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Research Article

The National Financial Burden of Hospitalization of Diabetes in Iran

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Abstract

Purpose: To determine hospitalization cost of diabetes in Iran.

Methods: The cost-of-illness analysis, using bottom-up and prevalence approach has been conducted. Cost information of 4002 diabetic inpatients, based on ICD-10 coding standard, were collected and analyzed.

Results: The study shows that the mean age of diabetic patients was 58.3 years and the average length of stay was 6.2. The average cost of diabetic patients irrespective of their type of diabetes was US \$716. Every one day of hospitalization of a diabetic patient imposes US\$117 on a typical buyer of service. With 4% prevalence rate of diabetes and presuming that diabetes raises the event of hospitalization by at least 3 times, about 884,591 diabetic patients were estimated to be hospitalized in 2009, in Iran. For buyers and based on the national tariff, the diabetes inpatients cost was amounted to US \$633.97 million, in 2009, while for providers this amount can increase up to US \$887.31 million. Diabetes hospitalizations consume 3.2 to 4.5 percent of the total health expenditure in Iran.

Conclusion: Diabetes hospitalization imposes a significant financial burden on individual, insurer, government and the society. This burden will increase as the prevalence of diabetes as well as the cost and rate of hospitalization increases.

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Introduction

Nowadays, management and treatment of chronic, non-contagious diseases is one of the major challenges and priorities in many developed and developing countries. The diagnosis and treatment of chronic diseases and complications associated with accounts for a significant part of the cost imposed on the health systems, which impose a heavy financial and economic burden on the society.

The evidences show that non-contagious diseases account for 59% of the total mortality in the world and 46% of the diseases burden. The financial burden of non-contagious, chronic diseases is increasing due to the industrialization and urban life, better life expectancy and increased number of old people, causing serious concerns both in developed and developing countries [1].

Diabetes is one of the most common chronic diseases which plays a significant role in the increased mortality rate and disability of the people. It is the most common metabolic disease which has caused serious problems for both the people and governments by creating multiple complications, reducing the quality of life, and increasing the mortality rate [2-4].

The risk of cardiac disease is twice in diabetic patients; the

figure is seventeen times for renal disease, twenty-five times for eye complications, and fifty times for limbs gangrene. Also, the mortality rate is reported to be 5 to 7 times more in diabetic patients and the life expectancy in such patients is 10 to 15 years less than the general population [5-6]. The disease has been found as the main cause of blindness, renal insufficiency, and gangrene of limbs, and a major factor in cardiac diseases, and the fifth cause of disease-related deaths in the United States [3, 7-8].

The global prevalence of diabetes was estimated to be 2.8% in 2000 and projected to rise to 4.4% by 2030, with more than three-quarters of people with diabetes living in developing countries [9]. In 2010, the highest prevalence of diabetes among population aged between 20 to 79 was reported from Nauru, UAE and Saudi Arabia, with 30.9%, 18.7% and 16.8%, respectively. According to World Diabetes Federation, the prevalence of diabetes in Iranian population aged 20-79 estimated to be 6.1% in 2010 end with a total number of 2,871,500 diabetes patients [10]. Table 1 summarizes the results of studies conducted on the prevalence of diabetes in different areas of Iran.

The evidences show that the use of health care services in diabetic patients is much higher than many other diseases [12-

17]. These led to diabetes to be responsible for 11.6% of the world's medical expenses in 2010 varying from 5% to 13% in different countries [1]. The direct health care costs of diabetes range from 2.5% to 15% of annual health care budgets, depending on local prevalence and sophistication of the treatments available [14]. A major part of direct medical expenses of diabetes occur in inpatient section. The hospitalization accounts for about 50% of the whole direct expenses of diabetic patients [18-19], however, this figure varies between different countries. Esteghamti et al's study (2009) shows that hospitalization accounts for about 28.6% of the total diabetes medical expenses, in Iran [20].

The aggregate clinical specifications, pathogenesis, mortality and financial burden of diabetes have made diabetes as one of the main health concerns that require serious attention in terms of its prevention and treatment. However, to make effective and evidence-based decisions, updated information on the prevalence of the diabetes, diabetes related complications and its financial burden are needed.

With respect to the high incidence rate of diabetes and its effect on the people's health, and also the significant direct and indirect costs that the disease imposes on both the individual and society, many studies have been conducted on the costs of illness of the diabetes (COI) around the world [21-22]. The aim of the cost of illness study is to identify and measure all the costs of a particular disease, including the direct, indirect, and intangible costs and estimate the maximum amount that could potentially be gained if a disease is appropriately treated. The output, expressed in monetary terms, is an estimate of the total burden of a particular disease to the society.

In Iran, like many other countries, there is not accurate information about the number of patients afflicted by diabetes, the rate of morbidity and mortality as well as its financial and economic burden. However, the evidences suggest that the number of diabetic patients and the financial burden is increasing.

The present study was intended to examine the direct hospitalization cost of diabetic patients in Iran in view of the individual purchasers and insurance organizations as well as the health care providers and government. This helps health policymakers and service-purchasing organizations to make informed decisions on the cost and effectiveness of the new technologies and treatments coming to the health care market.

Methods

Study design

This is a prevalence-based cost of illness study with bottom-up approach dealing with direct hospitalization costs [21-23]. The research population consists of 4002 diabetic patients who had been hospitalized in nine hospitals of seven provinces in Iran, in 2009. The treatment cost of diabetic patients has been considered in view of the both purchasers and providers of the health care services. The cost of hospitalization from purchasers perspective is equivalent to the money paid by the patients, the insurer or both.

Identification of diabetic patients

To identify the diabetic patients, the International Classification of Diseases (ICD) has been used. According to the guidelines issued by Ministry of Health, Treatment and Medical Education, all hospitals have the responsibility to use ICD, 10th revision, to record the diagnosed disease, including the primary diagnosis and the all secondary diagnoses of hospitalized patients. According to the ICD, Types 1 and 2 diabetic patients are denoted by E10 and E11, and depending on whether there is or is not any complication, one of the numbers 0 to 9 is used. Determination of the disease code is performed by the staff working in medical documentation centre using the notes put down by the attending physician. In cases where for any reason the expert is unable to determine the type of diabetes, code E14 as unspecified diabetes is used in place of E10 and E11.

Estimating the size of the population with diabetes

There is no consensus about the total number of diabetic patients in Iran. Different studies have reported different figures about the prevalence of diabetes varying from 2 to 10 percent. Iran population estimated to be 73,751,915 in 2009 of which almost 64% have 20 and above years of age. Considering a prevalence rate of 6.1% for people above 20 years of age [10] and assuming a prevalence rate of 0.026% for under 20 years of age [24], a total number of 2,948,637 people with diabetes had been diagnosed in Iran, in 2009. This figure is close to a prevalence of 4% in the whole population; however our analysis includes a range of 2-10 percent to reflect all potential magnitude of diabetes in Iran.

Estimating the hospitalized diabetic patients

There are no published data about the numbers and events of hospitalizations of diabetic patients in Iran. The rate of hospitalization in whole population, according to the information available on Iran Supreme Council of Insurance, was almost 100 in a thousand populations (10%), in 2009. As reported, diabetic patients have more chances of hospitalization and experience longer durations of stay compared to non-diabetic patients [14-16]. According to Berardis et al. (2011) diabetes can increase the likelihood of hospitalization by 2 to 6 times [25]. The higher hospitalization rate of 1.4-2.5 times by Kim and Boye's (2009) and 3 times by Bjork (2001) has also been reported [6, 26]. The rate of hospitalization of Iranian diabetic patients, according to Esteghamati et al. (2009), is found to be four times greater than the control group in Tehran, Iran capital city [20]. This figure might be lower for whole population as people of Tehran have better socioeconomic status and access to inpatient facilities compared to those residing in other areas. Thus, we assumed that the chance of hospitalization for diabetes is 3 times more than the whole population; however a range from 2 to 6 times would be examined.

Table 1. Prevalence of diabetes in Iran(Larjani et al.[11]).

Diabetes prevalence	Target Population	Province
7.40	Above 30 years old	Tehran
7.76	40 years and above	Isfahan
7.60	Rural population above 30 years old	Tehran
7.20	Urban population above 30 years old	Tehran
13.60	Urban population above 30 years old	Bushehr
5.00	Rural population above 30 years old	Zanjan
16.30	Adult urban population	Yazd

Table 2. Average length of stay, age and cost for hospitalized diabetes by different types.

Average cost US \$ (purchaser perspective)	Age	Average Length of Stay	Number of Patients	Type of diabetes
519 (428-611)	46.5 (44.3-48.7)	6.9 (6.3-7.5)	497	Type 1
870 (817-923)	61.5 (60.8-62.2)	6.9 (6.6-7.2)	1553	Type 2
645 (601-689)	58.8 (58.1-59.4)	5.4(5.1-5.6)	1952	Unspecified
716 (684-749)	58.3 (57.8-58.8)	6.1 (5.9-6.3)	4002	All patients

Cost analysis

Direct hospitalization costs, from purchasers' and providers perspective, were calculated from diabetic patients' discharge

records available in the selected hospitals. The total cost, the average cost per diabetes hospitalization and the mean cost per every day of hospitalization, the total cost by type of the services provided and also cost by diabetes complications are measured. As the actual cost of treatment is not reflected on the patient's invoice, the government provides subsidy to public hospitals to cover the cost of production in Iran. Thus, the cost

of hospitalization, from providers' perspective would be at least 40% higher than the money received from purchasers based on the agreed national tariff. All costs reported in US\$ with an exchange rate of 10464 IRR/1US\$ [27]. All analyses of the data were performed using the SPSS version 17 and whenever possible, the 95% confidence interval (CI) was reported along with the point estimation.

Table 3. Number of the diabetes hospitalized with different prevalence and hospitalization rate, Iran 2009.

Iranian population in 2009	Diabetes prevalence	Number of diabetic patients	Number of hospitalized diabetic patients with a hospitalization event of:					
			10%	20%	30%	40%	50%	60%
73.715.915	2%	1,474,318	147,432	294,864	442,295	589,727	737,159	884,591
	3%	2,211,477	221,148	442,295	663,443	884,591	1,105,739	1,326,886
	4%	2,948,637	294,864	589,727	884,591	1,179,455	1,474,318	1,769,182
	5%	3,685,796	368,580	737,159	1,105,739	1,474,318	1,842,898	2,211,477
	6%	4,422,955	442,295	884,591	1,326,886	1,769,182	2,211,477	2,653,773
	7%	5,160,114	516,011	1,032,023	1,548,034	2,064,046	2,580,057	3,096,068
	8%	5,897,273	589,727	1,179,455	1,769,182	2,358,909	2,948,637	3,538,364
	9%	6,634,432	663,443	1,326,886	1,990,330	2,653,773	3,317,216	3,980,659
	10%	7,371,591	737,159	1,474,318	2,211,477	2,948,637	3,685,796	4,422,955

Table 4. Average cost of hospitalization of diabetes by different complications.

Average cost (US \$) Providers' perspective	Average cost (US \$) Purchasers' perspective	Average length of hospitalization	Average age	Percent of Patients	Number of patients	Complications
429 (410-449)	307 (293-321)	1.4 (1.3-1.5)	58.9 (58.1-59.7)	25.4%	964	Eye complications
456(364-549)	326 (260-392)	5.9 (5.4-6.4)	59.1 (56.9-61.1)	7.9%	298	Indefinite
600 (447-754)	429 (319-538)	5.9 (5.4-6.5)	50.7 (48.3-53.1)	9.7%	366	Without complications
798 (645-951)	570 (461-679)	7.3 (6.2-8.4)	34.7 (30.2-39.1)	3.7%	140	Ketoacidosis
802 (404-1201)	573 (288-858)	6.9 (5.5-8.3)	60.3 (56.9-63.7)	1.7%	65	Nervous
934 (796-1071)	667 (569-765)	6.5 (5.8-7.1)	61.7 (59.9-63.4)	5.9%	226	Renal
1,127 (338-1916)	805 (242-1369)	7.5 (3.3-11.6)	56.8 (46.9-66.6)	0.4%	17	Coma
1,561 (1480-1642)	1115(1057-1173)	8.4 (8.1-8.7)	60.7 (59.9-61.4)	40.8%	1546	Vascular
1,671 (1230-2112)	1194(879-1509)	9.2 (8.1-10.3)	61.1 (58.8-63.4)	4.4%	169	Other
1,018 (971-1065)	727 (694-761)	6.0(5.9-6.2)	58.2(57.7-58.8)	100.0%	3791	Total

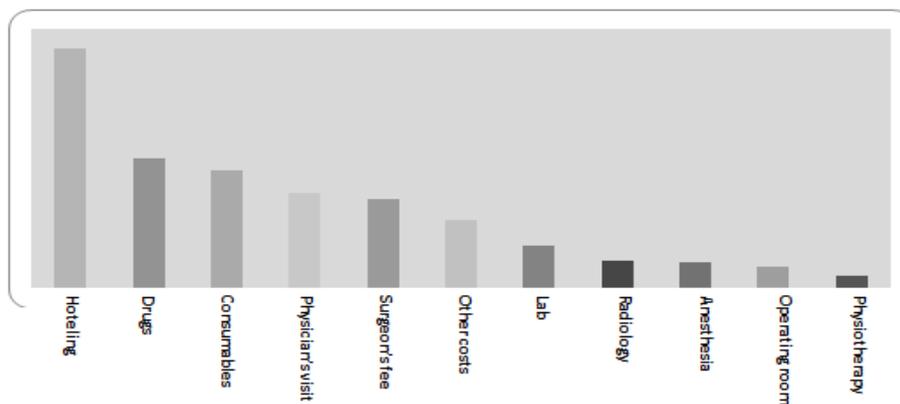


Figure 1. Cost of hospitalization of diabetic patients by different type of the services.

Results

Data of 4002 diabetic patients hospitalized in nine hospitals

from seven provinces of the country were collected and studied. The study shows that the average age of diabetic patients is

58.3 years and women with the average age of 58 years account for 54% of all the hospitalized patients. The average length of hospitalization of the diabetic patients is 6.1 days, a figure which is not different among the Type 1 and Type 2 diabetic patients. The average length of hospitalization of men and women is 6.4 and 6 days, respectively (Table 2).

About 12% of the hospitalized diabetic patients are of Type 1 and 39% are of Type 2, while the type of diabetes has not been specified for 49% of patients or the information required for identifying type of the diabetes has not been available in the patients' records. The average age of the hospitalized diabetes patients was 46.5 years for Type 1 diabetes, 61.6 years for Type 2 diabetes, and 58.8 years for those with unspecified type of the diabetes. The average cost of diabetic patients irrespective of their type of diabetes was US \$716. Every one day's hospitalization of a diabetic patient inflicts US \$117 on a typical buyer of service.

Estimated number of hospitalized diabetic patients in Iran in 2009

Considering a 4% prevalence of diabetes but varying from 2 to 10 percent, the total number of diabetic patients, in Iran, would be amounted to almost 2,948,637 (varying from 1,474,318 to 7,371,591). With this in mind that diabetes increase the chance of hospitalization by two to six times, Table 3 summarizes the number of diabetic patients who were hospitalized in 2009. For the sake of readers, our calculation includes the event rate of hospitalization from 10 to 60 percent for diabetes.

As indicated, different scenarios will end with different result about the total number of diabetic patients and the number of diabetes who were hospitalized. Our possible scenario in the present study is a 4% prevalence of diabetes, presuming that diabetes raises the event of hospitalization by three times. In this situation, 884,591 diabetic patients were hospitalized in 2009.

Cost of diabetes hospitalization by complications and type of the services

The detailed cost of hospitalization of diabetic patients in terms of type of service is shown in Figure 1. Hoteling accounts for the biggest part of the cost of hospitalized diabetic patients, with 27.6%, followed by drugs with 15%. The cost of lab and radiology account for 4.7% and 3.1%, respectively. The physiotherapy services provided to the diabetic patients

accounts for the smallest part of the cost (1.4%).

The analysis conducted on 3791 patients, for whom that it was possible to track the record of the complications, show that more than 25% of the diabetes was hospitalized due to eye complications (Table 4). The cost of treatment for patients with eye complications was US \$307 which is less costly than other complications. Patients with eye complications had an average length of stay of 1.4 days, which is the shortest duration compared with other groups. Vascular complications are the most common cause of hospitalization (40.8% of the total hospitalization) and also constitute the most expensive cases next to the 'Other Complications'. The average cost of hospitalization for cardiovascular patients with a cost of US \$1115 is approximately one and half times more than the total average cost. These patients, with an average length of stay of 8.4 days receive a longer time of care in the hospitals.

The most expensive cost and the longest duration of hospitalization are related to the patients classified as 'Other Complications', in which most of them treated for septicemia. Studies show that there is a direct relationship between the cost of treatment of diabetic complications and the length of hospitalization, so that for every one day increase in the length of hospitalization, the cost of treatment of a typical patient will increase by almost US \$114. The cost of treatment for patients who are hospitalized for ketoacidosis or nervous complications caused by diabetes are almost the same. Meanwhile, patients hospitalized for ketoacidosis, with an average age of 34.7 years, are of a younger age compared to others.

Estimation of hospitalization costs of diabetic patients in Iran, in 2009

The results show that the average cost of hospitalization of diabetic patients in nine hospitals is US \$716 (n=4002). In our pre-specified scenario, where diabetes increases the event of hospitalization by 3 times and prevalence of diabetes is about 4%, the financial burden imposed by the treatment of diabetic patients, in 2009, were US\$633.97 million from purchasers and US\$ 887.31 million from providers perspective. Assuming a 40% hospitalization rate, this figure will amount to US\$845.09 million, for purchasers, and US\$1183.12 for providers, indicating a direct relation between financial burden of hospitalization with diabetes prevalence and the chance of hospitalization. The estimated cost of hospitalization of diabetic patients in different scenarios has shown in Table 5.

Table 5. Cost (US \$ in million) of hospitalization of diabetes by different prevalence and hospitalization rate from purchasers' and (providers') perspective, Iran 2009.

Diabetes prevalence	Hospitalization event					
	10%	20%	30%	40%	50%	60%
2%	105.60 (147.84)	211.30 (295.81)	316.90 (443.65)	422.59 (591.63)	528.19 (739.47)	633.79 (887.31)
3%	158.45 (221.83)	316.90 (443.65)	475.34 (665.48)	633.79 (887.31)	792.24 (1,109.14)	950.78 (1,331.10)
4%	211.30 (295.81)	422.59 (591.63)	633.79 (887.31)	845.09 (1,183.12)	1,056.38 (1,478.94)	1,267.68 (1,774.75)
5%	264.05 (369.67)	528.19 (739.47)	792.24 (1,109.14)	1,056.38 (1,478.94)	1,320.43 (1,848.60)	1,584.58 (2,218.41)
6%	316.90 (443.65)	633.79 (887.31)	950.78 (1,331.10)	1,267.68 (1,774.75)	1,584.58 (2,218.41)	1,901.47 (2,662.06)
7%	369.74 (517.64)	739.49 (1,035.28)	1,109.23 (1,552.92)	1,478.98 (2,070.57)	1,848.62 (2,588.07)	2,218.37 (3,105.71)
8%	422.59 (591.63)	845.09 (1,183.12)	1,267.68 (1,774.75)	1,690.18 (2,366.25)	2,112.77 (2,957.87)	2,535.36 (3,549.50)
9%	475.34 (665.48)	950.78 (1,331.10)	1,426.13 (1,996.58)	1,901.47 (2,662.06)	2,376.82 (3,327.54)	2,852.26 (3,993.16)
10%	528.19 (739.47)	1,056.38 (1,478.94)	1,584.58 (2,218.41)	2,112.77 (2,957.87)	2,640.96 (3,697.34)	3,169.15 (4,436.81)

Discussion

Diabetes is an expensive chronic disease whose financial burden is ever increasing as the prevalence of the disease

increase. The costs of hospitalization of diabetes are major part of the direct medical costs varying in different countries. The present study was conducted with the purpose of investigating the hospitalization costs of diabetes from individual patient and insurance organizations as well as the providers' perspective and health system in Iran.

Our pre-specified scenario in the study was a 4% prevalence of diabetes presuming that diabetes raises the chance hospitalization by 3 times. In this case, 884,591 diabetic patients were hospitalized in 2009. The average cost of treatment was US\$519 for Type 1 diabetic patients, US\$870 for Type 2 patients, and US\$645 for patients with unspecified Type of diabetes. The lower cost of Type 1 diabetes might be due to the fact that Type 1 patients consulted the hospitals for the diabetes itself rather than for its complications and or they were not of such an old age which allows them to be hospitalized and treated for such expensive complications as cardiovascular or amputation of limbs. Due to the lack of supportive evidences, the explanation of low average cost of treatment of Type 1 diabetes, who account for 12% of the total hospitalized patients, was impossible. On the other hand, type of the diabetes in 49% of cases was unknown indicating that physicians do not provide comprehensive clinical information required for accurate coding and or staff working in the medical documentation center are unskilled or lack motivation for accurate coding. This highlights government order for accurate records of patients' clinical information either by clinicians or coding staff in Iran's hospitals. For all these reasons, the analysis focused on the total average cost of hospitalization of all diabetic patients.

The hospitalization costs of diabetic patients, where the prevalence of diabetes was about 4% and the hospitalization event rate for diabetes was 3 times more than the total population, amounted to US\$633.79 million for the purchasers and US\$887.31 for the providers, in 2009. This indicates that the total cost of hospitalization of diabetes is almost 3.2% - 4.4% of the total health care expenditure in Iran, in 2009. Due to excess hospitalization incurred by diabetes, the cost of hospitalization will be significantly increased if the prevalence of diabetes rises to 9.8%, as anticipated by IDF for Iran of 2030.

According to the study conducted by Esteghamati et al. (2009), hospitalization consists 28.6% of the total direct diabetes costs in Tehran-Iran, in 2004 [20]. The hospital costs account for 50% of the total direct medical cost of diabetic patients in the United States [21], 35% in India [28] and 55% in Europe [29]. In our prespecified scenario, if hospitalization consumes almost a third of the total direct medical cost of diabetes, the total direct medical costs of diabetes would be US\$1901.37 million from the purchasers and US\$2661.93 million from the providers' perspective. This is about 9.50 to 13.30 percent of the total spending on the health care system in Iran, in 2009. In 2010, it is anticipated that 12% of the global health expenditures or US\$1330 per person consumed by diabetes varying by region, age group, gender, and country's income level [30].

The burden of diabetes hospitalization, in this study, was calculated using the cost information provided on hospital inpatients bills which are based on the public hospital national tariff. The hospital national tariff, in Iran, does not reflect the actual cost of production in hospitals. The government of Iran provide subsidy to the public hospitals so that the actual costs of inpatients treated in the hospitals, at the best, are at least %40 higher than the costs reflected on the inpatients' bills. In addition, certain medical equipments procured by the patients themselves were not reflected in the patients invoice. The study findings were based on the information collected from the public hospitals where the average cost of treatment, from the purchasers' perspective, is less than the private one that cover 10 to 20 percent of the total hospital services. All this evidences support the idea that hospitalization costs of diabetes, in Iran, would be higher than that of reported in this study.

Diabetes and its complications have a significant economic impact on individuals, families, insurers, health systems and societies. The prevalence of diabetes, the rate of hospitalization, and the average costs of treatment of diabetic

patients are important factors influencing diabetes economic burden. In order to control the financial burden of diabetes, adopting a multi-sectoral approach and oriented national surveillance of diabetes are an urgent priority.

Conflict of interests: The authors declare no conflict of interest.

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