Private Diabetes Care Delivery in Iran, is it Cost-Effective?

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Abstract

Background

The quality of health care provided to diabetic patients has a significant impact on long-term costs and health outcomes. This study aims to determine the long-term cost-effectiveness analysis between private and public Diabetic Centers in Iran.

Methods

Using the localized UKPDS model, we performed a cost-effectiveness analysis to forecast 20 years quality-adjusted life expectancy (QALE) gains and direct medical costs(management of complications and Treatment Costs) in under-treatment patients referred to private and public Diabetic Centers in Iran. Costs and utility decrements derived from 1978 patients with type 2 diabetes from 7 private and eight Public diabetes centers in 5 provinces. We used statistical techniques (internal loops (Monte-Carlo trials) and bootstraps) to examine the robustness of the results.

Results

In a 20-year time horizon, the private sector will be more effective and more costly(5.17 vs 4.95 QALE and 15385 vs 8092). The incremental cost-effectiveness ratio (ICER) was $33,148.02 per QALE gained that was higher than our country threshold.

Conclusion

Although the pattern and quality of care in private-sector diabetes centers resulted in a slight increase in the life expectancy of T2DM patients, it is associated with unfavorable costs too.

Introduction:

Diabetes mellitus (DM) is a significant public health issue worldwide. The prevalence of type 2 diabetes in Iran was 11.4% in the adult population in 2011, with a growth rate of 35% during 2005–2011 (1). This significant increase in diabetes prevalence reflects that Iran has a high diabetes burden, especially when considering the impact of complications related to diabetes (2–4). Diabetes complications have a negative impact on the quality of life (QoL), and their management is a significant source of medical costs in people with diabetes (5). Many diabetes complications can be prevented or delayed with optimal medical care. Thus, health care providers could play a critical role in improving the quality of care delivered to diabetic patients (6). Several studies have identified significant gaps between private and public sectors in their costs and quality of care (8–11). This study aimed to analyze the costs and outcomes of diabetes care in public and private diabetes centers in Iran, which may also have lessons for other developing countries.

Methods:

Study design

We performed a patient-level cost-effectiveness analysis of diabetes care in private versus public diabetes centers using the localized United Kingdom Prospective Diabetes Study (UKPDS) outcomes model. The UKPDS Model is a microsimulation model that uses patient's baseline characteristics such as clinical data to predict four essential health economics outcomes (including life expectancy, quality-adjusted Life expectancy (QALE), costs of therapies, and costs of complications).

Our data obtained from seven private and eight public diabetes canter in 5 provinces in Iran**(Tehran, Isfahan, Yazd, Mazandaran, and Kurdistan).** We had some reason to choose cities, Tehran and Isfahan are two metropolises (23 percent of the total population of Iran lived in these two provinces in 2016) and also have better access to specialized health services compared to other provinces. Yazd has the highest prevalence of diabetes (16.3 percent) among all provinces (31 provinces), the family physician program had been run in Mazandaran, and Kurdistan was one of the most deprived provinces in terms of access to care. The total number of 1978 patients included in the study. The Clinical information, including baseline characteristics, risk factor values (13 main variables), and the history of previous events, were extracted from the patient's profiles.

Using the UKPDS outcomes model, we performed a patient-level modeling analysis for 20 years. In order to cope with the first and second-order uncertainty, statistical techniques including internal loops (Monte-Carlo trials) and bootstraps applied in the UKPDS.

Costs

We analyzed only direct health care costs from a patient perspective. These costs covered the prescription drugs, visits, paraclinical tests, and annual costs associated with managing diabetes-related complications. The patient’s medical records used to generate health care utilization data and a micro-costing approach carried out in order to collect our needed cost information(Table 1). The costs of private-sector care are calculated based on private sector tariffs. All costs were calculated based on the 2016 U.S. dollar value.

Table 1
Modelled management costs and utility decrements

Year	1			≥ 2	
Condition	Annual cost (US$)	Annual cost (US$)	Utility decrement	Annual cost (US$)	Utility decrement
	Acute	Not acute			
Ischemic artery disease	616.87	1280.15	-0.010	338.81	0.000
Myocardial infarction	2018.98	2609.39	-0.148	527.14	-0.060
Heart failure	0.00	2577.25	-0.071	1288.63	-0.185
Stroke	743.07	1650.99	-0.165	430.44	-0.165
Amputation	0.00	1363.57	-0.200	368.53	-0.172
Blindness	0.00	434.91	0.131	144.97	-0.103
End-stage renal disease	0.00	2886.87	-0.330	1934.49	-0.330
Diabetic wound	0.00	907.31	-0.200	193.04	-0.210

Outcomes

In our perspective, the primary outcome measure was Quality-Adjusted Life Expectancy (QALE). QALE is the remaining number of Quality-Adjusted life-Years (QALYs) at a certain age. It has calculated from age-specific mortality rates and average Health-related Quality of Life (HrQoL) (12, 13). We use the EQ-5D-3L questionnaire to measure HRQOL. The EuroQol Group has developed the EQ-5D-3L questionnaire as a simple, preference-based measure of HrQoL (Health-related Quality of Life) (14, 15). We use a disutility approach(Table 1). Direct medical costs (consist of costs of therapies and costs of complications), life expectancy, and QALE were estimated over 20 years using the UKPDS Outcome model.

Results

Population

The characteristics of 1978 patients with type 2 diabetes who referral to private and public diabetes centers shown in Table 2.

Table 2
Demographic characteristic of patients with type 2 diabetes (N = 1978)

Sector		Private	Public
Female (percent)		56	51
mean diabetic age (years)		15.84	14.34
Average age (years)		62.85	63.45
Body Mass Index (percent)	< 18.5 kg/m^2	2	1
	18.5–24.9 kg/m^2	19	19
	25.0–29.9 kg/m^2	43	40
	≥ 30 kg/m^2	36	40
Age (percent)	< 45	05	10
	45–65	65	55
	> 65	30	35

56% of the patients were female, and patients' mean diabetes age was 15.8 and 14.3 years for women and men, respectively. 43% and 36% of the patients were overweight and obese, respectively. 65% of women and 55% of men were in the age group of 45–65 years.

Predicted Costs of management and treatment

Table 3 shows the costs associated with managing diabetes-related complications during the prediction period (20 Years).

Table 3
Average costs for T2DM patients (20-year prediction), N = 1978

Cost components	Treatment Costs (US$)	Managing complications (US$)	Total cost (US$)
Private sector	2557.55	12827.78	15385.33
Public sector	1861.76	6231.01	8092.76
Total (private and public)	2209.65	9529.39	11739.05

The average treatment cost was $2,209.65. This amount is $2,557.55 and $1,861.76 per patient treated in the private and public sectors, respectively. The average cost of managing complications was $9,529.39. This amount is $12,827.78 and $6,231.01 per patient in the private and public sectors, respectively. The

average total cost was $11,739.05. This amount is $15,385.33 and $8,092.76 per patient in the private and public sectors, respectively.

Predicted outcomes

Table 4 shows the mean life expectancy and QALE during the prediction period (20 Years).

Table 4
Average clinical outcomes for T2DM patients (20-year prediction), N = 1978

outcome	Life expectancy	QALE
Private sector	6.99	5.17
Public sector	6.77	4.95
Total (private and public)	6.88	5.06

The average life expectancy gains were 6.88 years. It was 6.99 and 6.77 in the private and public sectors, respectively. The average QALE was 5.06 years. It was 5.17 and 4.95 in the private and public sectors, respectively.

Base case analysis

The results of the cost-effectiveness of private versus public-sector care in patients with type 2 diabetes from the patient perspective has shown in Table 5. In a 20-year time horizon, the difference between QALE gains and direct medical cost is 0.22 years and 7,292.56 $ in private and public diabetes centers, respectively.

Table 5
Base-case analysis per 1978 patients: Costs, Outcomes, and ICER of private sector compared with public sector diabetes care

	Private sector	Public sector	Difference
Life expectancy	6.99	6.77	0.22
QALE	5.17	4.95	0.22
Treatment costs (US$)	2557.55	1861.76	695.79
Costs of managing complications (US$)	12827.78	6231.01	6596.77
Total costs (US$)	15385.33	8092.76	7292.56
ICER			33148.02

The incremental cost-effectiveness ratio (ICER) was $33,148.02 per QALE gained. Since the pattern of care in private-sector diabetes centers leads to higher cost, In order to make decisions about two

strategies, ICER was compared with a threshold. The country's threshold is 3-times the country's GDP per capita ($5,417) equal to $16,251. Since the ICER was higher than the country's threshold, the pattern of care in private-sector diabetes centers is not a cost-effective strategy.

Discussion

The focus of this economic evaluation has been to predict long-term (20 years) costs and effects of private and public sector diabetes centers in the Iranian health care setting from a patient perspective. This is the first study to evaluate the cost-effectiveness of private-sector diabetes care, to the best of our knowledge. The results showed that the private sector diabetes care is associated with higher life expectancy when compared to the public sector (0.22 QALE gained) and higher direct medical costs ($7,292.56 cost increase). Calculated ICER ($33,148.02 per QALE gained), which is much higher than the country threshold, indicated that the private sector diabetes centers are not cost-effective strategies in the Iranian health care setting.

T2DM is one of the leading causes of morbidity and mortality in Iran and consumes about 8.7% of total health expenditure (16, 17). Hospital-inpatient care (mostly due to complications of diabetes) comprises the largest share of diabetes direct medical costs (18, 19). Our results showed that the average annual direct cost of diabetes treatment in the private sector is about two times higher than of the public sector ($15,385.33 versus $8,092.76). A study conducted with Iranian patients in 2011 found that the cost of inpatient services of T2DM in the private sector is 1.5 times higher than of the public sector (20). Other pieces of evidence confirm that this gap is expected to be exceedingly extensive (21).

Also, it is expectable that the public and private sectors were different in the quality of care provided. The quality of medical services and patient outcomes influenced by various(internal and external) factors such as resource availability, patient engagement, and provider collaboration. Public hospital diabetes clinics are often overcrowded, leading to prolonged waiting times and reduced face-to-face communication time between patient and physician (22). The limited-time available to each patient frequently translates into a simplistic laboratory test-prescription exchange and leaves other humanistic aspects of effective diabetes treatment unaddressed. (e.g., patient education, individualized treatment and self-management of diabetes) (23). The results of this study showed that the average life expectancy and QALE for 20 years in the private sector are higher than the public sector (0.22 life expectancy and QALE gained), but this difference is minimal. This slight difference in effectiveness could be explained by the fact that patients with acute severe and chronic morbidity are more likely to receive private-sector care (24, 25). Although no study to date has comparatively evaluated the quality of diabetes management by the private sector versus the public sector in Iran, evidence elsewhere indicates that, contrary to expectations, HrQoL and quality of care found to be similar across the two settings, especially as regards T2DM-related complications (8).

Our study has some limitations—first, the clinical evidence available limits the cost-effectiveness results (26). Second, our sample size due to the lack of access to all diabetes centers in Iran is relatively small,

which reduces the generalizability of the results. Finally, the UKPDS model does not explicitly include several diabetes-related morbidities (e.g., peripheral neuropathy); as a result, the use of the UKPDS model may result in the slightly overestimated ICER (27).

Conclusion

We found that diabetes care in private diabetes centers is associated with a slight increase in the life expectancy of T2DM patients. However, the pattern of care in private diabetes centers is associated with the high cost and then is not cost-effectiveness estimates and is unlikely to represent an efficient use of scarce health care resources.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the Ethics Committee (IR.TUMS.PSRC.REC.1396.1991) at Tehran University of Medical Sciences

Consent for publication

Available from the corresponding author on reasonable request

Availability of data and materials

Extra data is available by email to the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

All authors read and approved the final manuscript

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