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

INTRODUCTION

Diabetes mellitus is a chronic disease, which involve many factors, and is considerably developing worldwide. It is stated that increasing aging population and obesity in the societies has improved the scale of type 2 diabetes significantly. 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 
which 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).\(^5\) 
In 2013, the number of diabetic people worldwide was 
estimated to be 382 million and is expected to increase 
to 592 million by 2035.\(^5\) 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.\(^6\) 
The structure of Iranian population shows that more 
than \%45 of the Iranian population (more than 34 
million) are nor over 30.\(^7\) 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.\(^8\) 
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.\(^9\) 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.\(^10\) 
Diabetes related health expenditure per person is varied 
from $23 USD in Somalia (low-income country) to 
$11144 USD in Norway.\(^9\) This expenditure for low-
and middle-income countries is reported from $56 USD in 
Pakistan to $801 USD in Tuvalu.\(^9\) 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.\(^11-19\)

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.\(^14\) 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 
time interval 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 while 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 the public prices. However, other evidences confirm that the gap between private and public prices in inpatient services is expected to be very wider.[15]

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.[16] 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.[16] 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

<table>
<thead>
<tr>
<th>Group</th>
<th>Frequency (%)</th>
<th>Age (SD)</th>
<th>Disease duration - year (SD)</th>
<th>Nephropathy (%)</th>
<th>Neuropathy (%)</th>
<th>Retinopathy (%)</th>
<th>Cardiovascular disease (%)</th>
<th>Foot ulcer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>124 (4.3)</td>
<td>48.18 (9.99)</td>
<td>3.9 (4)</td>
<td>98 (78.4)</td>
<td>31 (24.8)</td>
<td>2 (1.6)</td>
<td>17 (13.6)</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>1456 (60.1)</td>
<td>45.5 (9.79)</td>
<td>8.7 (5.7)</td>
<td>1180 (81.0)</td>
<td>514 (35.3)</td>
<td>199 (13.7)</td>
<td>246 (18.9)</td>
<td>4 (0.3)</td>
</tr>
<tr>
<td>3</td>
<td>1004 (34.6)</td>
<td>57.1 (10.00)</td>
<td>14.1 (6.5)</td>
<td>643 (64.0)</td>
<td>462 (46.0)</td>
<td>314 (31.2)</td>
<td>187 (18.6)</td>
<td>6 (0.6)</td>
</tr>
<tr>
<td>4</td>
<td>314 (11.0)</td>
<td>58.24 (13.59)</td>
<td>15.5 (8.3)</td>
<td>184 (57.7)</td>
<td>126 (39.5)</td>
<td>90 (28.2)</td>
<td>72 (22.6)</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Total (mean)</td>
<td>2898</td>
<td>55.55 (10.57)</td>
<td>11.1 (7.0)</td>
<td>2105 (72.4)</td>
<td>1133 (39.0)</td>
<td>605 (20.8)</td>
<td>522 (18.0)</td>
<td>11 (0.4)</td>
</tr>
</tbody>
</table>

SD=Standard deviation

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

<table>
<thead>
<tr>
<th>Group</th>
<th>Public tariffs</th>
<th>Services costs (US $) (SD)</th>
<th>Private tariffs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory cost</td>
<td>Drug cost</td>
<td>Care cost</td>
</tr>
<tr>
<td>1</td>
<td>16.1 (7.6)</td>
<td>11.3 (18.8)</td>
<td>9.8 (5.1)</td>
</tr>
<tr>
<td>2</td>
<td>19.4 (8.9)</td>
<td>52.5 (35.8)</td>
<td>12.9 (5.4)</td>
</tr>
<tr>
<td>3</td>
<td>22.3 (9.9)</td>
<td>89.7 (40.2)</td>
<td>24.1 (7.8)</td>
</tr>
<tr>
<td>4</td>
<td>20.9 (11.3)</td>
<td>74.3 (46.9)</td>
<td>24.4 (7.5)</td>
</tr>
<tr>
<td>Total (mean)</td>
<td>20.4 (9.7)</td>
<td>65.9 (43.3)</td>
<td>17.9 (8.7)</td>
</tr>
</tbody>
</table>

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 group, instead of transferring to the next group. This interval time could show how effective the diabetics are managing their disease.[14] 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 1 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.[14]

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.[17] 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.[18]

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.[17] 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.[17] 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.[18]

Considering the structure of Iranian population[17] and the prevalence of diabetes in Iran,[5] 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.[14,19] 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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**REFERENCES**

7. Statistical Center of Iran, Demographic Indicators. Available from: http://www.amar.org.ir. [Last accessed on 2014 Jun 06].

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