -.008 | .003 | -2.78 | 0.008 | -.014 | -.002 |
| | Post-intervention trend | -0.004 | 0.002 | -1.819 | 0.075 | -0.009 | 0.001 |

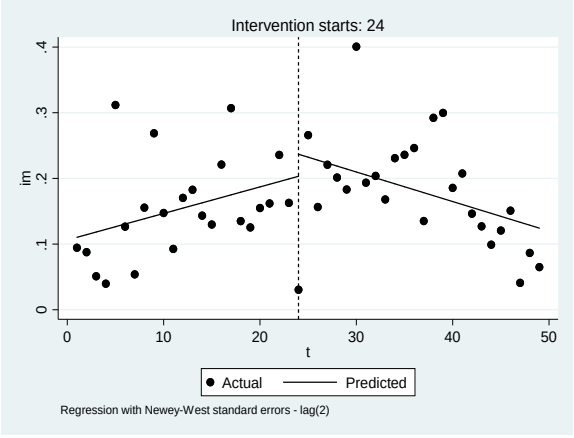


**Figure 4: Distribution of deduction percentage in the relief committee insurance during the study process**

before outsourcing (P=0.022; CI=[0.001, 0.007]). In the first month after the intervention, an increase of 0.033% which is not significant was observed in the deductions (P=0.432; CI=[- 0.051, 0.118]). The post-intervention deduction trend also had a decrease of 0.008% per month (compared to the pre-intervention trend) which is significant (P=0.008; CI=[- 0.014, 0.002]). Moreover, in the post-intervention, the deduction percentage had a decrease of 0.004 per month which is not statistically significant (P=0.075; CI=[- 0.009, 0.001]).

Moreover, Figure 4 demonstrates the distribution of deduction percentage in the relief committee insurance from May 2014 to May 2018. The y-intercept level of post-intervention has increased; nonetheless, the trend has a descending slope in the relief committee insurance.

## Discussion

Outsourcing some tasks of the medical records unit in the studied hospital has been performed since 2016. Any contract is required to evaluate and identify its advantages and disadvantages which can help it to present the corrective strategies. In this regard, the current study demonstrated the performance of the medical records unit before and after outsourcing. To this end, it investigated the insurance deductions trend which is often related to the performance of the medical records unit. The outsourced tasks reduced the workload of main personnel in the medical records unit and improved their satisfaction and performance in specific periods of time. Nevertheless, this effect is indirect and it is not practically and statistically effective in reducing deductions. It is due to the fact that the manager and personnel of the medical records unit believe that most of the cases provide insurance deductions as the result of technical and expert analyses of the records and documents. Regarding the healthcare insurance deductions, an increase in the deductions and a movement in the y-intercept were observed. Although the statistical results approved the percentage difference before and after outsourcing, the slope in the deduction trend cannot be directly related to the description of outsourced tasks. In that context and based on the manager and personnel of the medical records unit, the main reasons for an increase in the deductions included: “request for more surgical codes than the performed service”, “demand for more medicines and supplies than the standard level”, “incorrect registration of medicines and supplies in the records”, and “ request for subtasks codes”. In this regard, the most plausible reasons are related to the descriptions of surgical procedures and codes of tasks which can result from the absence of registration knowledge, non-recognition of the similar task codes, and lack of inter-unit coordination. More serious mistakes would be expected to occur since the studied hospital is a trauma center in which the rate of surgical treatment is more than the medical treatment. Therefore, the study conducted by Heidarinejad et al. recognized the wrong coding of surgical procedures as one of the main reasons for deductions (20). On the other hand, in his study,



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Mohammadinejad reported important cases of deductions in surgical procedures. They included incompleteness of surgery report instructions, anesthesia report, failure to record operation hours, incorrect registration of codes based on the tariff book, incompatibility of anesthesia codes with the surgery, and non-separation of surgery description forms (21). Moreover, in the study performed by Rezvanjou et al. at Alavi hospital of Tabriz, the surgery wage was reported as the strongest reason for deductions (22). Regarding the social security insurance deductions, an increase in the deductions and a movement in the y-intercept were observed. Although the statistical results confirmed the percentage difference before and after outsourcing, the slope in the deduction trend cannot be directly related to the description of outsourced tasks. According to he manager and personnel of the medical records unit, the main reasons for an increase in the deductions included: "request for more bed-days in order to wait for the surgery", "incorrect registration of medicines in the nursing reports", "request for unregistered anesthesia codes" and "non-presentation of invoice for the consumed equipment". Therefore, one of the main reported cases is the incorrect registration in the files by the secretaries and nurses which can be prevented by the mechanization of the files. For confirming these reasons, the study of Safdari et al. suggested that the calculation of unusual time in anesthesia and the incompatibility of anesthesia code with the surgical procedure were the most plausible reasons for deduction in the anesthesia tasks (15). Furthermore, in the study carried out by Khanlari et al., the incorrect registration of consumed equipment and more bed-days than the standard level provided insurance deductions at a social security center (23). In addition, Karami et al. suggested the strongest reasons for deductions in a study conducted on the social security insurance deductions. They reported these reasons as a request for medicines more than required, more time for anesthesia, and additional reformed codes for anesthesia (24). With respect to the armed forces insurance deductions, an increase in the deductions and a movement in the y-intercept were observed. Although the statistical results approved the percentage difference before and after outsourcing, the slope in the deduction trend cannot be directly related to the description of outsourced tasks. In this regard, although y-intercept value has increased, there was a descending slope which can be attributed to the reformed measures and a change in the trend of file analysis by experts. According to the manager and personnel of the medical records unit, the main reasons for an increase in the deductions consisted of: "additional request for surgeries", " disregard for the instructions of the armed forces insurance", and "unreadability of some documentations". Therefore, consideration for the instructions of the armed forces insurance is necessary and the descending slope can be continued in this insurance by performing some reformed actions. These reasons were confirmed in a unitary study conducted in Tehran military hospitals which reported the main reasons for deductions. They included a request for more surgery and anesthesia wage, registration of the additional medicines, disregard for the instructions of the armed forces insurance (25). In addition, the results of the study performed by Bagheri et al. demonstrated that the rejection of bed-days and the nursing services are the main reasons for deductions in the armed forces insurance (26). Eventually, concerning the relief committee insurance deductions, an increase in the deductions and a movement in the y-intercept were observed. Although the statistical results approved the percentage difference before and after outsourcing, the slope in the deduction trend cannot be directly related to the description of outsourced tasks. From that perspective, although the y-intercept value has increased, there is a descending slope which can be ascribed to the reformed actions based on the relief committee insurance regulations. In this insurance, the strongest reason for deductions was related to "additional requests for surgery codes", although gathered information in this regard may not be complete. The results of the study carried out by Moghadasi et al. can be considered a further confirmation of this reason. They demonstrated that additional request for surgery codes is one of the main reasons for the relief committee insurance deductions (27). Nonetheless, the study conducted by Karimi et al. reported the expired prescriptions as the main reason for deductions in the relief committee insurance (14). However, there was a descending slope for the relief committee insurance and the armed forces insurance. Moreover, it had a lower percentage of deductions, as compared to the social security and relief committee insurances.

## Conclusions

As evidenced by the obtained results, outsourcing some tasks of the medical records unit did not directly affect the deductions. Nonetheless, it decreased the workload of other personnel of the medical records unit, improved their relative



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performance, and reduced some costs. Based on these interpretations, technical problems in the registration and report were recognized as the main reason for deductions in different insurances at this center. The amount of deductions changed within 24 months after the outsourcing contract. Nevertheless, it is not wise to directly relate the ascending slope of deductions in the social security and health insurance and the descending slope of deductions in the relief committee and armed services insurances to this outsourced task description. However, based on managers and the head of the medical records unit, such a contract is efficient in terms of workload and cost; nonetheless, it has not decreased the y-intercept value in any insurance. Eventually, it can be concluded that the main reason for deductions must be reformed before analyzing and evaluating files and invoices while registering the records. Hospital Staff Training in the field of admission instructions, the accurate registration of medical documentation and records, changing the distributive mechanism of personnel, making a direct and significant relationship between mechanism and the size and quality of the work, and the amount of insurance deductions in the inpatient records can provide efficient strategies for errors reduction in the registration of the records.

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## Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of the current article.

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