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Original Article

Public Health Section

Economic Analysis of Type-2 Diabetes Mellitus in Vietnam: A Retrospective Study at a District Hospital, Ba Ria-Vung Tau Province

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ABSTRACT

Introduction: In Vietnam, despite the major health concerns of type-2 Diabetes Mellitus (T2DM), comprehensive information on its economic costs is lacking.

Aim: To evaluate the economic burden caused by diabetic patients in a district hospital in Vietnam from 2014 to 2016.

Materials and Methods: This retrospective study was conducted from January to June 2017, where the data of 1,841 patients, from 2014 to 2016, were extracted from the records of Dat Do Medical Centre. The study included patients diagnosed with a minimum of explicit diabetic symptoms or prescribed blood glucose lowering medications at a minimal time of one registered outpatient visit and for whom information about hospitalisation without complications was available. Cost components included the costs of operations, pharmaceuticals, diagnostics, hospital beds and health care services.

Results: The studied cohort included 582, 670 and 589 patients, in 2014, 2015 and 2016, respectively. The average age range was 59.6±11.2 years. Of the 1,814 patients, 71.8% were females. The economic burden of diabetes was estimated as 26,890; 22,960 and 16,744 USD in 2014, 2015 and 2016, respectively. A comparison based on the ratio of the yearly costs indicated that pharmaceutical costs accounted for the highest percentage (78.9%, 2014–2016). A comparison of the costs of illness per case indicated that the greatest average cost was incurred by the group of patients aged over 69 years, at 40.9±43 USD.

Conclusion: Diabetes places a considerable and rising economic burden in Vietnam. Consequently, the findings of this study may form a foundation for the future formulation of investment plans and fund allocations for the appropriate resolution of type-2 diabetes mellitus.

Keywords: District hospital, Economic burden, Treatment cost

INTRODUCTION

Diabetes Mellitus (DM) is a chronic disease which promotes more outpatient visits, more medication use, a greater risk of hospitalisation and a higher tendency to demand emergency and long term care by those afflicted with this disease [1]. The percentage of the population with diagnosed diabetes continues to rise. According to World Health Organisation (WHO), 422 million adults were diagnosed with diabetes in 2014, which represents almost a quadrupling compared to the statistics of 108 million in 1980. In many countries, diabetes and its complications are major causes of death (1.5 million deaths in 2012). Higher-than-optimal blood glucose added a further 2.2 million more deaths due to cardiovascular and other diseases [2].

Globally, 77% diabetic patients live in developing countries [3]. For instance, according to the WHO global report in 2016, Africa had an estimated 19.8 million adults with DM. In Europe, the number of people with T2DM is estimated at 56.3 million, whereas in Southeast Asia, an estimated 72.1 million people have diabetes [4]. The International Diabetes Federation (IDF) Seventh Edition 2015 puts the number of T2DM patients at 109.6 millionin China and 40.4 million more in India. Vietnam has an estimated 5 million adults living with T2DM [5].

Diabetes imposes a large economic burden on the global healthcare system and the wider global economy. Seuring T et al., estimated that the direct annual cost of T2DM to the world was more than 827 billion USD in 2011 [6]. Huang Y et al., described an increasing trend in total medical costs, from 2,383 to 2,780 USD, for diabetic patients in a sample city in China from 2009 to 2011 (USD are corrected for the exchange rate for each year) [7].

In Vietnam, diabetes-related treatment cost has been an underexplored area. The present retrospective study was undertaken to explore the direct medical costs of T2DM episodes at a district hospital in Ba Ria-Vung Tau Province from 2014 to 2016. The improved understanding of the economic cost of diabetes and its major determinants provided by this study will help to inform policy makers and to motivate decisions to reduce diabetes prevalence and burden.

MATERIALS AND METHODS

Study Design

This was a retrospective, cross-sectional descriptive study conducted at Dat Do Medicine Centre, Ba Ria Vung Tau province, in southern Vietnam. It involved T2DM patients who presented at the hospital between 2014 and 2016. The cost analysis process had five steps:

1) Designing the study. This involves identifying the objective, definition, and scope of the illness, clarifying the approach (whether the focus is on prevalence or incidence), defining the time horizon and perspective, and identifying which type of treatment or health service to examine;

2) Defining the services and resources that correspond to the study design;

3) Measuring the quantity of each component of services and resources to be used;

4) Converting the services and resources to a monetary value;

5) Calculating total costs, costs by component, and unit costs, taking into account the various factors that affect the cost [8].

Study Population

Patients (N=1,841) with a primary discharge diagnosis of T2DM between January 2014 and December 2016 according to the

International Classification of Diseases Codes-10 (ICD-10) with E11 code were included in the study [2].

Data Collection

The present study adopted a prevalence-based approach as it is more amenable to taking more accurate estimations and it assures the present economic burden of a disease rather than a projected burden [4,9].

Data were extracted for each year from the electronic database of Dat Do Medicine Centre. The dataset contained the demographic characteristics of the patient, including each patient's Internal Identification (ID) (which can be tracked during different years), gender and age, visit type (outpatient visit or hospitalisation), visit serial number, date of visit, level of institution, length of stay, diagnosis (E11), insurance and costs. This study included information from patients without complications (e.g., hypertension, dyslipidemia, kidney diseases, neuropathy, retinopathy).

Direct medical costs in this study included the costs of operations, pharmaceuticals, physician consultations, image techniques, hospital beds and health care services. Data on the demographic characteristics of the patient, resource utilisation, cost per component and total cost of the illness were summarised using descriptive statistical analysis.

The direct medical costs associated with health care provision (diagnostic tests and treatment) per patient were analysed. The electronic database of Dat Do Medicine Centre was searched to obtain data on overall medical costs. The overall expenses for all outpatient visits and hospitalisation were noted in the insurance database for a given year for chosen patients and were also keyed into the total medical cost. The report used US dollars for all mentioned costs at the exchange rate in 2017 (1 USD = 22,339 VND) [10] in order to facilitate the comparison between the results and those of other studies.

Ethics in Research

The research protocol followed the guidelines of the biomedical research ethics of Dat Do Medicine Centre (HDDD 03/2016/TB-NCKH). As this study utilised medical record data, with neither patient contact nor collection of personal data, the Dat Do Medicine Centre waived the need for documented consent from the patients.

STATISTICAL ANALYSIS

This study used descriptive statistical methods that presented the total number, number of missing values, minimum, median, maximum, mean and Standard Deviation (SD). Demographics of the included patients were checked for logic verification using the Chi-square test. The testing standard was the p-value<0.05 (bilateral) for the univariate analysis. An ANOVA test and other suitable tests for statistics were conducted to compare the considerable disparities in the existing treatment costs in subgroup panels. Statistical significance was considered to be met for a p-value<0.001. All calculations were executed using Microsoft Excel 2013.

RESULTS

Characteristics of the Study Participants

The number of patients fluctuated during the period of 2014-2016, with populations of 582, 670 and 589 persons in 2014, 2015 and 2016, respectively [Table/Fig-1]. Approximately 71.81% of the total number of patients were female. The Chi-square test indicated a non-significant difference between the proportion of male and female patients (χ^2=2.6417, p=0.2669). From 2014 to 2016, patients who underwent inpatient treatment for T2DM were 59.60±11.15 years of age. A high percentage of patients were from 50 to 69 years old. The average number of examinations per year was 4.14±3.86, but this number ranged from 1-20 examinations. In total, 14.83% of the investigated patients were not authorised for health insurance. The number of patients with health insurance were statistically different from those without health insurance (χ^2=106.7477, p<0.05).

Economic Burden of T2DM Patients

During the surveyed years of 2014, 2015 and 2016, the overall cost of illness for T2DM was calculated as 26,890; 22,960 and 16,744 USD respectively. However, the patients' payment accounted for 20% of these costs (operation, pharmaceutical, diagnosis, hospital bed, health care service). During the period 2014-2016, patients paid 20.0% of the total cost, the remain was reimbursed by health insurance.

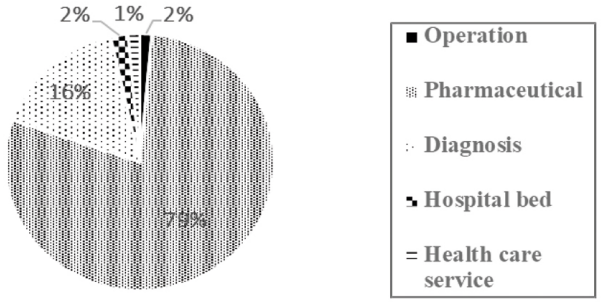
The annual cost per patient fluctuated during the period of 2014-2016; in fact, this cost decreased significantly from 2014 to 2016 (from 46.2 to 28.4 USD, respectively). Considering the specific health-related costs, annual changes in value compared to the overall structure and health care costs were clearly visible. If the

		2014 (n = 582)	2015 (n = 670)	2016 (n = 589)	2014–2016 (N = 1,841)	Chi-square (p-value [a])
Age (years)	Mean±SD	60.15±12.03	59.06±11.02	59.68±10.34	59.60±11.15	17.3186 (0.0270)
	<40	29 (4.98)	29 (4.33)	22 (3.74)	80 (4.35)	
	40-49	67 (11.51)	99 (14.78)	67 (11.38)	233 (12.66)	
	50-59	195 (33.51)	220 (32.84)	189 (32.09)	604 (32.81)	
	60-69	166 (28.52)	209 (31.19)	217 (36.84)	592 (32.16)	
	>69	125 (21.48)	113 (16.87)	94 (15.96)	332 (18.03)	
Gender	Male	177 (30.41)	176 (26.27)	166 (28.18)	519 (28.19)	2.6417 (0.2669)
	Female	405 (69.59)	494 (73.73)	423 (71.82)	1,322 (71.81)	
Health insurance (%)	0	117 (20.10)	108 (16.12)	48 (8.15)	273 (14.83)	106.7477 (<0.05)
	5	57 (9.79)	36 (5.37)	41 (6.96)	134 (7.28)	
	20	380 (65.29)	487 (72.69)	497 (84.38)	1,364 (74.09)	
	30	28 (4.81)	39 (5.82)	3 (0.51)	70 (3.80)	
Number of examinations per year	Mean±SD	4.14±3.79	2.89±2.63	5.57±4.55	4.14±3.86	
	Median	3	2	4	3	
	Range	1.00-20.00	1.00-18.00	1.00-20.00	1.00-20.00	

[Table/Fig-1]: Overview of demographics of the included patients between 2014 and 2016 [(N = 1,841), n (%)].
[a]: Chi-square test; [b]: These number are represented for the percentage of the total cost that is paid by governmental health insurance programme, the remain is co-paid by patients;
SD: Standard Deviation

Cost components	2014 (n=582)	2015 (n=670)	2016 (n=589)	2014–2016 (N=1,841)
Operation	214.7 (0.8)	282.9 (1.2)	420.9 (2.5)	918.5 (1.4)
Pharmaceutical	21,735.5 (80.8)	18,039.5 (78.6)	12,833.6 (76.6)	52,608.5 (78.9)
Diagnostic	4,231 (15.7)	4,055.2 (17.7)	2,554 (15.3)	10,840.1 (16.2)
Hospital bed	326.7 (1.3)	386.2 (1.7)	620.3 (3.7)	1,333.3 (2.1)
Health care service	382.7 (1.4)	196.3 (0.8)	316 (1.9)	895 (1.4)
Total cost	26,890.5 (100)	22,960.1 (100)	16,744.7 (100)	66,595.3 (100)
OOP payment (% of total cost)	5,198.2 (19.3)	4,867.2 (21.2)	3,257.2 (19.5)	13,322.6 (20.0)
Average cost per case	46.2	34.3	28.4	36.2

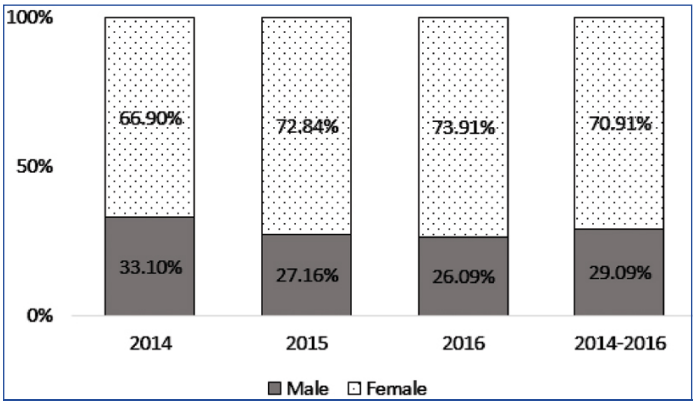
[Table/Fig-2]: Economic burden of T2DM patients from 2014–2016, Dat Do Medicine Centre {USD (%) in 2017}.
Abbreviations: OOP; out-of-pocket (0% of health insurance reimbursement)



[Table/Fig-3]: Economic burden of T2DM patients from 2014–2016, Dat Do Medicine Center (USD, 2017).

comparison is based on the ratio of the yearly costs, pharmaceuticals had a higher rate (78.9%, 2014-2016) [Table/Fig-3]. The cost of pharmaceuticals decreased annually, accounting for 80.8%, 78.6% and 76.6% of total costs in 2014, 2015 and 2016, respectively. The majority of T2DM costs was incurred by females (70.9%, 2014-2016); this percentage slowly increased overtime from 66.9% to 73.9% from 2014 to 2016 [Table/Fig-4].

As displayed in [Table/Fig-5], the mean±SD total cost was highest in 2014 at 46.2±54.7 USD. A comparison of the cost of illness in given age groups (p<0.001) revealed the greatest value of mean±SD cost was



[Table/Fig-4]: Cost of illness by gender between 2014 and 2016 (USD, 2017).

found for the age group above 69 years, at 40.9±43 USD. After using the ANOVA test to adjust the comparison of average costs between five subgroups (age <40, 40-49, 50-59, 60-69 and >69 years), the costs were considerably variable (p<0.001 for 2014-2016). The mean±SD cost did not fluctuate noticeably per year between age groups.

DISCUSSION

The study offered calculations and estimations of the costs of T2DM care in a district hospital, with references and statistics adopted from the hospital electronic medical database. The outcomes displayed a change in the overall medical costs and expenses associated with T2DM for diabetic patients during the survey.

The total money spent on medication during visits for T2DM check-ups decreased from 2014 to 2016, resulting from the tend to generics-branded substitution. This study included people undergoing T2DM inpatient treatment at the hospital with an average age of 59.60±11.15 years, similar to the study by Chatterjee S et al., in Thailand, in which the average age was 59.34±11.40 years [11]. However, these intakes were lower than those reported by Charmaine Shuyu Ng et al., in Singapore, in which the average age was 69.0±9.4 years [12].

During the period of 2014-2016, the group aged 50-59 years had the highest number of patients andaccounted for 32.81% (604 patients) of the patients, which is similar to the study of Javanbakht M et al., in Iran with a percentage of 35.8% (1,611 patients aged from 50 to 59) [13]. The ratio of male/female in this study was about 1/3 (1,322 female patients of the total 1,841). This percentage is vaies with respect to previous reports from Asian countries, such as Singapore (only 55.4%, 277 patients) [12], Iran (56%, 2,520 patients) [13] and Thailand (74.5%, 354 patients) [11].

The statistics in 2015 provided an estimated worldwide average yearly cost of 1,622.1 USD per person spent on curing and managing T2DM [5]. The outcome in the present study gave a value for the average yearly cost per patient of 36.2±42.3 USD (2014-2016). The Singapore study [12] provided an estimated direct medical cost average of 1,575.6 USD for hospital admissions. The average direct cost per capita in Iran was 842.6±102 USD [13]. The average per capita costs of T2DM in Latin America and the Caribbean regions was estimated at 703 USD. Specifically, the intake costs were greatest in Cuba (1,219 USD) and smallest for Colombia (442 USD) in 2000 [14].

When considering the expenses for controlling blood glucose and the various complications caused by T2DM and relevant diseases, medications are the crucial method of treatment [15]. Our results showed an emerging decrease in the percentage due to medication costs during T2DM visits (80.8%, 78.6% and 76.6% from 2014 to 2016 respectively). The percentage costs of T2DM related operations (0.8%; 1.2% and 2.5%) and hospital beds (1.3%; 1.7% and 3.7%) showed an increasing trend. The decrease in medical expenses can be explained. The increased expenses for operations and hospital beds could be the result of serious cases of disease, increased hospitalisation of cases and treatment of affiliated diseases.

LIMITATION

First, despite the fact that complications and associated illness are important factors affecting the cost of treating the disease, only diabetic patients without complications who would benefit

Year	<40	40-49	50-59	60-69	>69	p-value[b]	All ages	p-value[c]
2014	24.2±44.9	30.3±32.1	45.8±59.5	52.6±53.7	52±57.6	0.005	46.2±54.7	<0.001
2015	23.7±26.6	24.4±28.7	37.4±50.9	36.5±33.16	35.3±33	0.04	34.3±39.3	
2016	16±14.3	26±22.5	29.2±31.5	27.9±25.3	32.8±24	0.11	28.43±26.8	
2014-2016	21.8±32.1	26.6±28.1	37.6±49.3	37.9±39	40.9±43	<0.001	36.2±42.3	

[Table/Fig-5]: Mean±SD cost of illness for different ages from 2014–2016 (USD, 2017).
p-value[b]; p-value[c]: Calculated by one way ANOVA test; p-value[b]: Comparison of average cost between five subgroups (<40, 40–49, 50–59, 60–69 and >69 years);p-value[c]: Comparison of average total cost among three years; Abbreviations: SD: Standard Deviation

from the treatment available at health centres were involved in the study. Second, the study used retrospective data from a district hospital, so any trends observed may not successfully reflect the surging economic burden of T2DM in larger sized cities in Vietnam. Third, the study was conducted with references taken from electronic data, and this was believed to be a dependable, accurate and effective information system. However, mistakes are likely to occur during the data entry process due to the raw data level. Misclassifications of medications might also happen during prescriptions and diagnoses. Lastly, the data were not used to calculate indirect costs, which would be expected to the influence costs and will be the topic of a future investigation.The implementation of larger studies in the future will help to mitigate these limitations.

CONCLUSION

The estimation of T2DM prevalence growing in the future, based on its recent impact on the economy of Vietnam, indicates that suburban areas are facing considerable increases in economic burden, which result in a noticeable burden in terms of expenditures on hospitalised patients, as well as placing health budgets under pressure in the foreseeable future. The fairly new structure of universal health coverage in Vietnam means that the burden imposed by T2DM will exacerbate the gap between the finite available health resources and the rising demand for healthcare. Thus, a need exists to innovate prevention and treatment of T2DM to maintain the healthcare system in Vietnam.

DISCLOSURE

The Authors declare that they have no relevant conflicts of interest to disclose.

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