

# Economic Burden of Type 2 Diabetes Mellitus in Patients With Cardiovascular Disease in Commercially Insured Patients in the United States

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## BACKGROUND

- Type 2 diabetes mellitus (T2DM) is an important risk factor for cardiovascular disease (CVD), affecting 29.1 million people in the United States (US) and is associated with a 2- to 4-fold increase in risk of both CVD and CVD-related death.<sup>1-3</sup>
- However, the extent to which T2DM affects the economic outcomes of patients with CVD is not well documented, hence it is important to quantify the burden of T2DM in this population.

## STUDY OBJECTIVES

- To determine the prevalence of T2DM and quantify the healthcare resource utilization (HCRU) and costs associated with T2DM among patients with CVD.

## METHODS

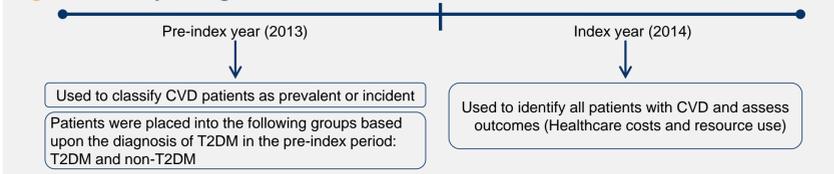
### Data Source and Study Design

- National commercial claims database (IMS LifeLink PharMetrics Plus™)
- Descriptive, cross-sectional study (Figure 1)

### Sample/Population Selection

- Target population: Patients having ≥1 hospitalization claim with diagnosis of a CVD condition in any field, which included myocardial infarction, angina pectoris, heart failure, stroke, other ischemic disease, arrhythmias, cardiac arrest, atherosclerosis, peripheral vascular disease, arterial thrombosis and embolism, cardiomyopathy, conduction disorders, endocarditis, pericarditis, myocarditis, rheumatic heart disease and fever, and other heart disease, or a revascularization procedure; or ≥2 medical claims at least 30 days apart and within 12 months in the outpatient setting with diagnosis of a CVD condition in any field.
- Inclusion:
  - Patients with CVD conditions during the index year
  - ≥18 years of age as of January 1, 2014
  - Continuous health plan enrollment during the pre-index and index year (January 2013 to December 2014)
- Exclusion:
  - Diagnosis of pregnancy, gestational diabetes, secondary diabetes, or type 1 diabetes mellitus anytime during the pre-index or index year
  - Missing demographic information (eg, age, gender, geographic region)
  - Diagnosis of T2DM only in the index year and not in pre-index year

Figure 1. Study Design



### Definitions

- T2DM:
  - ≥1 hospitalization with a diagnosis of T2DM in any diagnosis field **OR**
  - ≥2 medical claims at least 30 days apart within 12 months in the outpatient setting, except lab and radiology, with a diagnosis of T2DM in any diagnosis field **OR**
  - ≥1 pharmacy claim indicated for T2DM, including a) a non-insulin injectable, or b) an oral antidiabetic agent, except metformin, or c) metformin pharmacy claim without a diagnosis code for pre-diabetes or polycystic ovary syndrome<sup>4</sup>

### Study Outcomes

- Proportion of patients with T2DM: total number of patients identified with T2DM divided by the total study sample with CVD.
- HCRU
  - All-cause and CVD-related (primary diagnosis) length of stay per hospitalization, and bed-days per patient per year
  - Number of all-cause and CVD-related visits by setting of care (reported per patient per year)
- Healthcare costs (medical and pharmacy) in 2015 United States dollars (USD)
  - Computed using paid amounts on claims
  - All-cause and CVD-related costs (reported per patient per year)
- CVD-related HCRU and costs were identified as medical claims with a primary diagnosis of a CVD condition, and prescription claims for CVD-related drugs

### Statistical Analysis

- Sample characteristics and outcomes were compared between study groups using *t*-tests for continuous variables and chi-square tests for categorical variables.
- Statistical analyses were conducted using SAS® version 9.3 (SAS Institute; Cary, NC, USA).

## RESULTS

### Sample Characteristics During the Index Year

- 691,934 CVD patients met the study criteria, 20.3% of whom had T2DM.
- T2DM group was older, had a higher proportion of males and higher comorbidity burden vs the non-T2DM group. (Table 1)
- T2DM group had a higher number of CVD conditions; atherosclerosis/other ischemic heart disease were the most prevalent.
- Prevalence of revascularization procedures and CVD risk factors were also higher in the T2DM group compared to the non-T2DM group.

Table 1. Sample Characteristics During the Index Year

Characteristics During the Pre-index Period	T2DM Patients (N=140,155)	Non-T2DM Patients (N=551,779)	P-value
<b>Age at index (in years)</b>			
Mean (SD)	64.1 (10.4)	59.7 (13.2)	<.0001
<b>Male, %</b>			
	65.0%	57.6%	<.0001
<b>Geographic region, %</b>			
Northeast	24.2%	26.3%	<.0001
Midwest	26.9%	26.9%	
South	42.9%	40.5%	
West	6.0%	6.3%	
<b>Payer type, %</b>			
Commercial	48.1%	53.4%	<.0001
Medicaid/State Children's Health Insurance Program	1.0%	0.6%	
Medicare	3.1%	2.2%	
Self-insured	46.8%	42.5%	
Unknown/Other <sup>a</sup>	1.0%	1.3%	
<b>Clinical</b>			
Charlson comorbidity index, <sup>b</sup> mean (SD)	1.8 (1.9)	1.4 (1.6)	<.0001
<b>Type of CVD, %</b>			
Angina (pectoris or unstable)	11.0%	8.3%	<.0001
Arrhythmias	37.9%	44.1%	<.0001
Arterial thrombosis and embolism	1.1%	1.0%	<.0001
Atherosclerosis and other ischemic heart disease	63.3%	44.7%	<.0001
Cardiac arrest	0.5%	0.6%	0.0273
Cardiomyopathy	10.0%	8.6%	<.0001
Conduction disorders	8.5%	8.4%	0.2918
Endocarditis, pericarditis, myocarditis	20.4%	24.9%	<.0001
Heart failure	19.5%	11.2%	<.0001
Myocardial infarction	15.7%	11.6%	<.0001
Other heart disease	11.2%	9.9%	<.0001
Peripheral vascular disease	14.8%	10.6%	<.0001
Rheumatic heart disease and fever	5.6%	6.7%	<.0001
Stroke	21.4%	18.7%	<.0001
Number of CVD conditions, mean (SD)	2.4 (1.6)	2.1 (1.4)	<.0001
Revascularization procedures, %	18.8%	12.4%	<.0001
<b>Presence of CVD risk factors, %</b>			
Dyslipidemia	81.9%	57.8%	<.0001
Hypertension	76.9%	51.6%	<.0001
Obesity	13.1%	6.4%	<.0001

Key: CVD – cardiovascular disease; SD – standard deviation; T2DM – type 2 diabetes mellitus. <sup>a</sup> Self-insured, unknown/missing; <sup>b</sup> Excludes diagnoses of T2DM

## Study Outcomes

Figure 2. Mean Length of Stay and Bed-days During the Index Year

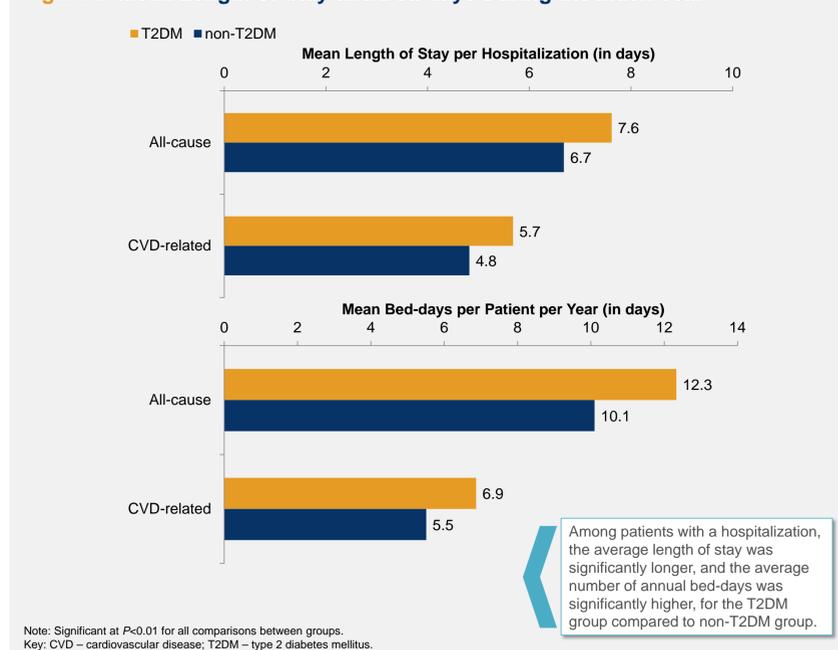


Figure 3. Percentage of Patients With Healthcare Utilization During the Index Year by Setting of Care

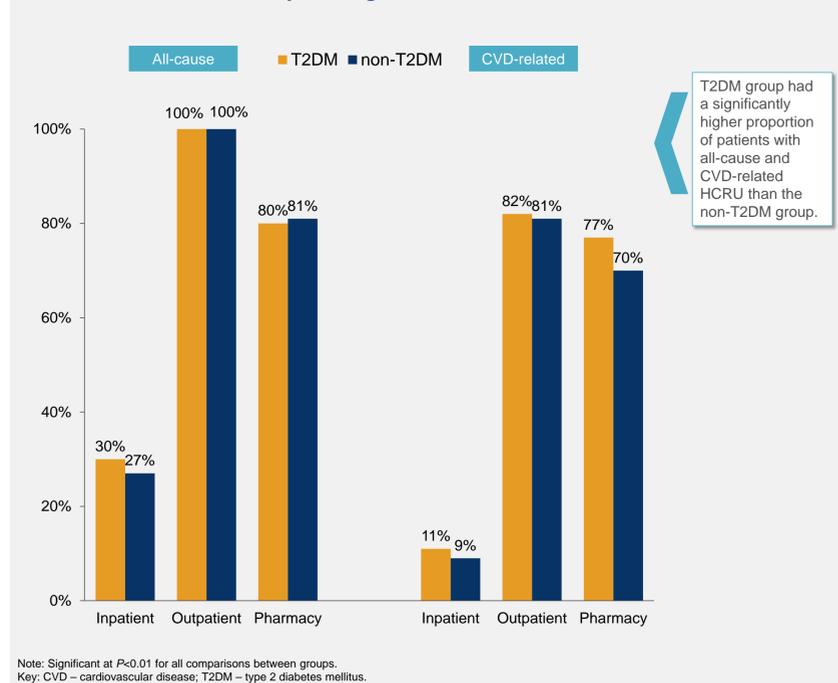
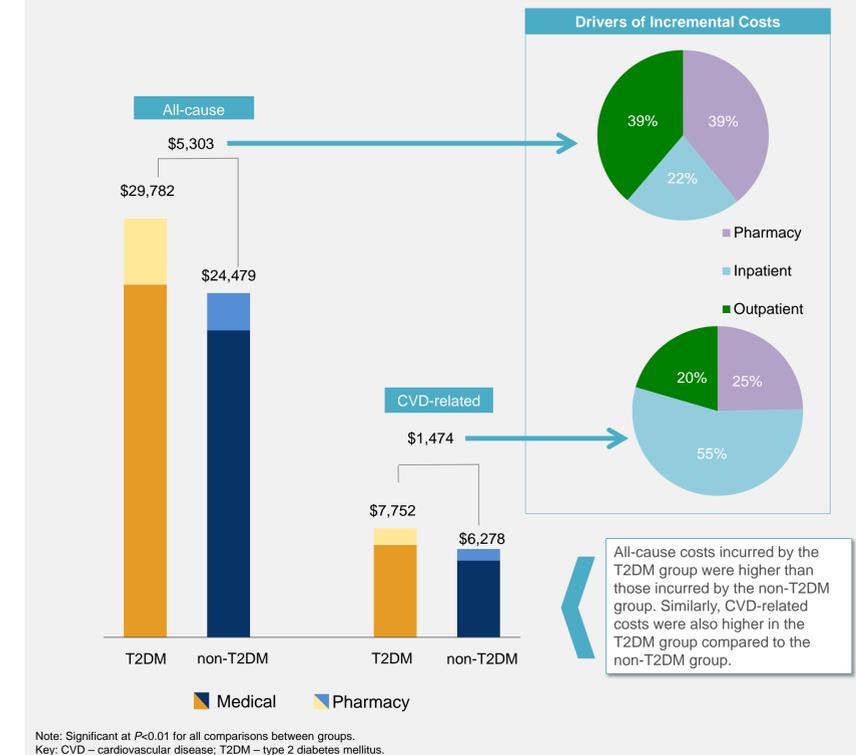


Figure 4. Mean Healthcare Costs During the Index Year



## LIMITATIONS

- Baseline characteristics between groups were not controlled for, thus confounders like hypertensive disease, rather than CVD, may have contributed to the differences observed in outcomes.
- Continuous enrollment requirement may have introduced survival bias and did not account for the costs incurred by patients who died.
- Results of the analysis are primarily generalizable to a commercially insured population

## CONCLUSION

- Nearly 1 out of every 5 CVD patients had comorbid T2DM.
- Among patients with CVD, comorbid T2DM was found to be associated with increased all-cause costs and CVD-related healthcare resource utilization and costs.

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## FUNDING AND DISCLOSURES

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