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Health insurance deductions in Iranian public hospitals before and after the health transformation plan

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Abstract

Background: Developing countries, such as Iran, have been struggling with high rates of insurance deduction. As part of the Health Transformation Plan (HTP) in Iran, a new reference book was introduced to update the medical tariffs. This study aimed to compare the rates and extent of insurance deductions before and after HTP in Iran's public hospitals.

Methods: This was a quasi-experimental study. Overall, 400 medical bills were selected from Iran's national Health Information System using multilevel random sampling before and after HTP implementation (2014 and 2017). Insurance deductions were divided into 5 groups: (1) diagnostic procedures, (2) medication and medical appliances, (3) accommodation and human capital provision, (4) surgery, and (5) other services. Using STATA Version 14.0, independent t test and Fisher's exact test were used for data analysis. Significance level was set at 0.5.

Results: There was a significant decrease in insurance deductions among Iran's Health Insurance (HI) and Social Security Insurance (SSI). Accordingly, before HTP, the average amount of insurance deductions was 58.9% and 71.3% in HI and SSI, respectively. Moreover, there was a significant decline in all 5 groups between the pre- and postimplementation of HTP ($p<0.05$). Based on the results, hospitalization time (OR=2.31, 95% CI=1.9-3.2), patients in general hospitals (OR=1.49, 95% CI=1.4-2.7), coverage by SSI (OR=2.54, 95% CI=1.8-5.6), and having surgery (OR=3.5, 95% CI=2.0-7.3) increase the chance of insurance deduction significantly ($p<0.05$).

Conclusion: Findings of this study showed that after HTP, insurance deductions were decreased significantly. The causes of this decline may be due to the range of services covered by public insurances, increase in insurance coverage, and improvement in health providers-insurance companies communication.

Keywords: Insurance deduction, Relative value unit, Health transformation plan, Hospitals

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Introduction

Hospitals play a vital role in provision of care worldwide. In fact, hospitals constitute 50%-80% of public health re-

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↑What is "already known" in this topic:
Different countries with different health system reforms have been trying to decrease insurance deduction to increase health system efficacy and improve health equity. However, there are knowledge gaps about the insurance deduction status after the implementation of Iran's Health Transformation Plan and about the determining factors affecting the increase in the chance of insurance deduction in Iran as a developing country.

→What this article adds:
Insurance deduction was decreased significantly in public and private hospitals after implementation of Iran's Health Transformation Plan. Also, some factors such as hospitalization time, coverage by Social Security Insurance, and having surgery increase the chance of insurance deduction significantly.

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sources in developing countries (1). To optimize the performance of hospitals, the policymakers and health managers must constantly consider their expenses and revenues (2). In many health systems, one of hospitals' main sources of income is collaborating with insurance companies to provide health care to insured individuals (3). It is important to note that insurance deductions, despite its importance, is not limited to Iran, as most health systems that rely heavily on insurance payments could struggle with this issue. For instance, on average, about 26.8% of medical bills in The United States are deducted by insurance companies annually (4, 5).

In Iran, following the Universal Health Insurance Act, public hospitals work with medical schools and insurance companies to provide health services (6). While public hospitals document the associated costs of these services, Iranian health insurers are responsible to review the associated expenses and reimburse public hospitals on a monthly basis (7). However, the Iranian public hospitals are usually compensated with a lower amount than what they actually bill, mainly due to insurance deductions. Deductions are hospital expenses that are not reimbursed by insurance companies due to inadequate billing such as miscalculation of expenses and claiming the costs that are not under the corresponding insurance plan (8). Deductions are usually attributed to lack of a standardized billing protocol and miscommunication between hospitals and insurers. In Iran, inappropriate coding for surgeries, not following medical tariff regulations, miscalculation of expenses, incomplete documents, and overbilling are the most common reasons for deduction (9). Considering the financial burden of deductions, minimizing such errors has been associated with higher hospital revenue, physician motivation, and higher patient satisfaction (9-11).

Another issue with billing in Iran has been the suitability of medical tariffs. Ministry of Health and Medical Education and insurers in Iran outline the majority of medical compensations based on predefined tariffs (6). Prior to the implementation of Health Transformation Plan (HTP), these tariffs were determined based on each clinical service's relative value using a book named California. Although newer versions of this book were published, until recently, these tariffs were still based on an older version, published in mid-1970s (12). Meanwhile, because of medical advancements, many procedures have become simpler, less time-consuming, and less risky (2). Thus, relying solely on the older version of the book resulted in an unbalanced, outdated definition of medical tariffs in Iran. This unbalanced definition led to a mismatch between clinician's income and relative value of the services offered, created large income gaps between different specialities, and occasionally resulted in informal payments (13, 14).

In the past years, lack of a nationwide intervention to solve such complications has encouraged the government to design effective strategies that could address patients' needs and meet international medical standards. In May 2014, the Iranian Ministry of Health and Medical Education introduced Health Transformation Plan (HTP), an interdisciplinary program that aimed to increase financial protection of people against health costs, increase equity in access to services for the general public, and improve the quality of health care in hospitals, especially in public hospitals. HTP initially involved such interventions as increasing population coverage of basic health insurance, lunching updated relative value units of clinical services, and updating tariffs to more realistic values (15, 16). These interventions resulted in reducing the number of uninsured citizens from 16.85% (17, 18) to 4% (19, 20). Furthermore, the first phase of HTP prioritized the enhancement of medical services by following international standards such as increasing the number of full-time specialists in public institutions, improving hoteling, and implementing quality assurance measures for patients' visits. While the first phase of HTP focused more on health equity and patient's interaction with the Iranian health care system, the third phase modified medical tariffs by introducing a new reference book to all Iranian public hospitals (16, 21).

We speculate that implementation of HTP must have influenced hospitals' income. Many of the clinical procedures were previously deducted by public insurance companies, as they were labelled "medically unnecessary". Following the implementation of the first phase of HTP, insurance companies are now mandated to compensate hospitals for these interventions (10, 15). Furthermore, the increasing number of insured individuals and updating medical tariffs could have influenced hospitals' expenses and revenues. Considering public hospitals' financial deficit in Iran, investigating such influences is essential in sustainability of their health system. As a result, this study aims to assess how the rates and the extent of health insurance deductions have changed since HTP implementation.

Methods

Study design

This quasi-experimental study aimed to evaluate how reintroduction of medical tariffs by HTP influenced insurance deductions in Iran. Although limited by lack of randomization, choosing a quasi-experimental study allowed us to ethically compare insurance deductions prior to and after the implementation of HTP (4-6). To this end, the investigators selected a random sample in each time frame and compared their characteristics with one another (4).

Study population

The target population for this study was every medical document that was sent to the public insurance company (Social Security Insurance (SSI) and Health Insurance (HI)) by any public hospital in Tehran. The investigators selected 2014 and 2017 as the pre implementation and post implementation time frames, respectively; this selection resulted in a total population of 112,000 medical charts.

Considering an alpha level (α=0.05), margin of error (d=0.05), and p=0.06 (9, 22), a total sample size of 382 medical documents were calculated. Expecting some degree of attrition, 400 medical documents were collected from each of the 2 periods by multilevel random sampling.

$$n = \frac{Z^2_{1-\frac{\alpha}{2}} \times p(1-p)^2}{d^2}$$

Initially, 2 random insurance companies were selected

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from the 5 main Iranian health insurers (SSI, HI, Private Insurance, Rural Insurance, and Army). Following this step, investigators used the Iranian Health Information System (HIS) to identify patients' insurance types in the desired time frames. Next, using a systematic random sampling, about 400 documents that corresponded to the 2 insurance companies were selected in each period. To do so, a constant interval was calculated using the ratio of the desired sample size (400) to the population size (112 000 charts). Also, using a random beginning point, documents were selected at the calculated interval, resulting in 391 and 369 medical documents for the pre implementation and post implementation phases, respectively.

Data collection

Patients' demographic characteristics and their financial health service use were recorded. Demographic data entailed gender, age, length of hospital stay, and insurance type. Meanwhile, financial data included total hospitalization expenses (out-of-pocket payments, government subsidies, and insurance coverage), health service type, number of health service uses, total requested amount for reimbursement, total amount of insurance deductions, total reimbursed amount by the insurance company, and total service use costs. Further total service use costs were defined as the sum of all the expenses associated with the patient's service use such as hoteling, physician visit, consulting, surgery, surgery room, anaesthesia, medications, lab work and pathology, radiology, ultrasound, and miscellaneous. These costs were categorized into 5 main groups of diagnostic procedures: medication and medical appliances, accommodation, human capital provision, surgery, and other services. All the above variables were extracted from patients' charts, and in cases where such information was missing, our access was denied due to legal issues, and a substitute sample chart was selected.

Data Analysis

SPSS version 22.0 was used for data analysis. In addition to descriptive statistics, independent t test was conducted to compare insurance deductions on different levels and to evaluate its fluctuations following the implementation of HTP. Furthermore, multiple logistic regressions was conducted to investigate the relationship between various independent variables and insurance deductions. In this analysis, an alpha level of 0.05 was considered and backward elimination was used to reach the final regression model.

Results

Table 1 represents the demographic information of participants in the pre and post-HTP time frames. As the t test and chi-square tests results indicated, there were no significant differences between the demographic characteristics of the 2 groups.

Insurance deductions

The percentage of medical bills with any type of insurance deduction declined from 65.0% to 55.5% between the 2 selected periods (2014 and 2017). Such a change involves a significant reduction in deductions at both of the insurance companies. The frequency percentage of deducted bills for HI declined from 59% in 2014 (pre implementation period) to 48% in 2017 (post implementation period). Similarly, deductions in SSI medical bills reduced from 71% in 2014 (pre implementation period) to 63% in 2017 (post implementation period). Table 2 summarizes these findings. Based on the results of Fisher's exact test, there were significant differences in the percentage of deductions by type of insurance and in general ($p<0.001$).

The total amount of deductions in the pre implementation period (2014) was 22 808 868 464 IRR that declined to 20 807 557 714 IRR in the post implementation year (2017), which decreased about 9% in total. As indicated by Table 3, there was a significant difference between the total amounts of deductions between the 2 periods. The most common type of deduction in both periods was workforce-related along with medications and medical supplies.

Table 1. Frequency and percentage of the demographic characteristics of participants between pre and post implementation of the health transformation plan

Characteristics	Health Transformation Plan Time Frames		P Value
	Pre implementation Period (%)	Post implementation Period (%)	
Gender			
Male	180 (46.0)	164 (53.9)	0.126
Female	211 (57.1)	205 (55.5)	
Age			
<25	32 (8.1)	35 (9.4)	0.211
25-35	81 (20.7)	68 (18.4)	
35-45	124 (31.7)	119 (32.2)	
>45	154 (39.3)	147 (39.8)	
Insurance Type			
Social Security	223 (57.0)	209 (56.6)	0.618
Health Insurance	168 (42.9)	160 (43.3)	
Complimentary Insurance			
Yes	73 (18.6)	45 (12.1)	0.109
No	318 (81.3)	324 (87.8)	
Length of Hospital Stay (Days)			
1-2	124 (31.7)	113 (30.6)	0.347
3-4	189 (48.3)	162 (43.9)	
>5	78 (19.9)	94 (25.4)	

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Table 2. Frequency and percentage of insurance deductions between pre and post implementation of the Health Transformation Plan

Insurance Type	Deductions	Health Transformation Plan Time Frames		Fisher's exact test (P value)
		Pre implementation Period	Post implementation Period	
HI	Present (%)	99 (58.9)	78 (48.7)	<0.001
	Not Present (%)	69 (41.0)	82 (51.2)	
SSI	Present (%)	159 (71.3)	132 (63.1)	<0.001
	Not Present (%)	64 (28.6)	77 (36.8)	
Total	Present (%)	258 (65.9)	210 (56.9)	<0.001
	Not Present (%)	133 (34.0)	159 (43.0)	

Abbreviations: HI: Health Insurance. SSI: Social Security Insurance

Table 3. Total monetary value of insurance deductions between pre and post implementation of the health transformation plan

Insurance	Service Type Corresponding to the Deduction	Health Transformation Plan Time Frames		T test
		Pre implementation Period *	Post implementation Period *	(P value)
HI	Diagnostic Tests	1775181244	1533899880	<0.001
	Medications and Medical Supplies	1895241812	1771076684	0.011
	Workforce and Accommodation	2761393047	2531066481	0.003
	Surgery and Anesthesia	1440726807	1284121642	<0.001
	Other Deductions	703211894	611892706	<0.001
SSI	Diagnostic Tests	2946254527	2738447062	<0.001
	Medications and Medical Supplies	3145518119	3005059070	<0.001
	Workforce and Accommodation	4583062599	3779833602	<0.001
	Surgery and Anesthesia	2391163095	2452406552	<0.001
	Other Deductions	1167115320	1099754035	<0.001
Total	Diagnostic Tests	4721435771	4272346942	0.017
	Medications and Medical Supplies	5040759931	4776135754	0.023
	Workforce and Accommodation	7344455646	6310900083	<0.001
	Surgery and Anesthesia	3831889902	3736528194	0.032
	Other Deductions	1870327214	1711646741	<0.001
Total Cumulative Deductions		22808868464	20807557714	<0.001

Abbreviations: HI: Health Insurance. SSI: Social Security Insurance
* All rates offered are in Iranian Rails (IRR).

Modelling insurance deductions

Using multiple binary logistic regression and backward elimination techniques, we modelled how the independent variables predict the odds of insurance deductions. Study time frame (2014 vs 2017), length of hospital stay, hospital type (specialized vs general), insurance type (HI vs SSI), presence of complimentary insurance, and service type (surgery vs no surgery) were included as independent variables (Table 4).

The bills sent in the post implementation period were 40% less likely to undergo deduction (OR=0.6, 95% CI=0.1-0.9) (Table 4). Further, medical bills sent to insurance companies from general hospitals were about 1.5 times more likely to be deducted compared to those sent from specialized settings (OR=1.49, 95% CI=1.4-2.7); also, patients whose length of hospital stay exceeded 5 days, had a 2.3 times higher chance of insurance deduction (OR=2.31, 95% CI=1.9-3.2). Being covered by the HI Plan also reduced the odds of deductions compared to having SSI (OR=2.54, 95% CI=1.8-5.6), while having a complimentary insurance increased the odds of insurance deduction (OR=1.9, 95% CI=1.7-2.1). Last, bills that corresponded to patients with surgery were 3.5 times more likely to undergo insurance deductions (OR=3.46, 95% CI=2.0-7.3).

Discussion

In this study, the rate and extent of insurance deductions

Table 4. The Prediction of odds of insurance deductions by independent variables

Independent Variables	Adjusted OR	95% Confidence Interval	
		Lowest	Highest
Health Transformation Plan Time Frames			
Pre implementation Period (Reference)	-	-	-
Post implementation Period	0.6	0.1	0.8
Length of Hospital Stay (Days)			
1.2 (Reference)	-	-	-
3-4	1.41	1.2	2.4
5<	2.31	1.9	3.2
Hospital Type			
Specialized (Reference)	-	-	-
General	1.49	1.4	2.7
Insurance Type			
Health Insurance (Reference)	-	-	-
Social Security Insurance	2.54	1.8	5.6
Presence of Complimentary Insurance			
Present (Reference)	-	-	-
Not Present	1.9	1.7	2.1
Service Type			
Nonsurgical (Reference)	-	-	-
Surgical	3.46	2.0	7.3

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before and after HTP were considered. The findings of this study indicated that the total rate of insurance deductions declined significantly following the implementation of HTP, as the hospitals benefited from an 8% and an 11% reduction in deducted bills respectively. We speculate that one of the main underlying reasons for such significant reduction could be due to the implementation of HTP and expanding its coverage of medical services. Furthermore, HTP has enhanced communication between health sectors and insurers by standardizing data management in hospitals and training health professionals on appropriate billing (15). A large portion of insurance deductions were previously due to ineligible writing, lack of physicians or hospitals' stamp, invalid dates, and inadequate formatting (23). Also, use of electronic health records nationwide after HTP could be another reason for this decline. Findings of other studies are also aligned with this speculation that using electronic health systems has been associated with lower health costs, billing errors, and insurance deductions (4, 10).

Among the bills sent for inpatient hospitalizations, medical bills associated with surgical procedures and anaesthesia were deducted the most in both time frames. This finding is in agreement with that of Khorammi et al, as they identified orthopedic surgeries as the most deducted health service (33%) in Iran (8). On the contrary, Yavari et al indicated that diagnostic bills are deducted the most by the Iranian insurance companies (3). One of the reasons for higher rates of insurance deductions in the diagnostic category could be the large breadth of health services that are labelled as diagnostic. Moreover, such high rates of insurance deductions in diagnostic and surgical procedures may be due to inadequate documentation of health services, particularly when additional interventions are provided along with the treatment, medical bills miss the attending physician's stamp or report, or when there is discrepancy between diagnosis and the prescribed intervention. However, HTP implementation was associated with a significant decline in surgical services. Several studies emphasized that inpatient hospital services, especially surgical costs, are deducted more commonly in comparison with other types of expenses (8, 9, 11).

Medication costs were significantly reduced following HTP implementation (15, 19, 20). Similar to the literature, we identified medication costs as another category with high insurance deduction rates. In a study by Tavakoli et al, this category was the most commonly deducted health service (24) and Safdari, following a thorough investigation of medical bills processed by Tehran's University of Medical Sciences, identified medication costs as one of the most significant causes of insurance deductions (9).

Reduction in the rate of deductions in costs associated with workforce and accommodation after HTP was considerable. Oswald et al indicated that physicians' costly practice routines are associated with higher deduction rates in this category; therefore, they requested clear guidelines that would standardize and limit physicians' expenditure (25). Tavakoli et al also identified malpractice among health professionals, particularly physicians, as one of the most significant causes of insurance deduction (24). Investigating the underlying causes of insurance deduction in France, Defez et al concluded that lack of predetermined medical tariffs, in addition to absence of required documentation, are the leading contributors to such deductions (26). In an American context, Keeny indicated high rates of insurance deductions due to hospital services and discussed the need for infrastructural changes to minimize such preventable costs. Similar to the present study, they highlighted a significant decline in insurance deductions following the implementation of infrastructural changes (27). Based on global literature and our findings, it can be concluded that updating and modifying predefined medical tariffs could reduce the rate of insurance deductions in health systems that rely heavily on publicly funded insurance companies (4, 28). These modifications are most effective if they are implemented in conjunction with educational training sessions where health professionals are informed about system changes and standardized billing (29).

Overall, 40% reduction in the rate of insurance deductions between the 2 time frames (pre and post-HTP implementation phases) may be considered as an indicator of the positive financial influence of HTP on the Iranian health system. These findings confirm several studies that discuss the promises of the HTP to improve the Iranian health economy (15, 16, 19-21).

Compared to specialized hospitals, insurance deductions were about 1.5 times more common in settings with a general focus. This finding agrees with that of Yavari et al who found a significantly higher rate of insurance deduction in general hospitals (3). In addition, hospitals that focused on a unique specialty had the lowest rate of insurance deduction (9). The main contributor to this difference is the diversity of services that are offered in general hospitals (3, 26, 30-32). Furthermore, since general hospitals are more involved with medical trainees and the billing procedure is usually more complicated in such settings, they are more likely to bill inadequately, which leads to higher deduction rates (3, 32).

The results of the logistic regression analysis indicated that surgery and having complimentary insurance are the best predictors of insurance deductions. In fact, patients who had surgery were 3.5 times more likely to experience insurance deduction. Bagheri et al suggest that this increased risk among C-section and natural birth surgeries is particularly due to health professionals' failure to follow a standardized protocol to code for medical procedures. Moreover, medical surgeries are more likely to be followed up with additional interventions that were not previously determined by insurance companies (32). Kaplow also found a positive relationship between having complimentary insurance and number insurance deductions (33). He also highlighted how U.S. health reforms were associated with a reduction in the number of insured individuals and an overall increase in insurance deductions (34).

Being affiliated to one of Iran's largest medical schools and investigating insurance deductions in 17 hospitals across the country increased the generalizability of this study. Using a quasi-experimental approach is also a primary step to foreshadow the effectiveness of HTP in solving some of the common issues of Iranian health system.

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Moreover, the quality of data source for this study was "checked and rechecked" to ensure the validity of the analysis. However, the limitations of this study were excluding rural and army insurances, general categorization of patients' charts, and focusing only on Iranian hospitals.

Conclusion

This study highlights the reduction in insurance deductions before and after HTP in Iran. It could be speculated that this reduction is mediated by focus of the HTP on updating predefined medical tariffs in Iran. Moreover, HTP has introduced realistic relative values for medical tariffs, encouraged the use of the Iranian national Health Information System (HIS), expanded public insurance's coverage, and enhanced communication between health providers and insurers. This study also highlighted that hospital type, hospital length of stay, having complimentary insurance plans, and surgical procedures are the most significant predictors of having an insurance deduction. As a result, policymakers could benefit from our findings by identifying effective strategies to promote adequate billing for patients, particularly those who are at a higher risk of undergoing deduction.

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Conflict of Interests

The authors declare that they have no competing interests.

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