



## The Direct Medical Costs of Outpatient Cares of Type 2 Diabetes in Iran: A Retrospective Study

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### ABSTRACT

**Background:** Diabetes mellitus is a chronic disease which many factors are involved and is developing considerably worldwide. Increasing aging population and obesity in the societies has improved the scale of the type 2 diabetes significantly. The aim of this study was to determine the direct medical costs of outpatient cares of diabetes in Iran.

**Methods:** Active patients of Isfahan Endocrinology and Metabolism Research Center (IEMRC) by the end of March 2011 were employed for data extraction. Type 2 diabetics were classified into 4 groups based on their therapeutic regimens. Type and frequency of health care services were extracted from the patients' profiles manually. The incidence of major diabetes complications were also examined from the subjects' profiles. The numbers of services used by the patients in different treatment groups were multiplied by the desired medical tariffs to calculate the direct medical costs.

**Results:** 2898 number of cases was reviewed in this study; 63.8 % women and 36.2% men. 4.3% of the patients were placed group I; 50.1% in group II, and 34.6% and 11% in groups III and IV respectively. The age distribution of the patients varied widely from 30 to 90 years; 5.8% between 30 and 39 years, 62.3% between 40 and 59, and 31.9% at 60 and over. Nephropathy (72.4%), and neuropathy (39%) were the most frequent adverse effect between the type 2 diabetics in Isfahan. The group III with spending \$192.3 in total was absorbed the highest amount of the resources between the patients' groups. The average direct medical cost of outpatient cares of diabetics per year was 155.8 US \$.

**Conclusions:** The direct medical cost of diabetes management is progressed sharply in past years in Iran. Pharmaceutical expenditures was the main cost component of outpatient cares for diabetes. It is estimated that the Iranians directly spend approximately \$4.05 milliard annually to manage 5.2 million diabetics in the country.

**Key words:** Diabetes complications, direct medical costs, Iran, type 2 diabetes

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### INTRODUCTION

Diabetes mellitus is a chronic disease, which involve many factors,<sup>[1]</sup> and is considerably developing worldwide.<sup>[2]</sup> It is stated that increasing aging population and obesity in the societies has improved the scale of type 2 diabetes significantly.<sup>[3-5]</sup> While the prevalence of

this type of diabetes in Africa is varying between %1.7 (in Uganda) and %4.5 (in South Africa), in Europe and North America is varied between %4.9 (in the UK) and %14.4 (in Portugal). Likewise, the prevalence of type 2 diabetes in Asia is deviated between %2.8 (in Myanmar) and %11.5 (in Sri Lanka), and in middle-east it is varied from %3.0 (in Yemen) to %16.8 (in Saudi Arabia).<sup>[5]</sup> In 2013, the number of diabetic people worldwide was estimated to be 382 million and is expected to increase to 592 million by 2035.<sup>[5]</sup> The average prevalence of diabetes between Iranians was %7.9 in 2010, but the distribution of this prevalence in Iran is also diverged widely between 1.3 and %14.5 in various provinces.<sup>[6]</sup> The structure of Iranian population shows that more than %45 of the Iranian population (more than 34 million) are now over 30.<sup>[7]</sup> And at the risk of getting diabetes type 2 diabetes.

Diabetes mellitus has been imposing a high economic burden to individuals, families, health systems, and societies. It is estimated that direct medical costs of diabetes are 2–3 times higher than nondiabetic people.<sup>[8]</sup> These additional costs are mainly attributed to the fact that diabetics are at high risk for blindness (retinopathy), kidney failures (nephropathy), neuropathy, foot ulcer and amputations, and disorder in sexual function.<sup>[9]</sup> It is stated that considerable amount of economic burden of diabetes is derived from indirect costs originated from the loss of productivity and premature mortality.<sup>[10]</sup> Diabetes related health expenditure per person is varied from \$23 USD in Somalia (low-income country) to \$11144 USD in Norway.<sup>[5]</sup> This expenditure for low- and middle-income countries is reported from \$56 USD in Pakistan to \$801 USD in Tuvalu.<sup>[5]</sup> Thus, it is important to evaluate the cost of diabetes in Iran.

This study is a cost analysis study which encompass a systematic collection and assessment of costs related to an intervention, or a specific condition, or disease. Nevertheless, because of unavailability of a comprehensive database for evaluating the full economic burden of diabetes, the aim of this study was to evaluate the direct medical costs of outpatient cares of type 2 diabetes in Iran.

## METHODS

To calculate the direct therapeutic costs of outpatient cares in noninsulin-dependent diabetes mellitus or type 2 diabetes, it is necessary to undertake 4 steps: Identify resource consumption, measuring resource consumption, valuation of resource units, and calculating total costs of the intervention options.<sup>[11-13]</sup>

The medical records of all patients, who were registered in Isfahan Endocrine and Metabolism Research Center (IEMRC), were used to identify the type and frequency

of resources consumption. Due to the absence of a comprehensive registry system for diabetic patients in Isfahan, it is not possible to determine a precise estimation of the percentage of diabetic patients who were registered in IEMRC. However, considering the prevalence of diabetes in Isfahan, it is reasonable to claim that %0.5 of the diabetic patients were registered in IEMRC. Nonetheless, since this diabetic center is known as one of the oldest diabetic centers in Isfahan, it is sensible to consider this center as a referral diabetic center in Isfahan.

To ensure the reliability of the recorded data, we employed only the profiles of the “active patients” of IEMRC by the end of March 2011 for data extraction. An “active patient” is defined as a patient who had visited the center based on the IEMRC plan by the end of March 2011.

After selecting active patients’ profiles, type 2 diabetics were selected for data extraction. Type 2 diabetes is defined as diabetes with onset after 30 years of age with or without current insulin treatment.<sup>[14]</sup> These patients were classified into four groups based on their therapeutic regimens; these were patients with no medication (group I), patients on oral medication (group II), patients on oral medication and insulin treatment (group III), and patients on insulin treatment (group IV). The therapeutic regimens were extracted from the patients’ profiles. As the stage of the disease are recorded in patients’ profiles, we evaluated the interval time between the dates of the registration of diabetic patients in stage one and the date they are transferred to the next stages, say stage four.

To measure medical services used by the patients’ type and frequency of health care services including number of general practitioners’ visit, specialists’ visits, laboratory tests, kind and number of medicines (such as metformin, glybenclamid, and number of neutral protamine Hagedorn and regular insulin units), and the number of syringes used were extracted from the patients’ profiles manually. In addition to the medical services, the incidence of major diabetes complications including cardiovascular disease, neuropathy, nephropathy, and retinopathy were also extracted from the subjects’ profiles. Nonetheless, as the type and the frequency of health services used to manage these complications were not available in IEMRC, the costs of managing these complications were not calculated. Demographic information including age and sex of the patients were also extracted.

Measuring the unit cost of medical services, the numbers of services used by the patients in different treatment groups were multiplied by the desired public and private medical tariffs. Nevertheless, as the private tariffs can

represent more realistic cost of the services, we analyzed our findings based on the private tariffs. We used Iranian Central Bank exchange rate for converting the value of resources used to the US dollar.

As IEMRC is one of the standard and well-known diabetic centers in Iran, we assumed that the pattern of the type and the amount of diabetic health care utilization across the country are similar with IEMRC. Thus we believe the results are generalizable to the whole country.

## RESULTS

The total active patients of type 2 diabetes registered in IEMRC were 2898 by the end of March 2010; %63.8 female and %36.2 men. Of these, only %4.3 were placed in no medication group (group I); %50.1 in group II, and %34.6 and %11.0 in groups III and IV, respectively. The mean age in men and women was 58 and 56 years, respectively. The results of the age distribution and the incidence of diabetes complications are summarized in Table 1. The average age of the patients in group I was 49.5 years, but, as it was expected, this average was increased to 55.5, 58 and 59.8 years in groups II to IV correspondingly. The results also show that the age distribution of the patients varied widely from 30 to 90 years in Iran; %5.8 between 30 and 39 years, %62.3 between 40 and 59, and %31.9 at 60 and over.

The mean interval time between the dates of the registration of diabetic patients in stage one and the date they are transferred to the next stages showed that the average disease duration for patients in group I was 3.9 years and for the patients in groups II, III, and IV were 8.7, 14.0, and

15.5 years, respectively. However, the mean interval time for transferring from stage 1 to 4 was 11.6 years.

Table 1 illustrates that nephropathy, neuropathy, and retinopathy are, respectively, the most frequent adverse effects between type 2 diabetes in Isfahan. The rate of all kinds of adverse effects in group III was considerably higher than the others.

The results of therapeutic costs of outpatient services for type 2 diabetes in different groups with public and private tariff are summarized in Table 2. This table shows that the group III, with spending \$192.3 in total for their services, was absorbed the highest amount of the resources between the patients' groups. Table 2 also shows that the prices in the private section were sometimes as high as 1.5 times of the public prices. However, other evidences confirm that the gap between private and public prices in inpatient services is expected to be very wider.<sup>[15]</sup>

## DISCUSSION

The aim of this study was to determine the direct medical costs of outpatient cares of diabetes in Iran. The age distribution of the diabetics suggests that the prevalence of diabetes in middle age is very high in Iran when comparing with many Western countries.<sup>[16]</sup> For example, while %62.3 of diabetics in Isfahan were between 40 and 59, the age distribution of type 2 diabetes in the USA showed that the high rate prevalence of diabetics is placed in age 60 and over.<sup>[16]</sup> This age difference implies that both relative direct and indirect costs of diabetes in Iran would be significantly higher than other Western countries.

**Table 1: Age distribution and the incidence of diabetes complications**

Group	Frequency (%)	Age (SD)	Disease duration - year (SD)	Nephropathy (%)	Neuropathy (%)	Retinopathy (%)	Cardiovascular disease (%)	Foot ulcer (%)
1	124 (4.3)	48.18 (9.99)	3.9 (4)	98 (78.4)	31 (24.8)	2 (1.6)	17 (13.6)	-
2	1456 (50.1)	45.5 (9.79)	8.7 (5.7)	1180 (81.0)	514 (35.3)	199 (13.7)	246 (16.9)	4 (0.3)
3	1004 (34.6)	57.1 (10.00)	14.1 (6.5)	643 (64.0)	462 (46.0)	314 (31.2)	187 (18.6)	6 (0.6)
4	314 (11.0)	58.24 (13.59)	15.5 (8.3)	184 (57.7)	126 (39.5)	90 (28.2)	72 (22.6)	1 (0.3)
Total (mean)	2898	55.55 (10.57)	11.1 (7.0)	2105 (72.4)	1133 (39.0)	605 (20.8)	522 (18.0)	11 (0.4)

SD=Standard deviation

**Table 2: The therapeutic costs of outpatient services of type 2 diabetes in different groups with public and private tariff**

Group	Services costs (US \$) (SD)							
	Public tariffs				Private tariffs			
	Laboratory cost	Drug cost	Care cost	Total cost	Laboratory cost	Drug cost	Care cost	Total cost
1	16.1 (7.6)	11.3 (18.8)	9.8 (5.1)	37.2 (23.4)	41.3 (19.6)	11.6 (18.9)	23.0 (12.4)	76.0 (36.9)
2	19.4 (8.9)	52.5 (35.8)	12.9 (5.4)	84.8 (40.2)	49.8 (23.1)	54.2 (35.9)	29.9 (12.8)	133.9 (52.9)
3	22.3 (9.9)	89.7 (40.2)	24.1 (7.8)	136.1 (46.2)	57.1 (25.6)	91.8 (40.4)	43.4 (15.8)	192.3 (60.6)
4	20.9 (11.3)	74.3 (46.9)	24.4 (7.5)	119.7 (55.6)	53.6 (28.9)	76.3 (47.2)	41.6 (16.4)	171.5 (73.5)
Total (mean)	20.4 (9.7)	65.9 (43.3)	17.9 (8.7)	104.3 (51.6)	52.4 (24.9)	67.8 (43.7)	35.6 (15.9)	155.8 (65.7)

SD=Standard deviation

In addition to the age distribution, the noteworthy finding to be considered in managing diabetes was the transition interval of the patients between different patient groups (groups I to IV). This transition interval showed the duration which patients remained in their groups, instead of transferring to the next group. This interval time could show how effective the diabetics are managing their disease.<sup>[14]</sup> Our findings show that this time was 4.8 years for patients in group 1 and 5.4 and 1.4 years for groups 2 and 3, respectively. This means that on average it took 11.6 years for an Iranian diabetic to be transferred from group 1 to group 4.

The results [Table 2] shows the average direct therapeutic costs for a diabetic woman in group I in Iran was US \$74.8 versus US \$78.7 for a diabetic man in the same group (%5.0 less). However, a study in 2003 in America showed that the total direct costs of therapeutic regimen for a diabetic woman were almost %24 higher than a diabetic man.<sup>[14]</sup>

Table 2 also illustrates that the average total therapeutic cost per patients with diabetes in 2010 with a private tariff was equal to \$156 which is 2.62 times greater than the total therapeutic cost of diabetes in 2000 in Iran.<sup>[17]</sup> However, if considering the local currency, the fact was that this cost has increased from 104,568 Iranian Rials (IR) to 1,531,928 IR, which confirms that the outpatient therapeutic cost of diabetes in Iran has enlarged 14.6 times during the past 10 years. The changes in monetary policy of the Iranian government after 2000 is one of the main reasons which could explain why there is a big difference between the amount of the growth rate in terms of IR comparing with \$US.<sup>[18]</sup>

This study showed that the main cost component for outpatient diabetics' care in both public and private has been medication costs. This is compatible also with what happened to the cost component of diabetics care in 2000 in Iran.<sup>[17]</sup> However, while the second largest part of diabetics cost was the cost of laboratories in 2010, it was the third largest part of diabetics' cost in 2000.<sup>[17]</sup> This could verify that the price of laboratory services has increased faster than the price of physicians' visits in the past 10 years.

According to the Iranian Central Bank database, inflation rate in Iran varied between 10.8 and 20.1 during the years 2000 to 2010. Considering the national currency, it is obvious that the growth rate of the outpatient therapeutic cost of diabetes has risen more than the inflation rate.<sup>[18]</sup>

Considering the structure of Iranian population<sup>[7]</sup> and the prevalence of diabetes in Iran,<sup>[5]</sup> it is estimated that around 5.2 million of Iranians are suffering from type 2 diabetes. Therefore, the total cost of outpatient services for type 2 diabetes in the Iran is estimated to be around \$810 million annually. It is important to note that the direct medical cost of managing diabetes complications

could be 2.9–5 times greater than the outpatient therapeutic cost of diabetes.<sup>[14,19]</sup> This is particularly important when considering that the prevalence of diabetes complications in Iran is very high [Table 1]. This could, therefore, suggest that the Iranians may directly spend between \$2.35 and \$4.05 milliard annually to manage 5.2 million diabetics in Iran. However, as the prevalence of diabetes complications in Iran is very high, the supplementary investigation is necessary to calculate the direct medical cost of diabetes complications as well as the total indirect cost of diabetes in Iran.

### Limitation

There are two main limitations in this study which deserve consideration. The first was that the secondary health care services for managing diabetes complications were not available in IEMRC and thus it was impossible to calculate these costs. The second limitation was that we did not have access to similar databases from other cities in Iran and therefore the generalization of the results should be taken cautiously.

## CONCLUSIONS

The findings of this study highlight that the outpatient therapeutic cost of diabetes in Iran has enlarged 14.6 times during the past 10 years, which is much more than the inflation rate in Iran. However, pharmaceuticals have remained the main cost component of outpatient therapeutic cost of these patients. The age distribution of type 2 diabetes in IEMRC shows that diabetics in Isfahan (and more likely in Iran) are considerably younger than diabetics in Western countries. It is estimated that the total costs of outpatient services for type 2 diabetes in the Iran is around \$810 million annually. This implies that the Iranians directly spend nearly \$4.05 milliard annually to manage 5.2 million diabetics in Iran.

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