PDB38

Burden of Cardiovascular Disease and Cardiovascular Risk in Patients With Type 2 Diabetes Mellitus: Analysis of a US Health Insurance Database

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BACKGROUND

- A recent worldwide study estimated that cardiovascular disease (CVD) affects approximately one-third of all patients with type 2 diabetes mellitus (T2DM) and was the cause of death in approximately 50% of patients with T2DM.[1]
- While significant information exists on the health care resource utilization (HCRU) and costs for patients with T2DM and CVD, limited recent, real-world evidence is available for HCRU and costs among patients with T2DM and cardiovascular (CV) risk factors.[2]

OBJECTIVE

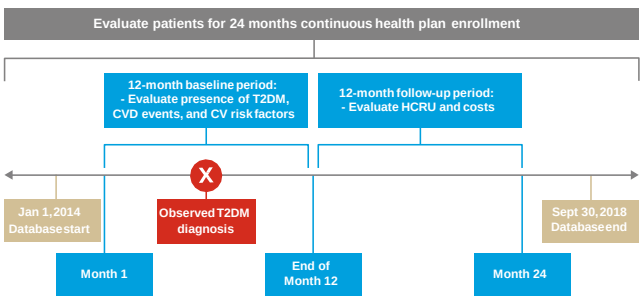
- Describe the annual total all-cause, T2DM-related, and CVD-related HCRU and costs (including the proportion of all-cause costs that are T2DM- and CVD-related) associated with the following patient populations:
  - All patients with T2DM in the United States
  - All patients with T2DM and pre-existing CVD
  - All patients with T2DM and pre-existing CV risk factors (i.e., CV risk factors other than T2DM)

METHODS

Study Design Overview

- De-identified data from the IBM Watson Health Analytics' MarketScan suite of data (i.e., Commercial Claims and Encounters and Medicare Supplemental and Coordination of Benefits databases).
- An overview of the study design is presented in Figure 1.

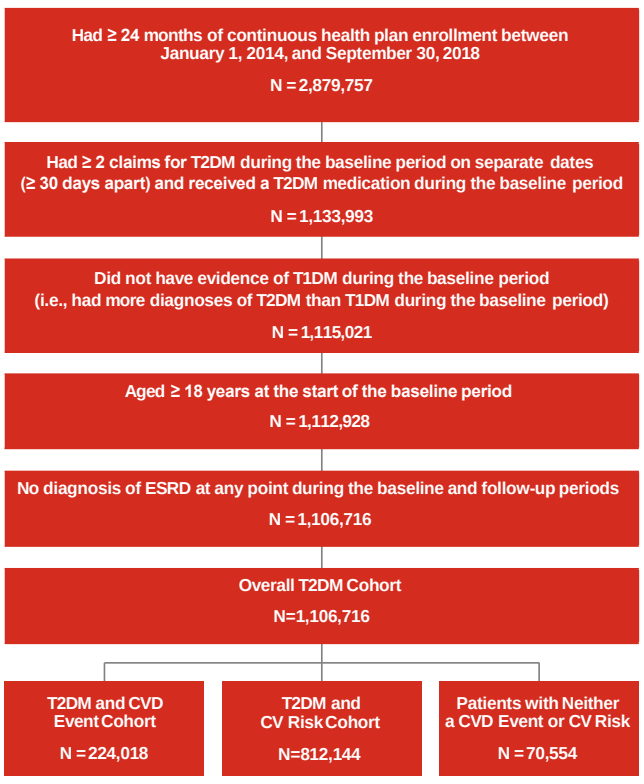
Figure 1. Study Design Schema



Patient Selection Criteria and Study Cohorts

- The overall sample selection criteria and corresponding patient attrition are presented in Figure 2.

Figure 2. Sample Selection Flow Chart



ESRD = end-stage renal disease; T1DM = type 1diabetes mellitus

- Three cohorts of patients were identified based on the presence of diagnoses observed during the baseline and follow-up periods.
  - **Overall T2DM cohort:** included all patients who met the study inclusion criteria described in Figure 2, including those in the T2DM and CVD cohort and T2DM and CV risk cohort.
  - **T2DM and CVD event cohort:** included all patients who met the study inclusion criteria described in Figure 2 and had ≥ 1 CVD event (i.e., a diagnosis of acute myocardial infarction, acute coronary syndromes, carotid arterial disease, left ventricular hypertrophy, transient ischemic attack, coronary artery disease, heart failure, unstable angina, ischemic stroke, peripheral artery disease, a coronary artery bypass graft, or percutaneous coronary intervention procedure) during the baseline period.
  - **T2DM and CV risk cohort:** included all patients who met the study inclusion criteria described in Figure 2 and did not have a CVD event during the baseline period and had ≥ 1 CV risk factor (i.e., a diagnosis of hypertension, hyperlipidemia, micro-or macroalbuminuria, smoking history, obesity, or filled a prescription for aspirin, beta blockers, calcium channel blockers, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, diuretics, antithrombotics, or antihyperlipidemics) during the baseline period.

Study Measures and Data Analyses

- Charlson Comorbidity Index (CCI) score, calculated during the baseline period
- Diabetes Complications Severity Index (DCSI), calculated during the baseline and follow-up periods
- Types of CVD events observed during the baseline period (T2DM and CVD event cohort only)
- Types of CV risk factors observed during the baseline period (T2DM and CV risk cohort only)
- HCRU and costs, including the following information for all study cohorts:
  - All-cause, T2DM, and CVD-related HCRU and costs in the baseline and follow-up periods
  - The categories of HCRU and costs included: inpatient stays, outpatient hospital visits, emergency department (ED) visits, office visits, other outpatient and ancillary care, pharmacy, and total
  - Proportion of all-cause costs attributable to T2DM
  - Proportion of all-cause costs attributable to CVD
- All analyses were conducted using SAS version 9.4 and were descriptive and entailed the tabular display of mean values, medians, ranges, and standard deviations (SD) of continuous variables of interest and frequency distributions for categorical variables.

RESULTS

Patient Demographic and Clinical Characteristics

- Patient demographic and clinical characteristics are presented in Table 1.
- Both the CCI and DCSI scores were higher in the T2DM and CVD event cohort compared with the T2DM and CV risk cohort. Across cohorts, there is worsening severity of diabetes comorbidities over the study period as indicated by increase in the DCSI scores.

CVD Characteristics

- The most common first observed CVD events in the baseline period for patients in the T2DM and CVD event cohort were coronary artery disease (37.2%), peripheral artery disease (29.2%), and heart failure (16.0%).
- The most common CV risk factors observed in the baseline period for patients in the T2DM and CV risk cohort were prescribed pharmaceuticals (83.3%), hyperlipidemia (73.1%), and hypertension (71.5%).

HCRU and Costs

- Any all-cause hospitalization for the overall T2DM cohort was 11.5% during the baseline period. The percentage was higher in the CVD event cohort (32.4%) compared with the CV risk (6.3%) cohort.
  - In the overall T2DM cohort, 11.4% and 9.7% of patients had a T2DM-related and CVD-related ED visit, respectively. T2DM-related and CVD-related ED visits were higher in the CVD cohort (18.3% and 19.0%, respectively) compared with the CV risk cohort (9.6% and 7.7%, respectively).
- During the baseline period, all-cause, T2DM-related, and CVD-related costs were higher for the CVD event cohort compared with the CV risk cohort (Figure 3).
- The proportion T2DM-related costs remained fairly consistent regardless of time period or cohort while the portion of CVD-related costs were highest in the baseline period among patients in the CVD event cohort (Table 2).

Table 1. Patient Demographic and Clinical Characteristics

Characteristics	Overall T2DM Cohort	T2DM and CVD Event Cohort	T2DM and CV Risk Cohort
N	1,106,716	224,018	812,144
Mean (SD) age	59.7 (12.5)	67.6 (11.9)	58.0 (11.5)
Male (%)	59.8%	59.0%	51.5%
Medicare payer (%)	28.8%	55.7%	22.0%
Mean (SD) CCI score			
Baseline period	3.4 (2.4)	5.5 (2.9)	2.9 (1.8)
Follow-up period	3.5 (2.5)	5.3 (3.1)	3.1 (2.1)
Mean (SD) DCSI score			
Baseline period	0.9 (1.2)	1.7 (1.7)	0.7 (1.0)
Follow-up period	1.9 (1.3)	2.5 (1.6)	1.8 (1.1)

Figure 3. Mean Per Patient Annual Health Care Costs by Care Setting and Time Period

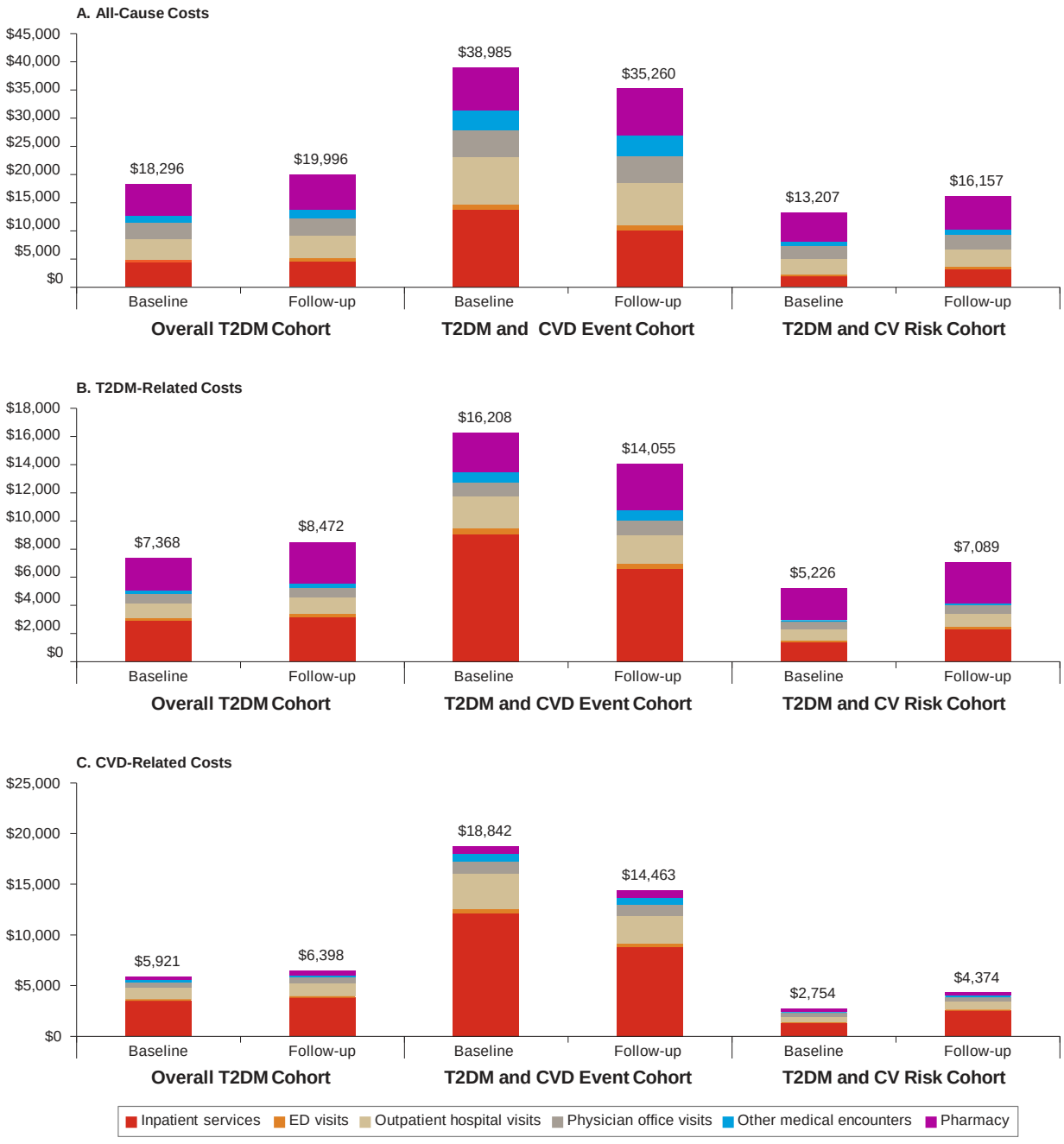


Table 2. Proportion of Annual Health Care Costs Attributable to T2DM and CVD by Cohort

	Overall T2DM Cohort N = 1,106,716		T2DM and CVD Event Cohort N = 224,018		T2DM and CV Risk Cohort N = 812,144	
Component	Baseline Period Costs	Follow-Up Period Costs	Baseline Period Costs	Follow-Up Period Costs	Baseline Period Costs	Follow-Up Period Costs
Sum of all-cause health care costs	$20.249B	$22.130B	$8.733B	$7.899B	$10.726B	$13.122B
Sum of T2DM-related health care costs	$8.154B	$9.377B	$3.631B	$3.148B	$4.244B	$5.757B
Sum of CVD-related health care costs	$6.553B	$7.081B	$4.221B	$3.240B	$2.237B	$3.552B
Proportion of all-cause costs that are T2DM-related	40.3%	42.4%	41.6%	39.9%	39.6%	43.9%
Proportion of all-cause costs that are CVD-related	32.4%	32.0%	48.3%	41.0%	20.9%	27.1%

LIMITATIONS

- Diagnoses in the databases are based on ICD-9-CM and ICD-10-CM codes, which are subject to inaccuracies, and it was neither possible to confirm diagnoses nor obtain any information on diagnoses that occurred before the start of the database.
- No information on lab test results, longitudinal weight, or smoking history was available in the database (aside from ICD-9-CM and ICD-10-CM diagnoses for obesity and smoking history). Therefore, the number of patients with CV risk factors and the number of CV risk factors present per patient may be underestimated.

CONCLUSIONS

- Hospital admissions and emergency department visits were higher among patients in the CVD event cohort compared with patients in the CV risk cohort.
- Mean all-cause costs were also higher for patients with T2DM and a CVD event, with a greater proportion being CVD-related, compared with patients with T2DM and CV risk.

REFERENCES

1. Einarson TR, et al. Cardiovasc Diabetol. 2018 Jun 8;17(1):83.
2. Einarson TR, et al. Value Health. 2018;21:881-90.

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