Association between Diabetes-related Complications and Healthcare Resource Use and Costs in a Large Medicare Advantage Population

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Background

- Much of the excess burden of care associated with type 2 diabetes mellitus (T2DM) is thought to be linked to complications, especially among the elderly[1]. Individuals diagnosed with T2DM are at risk for a range of complications, which can be debilitating and costly[2].
- The Diabetes Complications Severity Index (DCSI)[3] is a method of quantifying the severity of diabetes-related complications using medical and laboratory claims[3]. It comprises 7 categories of diabetes-related complications: cardiovascular complications, nephropathy, retinopathy, peripheral vascular disease, stroke, neuropathy, and metabolic complications.
- The present study utilized a recent implementation of the DCSI, which demonstrated that a modified version of the index, omitting lab data, could be used to explain concurrent medical costs in a managed care population [4].

Objective

The objective of this study was to evaluate the healthcare resource utilization (HRU) and costs associated with complications among Medicare Advantage with Prescription Drug coverage (MAPD) patients diagnosed with T2DM.

Methods

- This study was a retrospective cohort analysis of medical, pharmacy, and enrollment data of 333,576 Humana MAPD patients aged 18 – 89, who had claims with primary ICD-9 CM codes of 250.x0 or 250.x2, or claims for antidiabetic medications during the period of 01/01/2010 -12/31/2011.
- Patients had ≥ 24 months of continuous enrollment.
- Patients with Type 1 DM or gestational DM were excluded.
- The cohort was divided into 6 subgroups based on DCSI scores of 0 (no complications) through 5+ (score of five or more).[4]
- DCSI was assessed concurrently with HRU and costs.
- RxRisk Score, selected comorbidities, and treatment by antidiabetic therapeutic classes were assessed.

Methods Cont.

- HRU was reported descriptively by counts and percentages, as well as by place of service (outpatient, inpatient, ER).
- Healthcare costs were reported as means and standard deviations (SD) of all-cause and T2DM-related medical, pharmacy, and total costs.

Results

Table 1: Demographic Characteristics by DCSI Grouping

Demographic Characteristic	DCSI=0	DCSI=1	DCSI=2	DCSI=3	DCSI=4	DCSI=5+
n	71,514	45,499	60,657	42,341	41,189	72,376
Age, years (mean, SD)	68.5 (± 8.8)	69.0 (± 8.7)	70.5 (± 8.5)	71.0 (± 8.6)	72.4 (± 8.3)	73.5 (± 8.3)
Age Category (n, %)						
18-39	98 (0.1%)	26 (0.1%)	18 (0.0%)	9 (0.0%)	2 (0.0%)	4 (0.0%)
30-39	588 (0.8%)	252 (0.6%)	197 (0.3%)	114 (0.3%)	63 (0.2%)	77 (0.1%)
40-49	2,199 (3.1%)	1,224 (2.7%)	1,119 (1.8%)	722 (1.7%)	452 (1.1%)	545 (0.8%)
50-59	5,749 (8.0%)	3,941 (8.7%)	4,358 (7.2%)	2,915 (6.9%)	2,157 (5.2%)	3,401 (4.7%)
60-69	30,796 (43.1%)	18,467 (40.6%)	21,828 (36.0%)	14,100 (33.3%)	12,067 (29.3%)	18,263 (25.2%)
70-79	26,074 (36.5%)	17,097 (37.6%)	24,609 (40.6%)	17,585 (41.5%)	17,965 (43.6%)	31,360 (43.3%)
80-89	6,010 (8.4%)	4,492 (9.9%)	8,528 (14.1%)	6,896 (16.3%)	8,483 (20.6%)	18,726 (25.9%)
Gender (n, %)						
Male	30,860 (43.2%)	20,766 (45.6%)	29,206 (48.1%)	20,253 (47.8%)	20,706 (50.3%)	37,909 (52.4%)
Female	40,654 (56.8%)	24,733 (54.4%)	31,451 (51.9%)	22,088 (52.2%)	20,483 (49.7%)	34,467 (47.6%)
Race/Ethnicity (n, %)						
White	58,177 (81.4%)	36,803 (80.9%)	48,984 (80.8%)	33,626 (79.4%)	32,891 (79.9%)	57,125 (78.9%)
Black	9,218 (12.9%)	5,908 (13.0%)	8,218 (13.6%)	6,171 (14.6%)	5,858 (14.2%)	10,903 (15.1%)
Hispanic	1,099 (1.5%)	848 (1.9%)	1,256 (2.1%)	1,032 (2.4%)	1,085 (2.6%)	2,233 (3.1%)
Other	3,020 (4.2%)	1,940 (4.3%)	2,199 (3.6%)	1,512 (3.6%)	1,355 (3.3%)	2,115 (2.9%)
Geographic Region (n, %)						
Northeast	1,480 (2.1%)	929 (2.0%)	1,140 (1.9%)	666 (1.6%)	631 (1.5%)	966 (1.3%)
Midwest	19,649 (27.5%)	11,146 (24.5%)	15,982 (23.1%)	8,304 (19.6%)	7,921 (19.2%)	12,225 (16.9%)
South	43,174 (60.5%)	28,879 (63.5%)	39,955 (65.9%)	29,419 (69.5%)	29,118 (70.7%)	53,305 (73.7%)
West	6,081 (8.5%)	3,749 (8.2%)	4,729 (7.8%)	3,324 (7.9%)	3,003 (7.3%)	5,176 (7.2%)

Figure 1: Presence of Selected Comorbidities by DCSI Grouping*
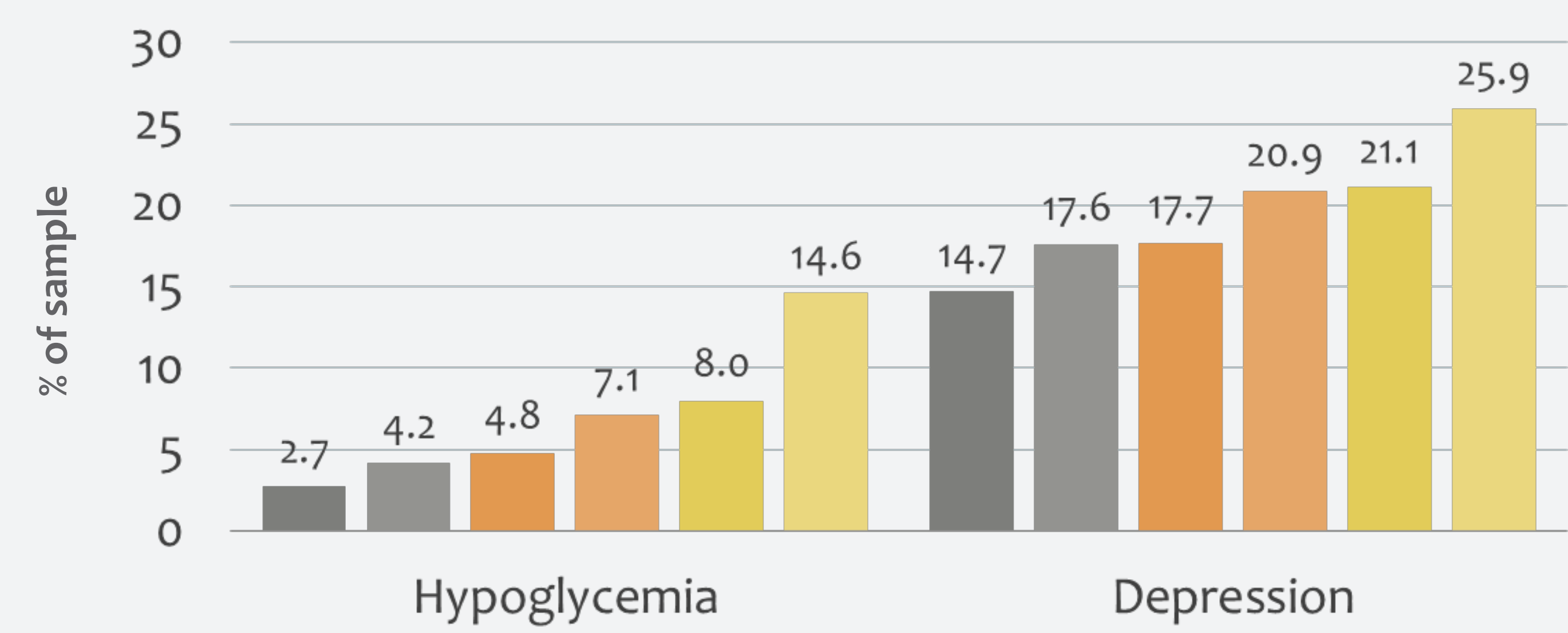
* ■DCSI=0 ■DCSI=1 ■DCSI=2 ■DCSI=3 ■DCSI=4 ■DCSI=5+

Results Cont.

Table 2: Clinical Characteristics by DCSI Grouping

Clinical Characteristic	DCSI=0	DCSI=1	DCSI=2	DCSI=3	DCSI=4	DCSI=5+
n	71,514	45,499	60,657	42,341	41,189	72,376
RxRisk V Score*, (Mean, SD)	1.8 (± 1.2)	2.0 (± 1.2)	2.0 (± 1.2)	2.1 (± 1.2)	2.1 (± 1.2)	2.3 (± 1.2)
Complications, (n, %)						
Retinopathy	0 (0.0%)	7,475 (16.4%)	7,076 (11.7%)	8,070 (19.1%)	7,503 (18.2%)	23,383 (32.3%)
Nephropathy	0 (0.0%)	1,387 (3.0%)	16,410 (27.1%)	16,605 (39.2%)	23,747 (57.7%)	56,422 (78.0%)
Neuropathy	0 (0.0%)	14,993 (33.0%)	10,432 (17.2%)	18,495 (43.7%)	14,183 (34.4%)	44,841 (62.0%)
Cerebrovascular	0 (0.0%)	752 (1.7%)	5,407 (8.9%)	7,595 (17.9%)	11,885 (28.9%)	38,311 (52.9%)
Cardiovascular	0 (0.0%)	3,644 (8.0%)	6,928 (11.4%)	11,063 (26.1%)	12,576 (30.5%)	44,783 (61.9%)
Peripheral vascular disease	0 (0.0%)	17,003 (37.4%)	30,936 (51.0%)	27,227 (64.3%)	33,322 (80.9%)	67,329 (93.0%)
Metabolic	0 (0.0%)	0 (0.0%)	459 (0.8%)	379 (0.9%)	538 (1.3%)	2,340 (3.2%)
Depression (n, %)	10,493 (14.7%)	8,006 (17.6%)	10,757 (17.7%)	8,841 (20.9%)	8,701 (21.1%)	18,764 (25.9%)
Hypoglycemia (n, %)	1,942 (2.7%)	1,904 (4.2%)	2,916 (4.8%)	2,996 (7.1%)	3,314 (8.0%)	10,540 (14.6%)

* A prescription claims-based comorbidity index (Farley et al., 2006, Am J Manag Care 12:110-17; Fishman et al., Med Care 2002; 41: 84-89)

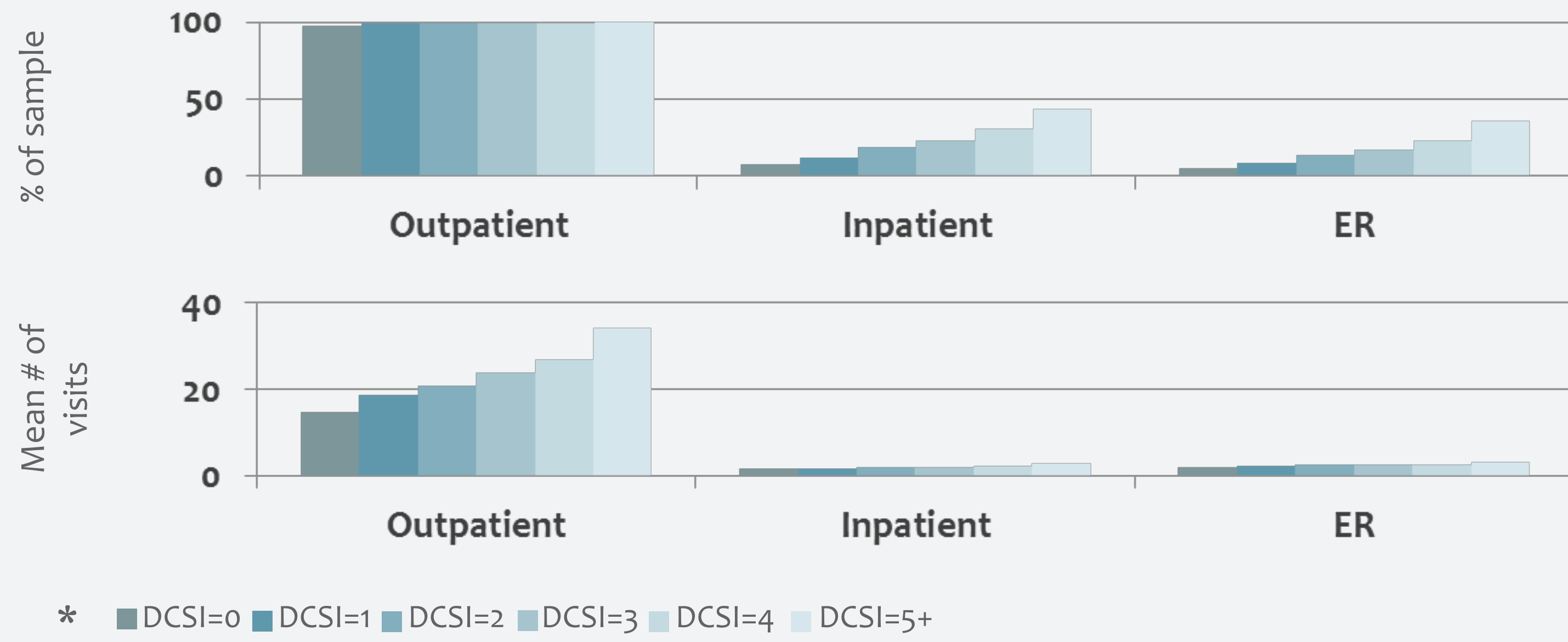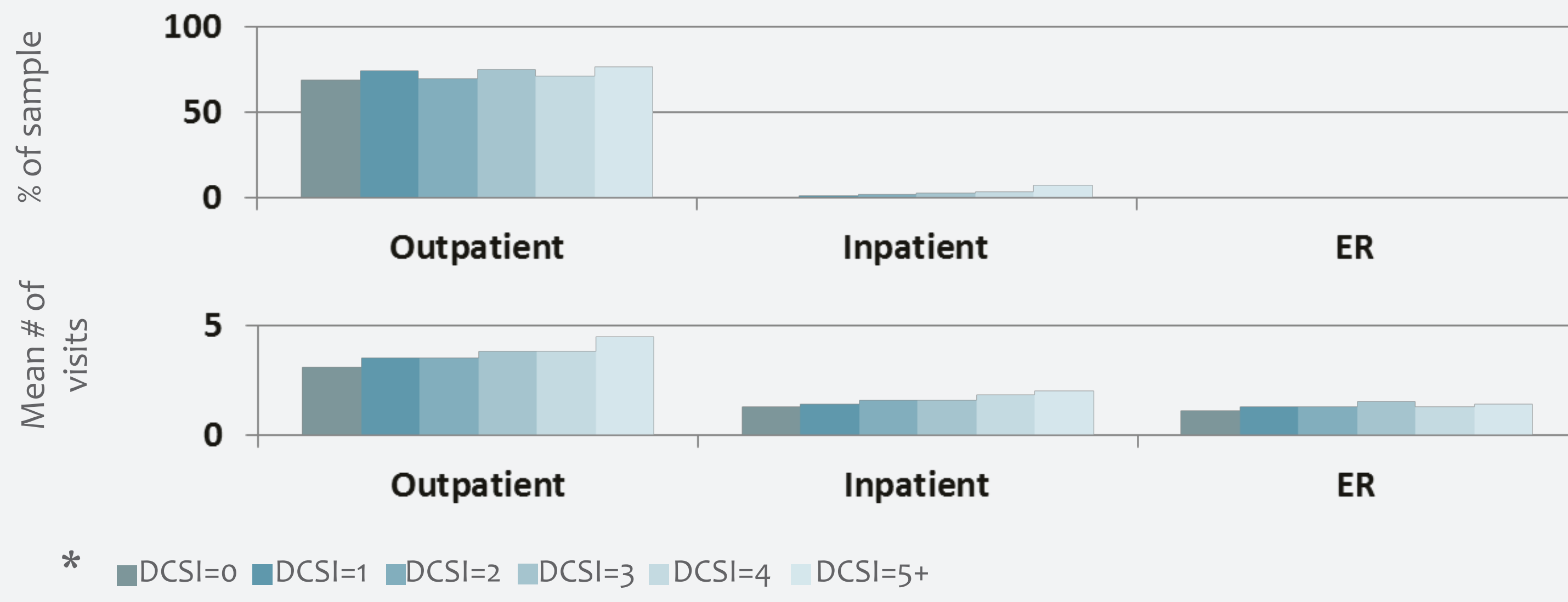**Figure 2: All-cause Healthcare Utilization by DCSI Grouping* - 2011**

* ■DCSI=0 ■DCSI=1 ■DCSI=2 ■DCSI=3 ■DCSI=4 ■DCSI=5+

Figure 3: T2DM-related Resource Utilization by DCSI Grouping* -2011

* ■DCSI=0 ■DCSI=1 ■DCSI=2 ■DCSI=3 ■DCSI=4 ■DCSI=5+

Table 3: All-cause Total Healthcare, Medical, and Pharmacy Costs by DCSI Grouping - 2011

Cost Measure	DCSI=0	DCSI=1	DCSI=2	DCSI=3	DCSI=4	DCSI=5+
n	71,514	45,499	60,657	42,341	41,189	72,376
Total Healthcare Costs (Mean, SD)	$5,247.29 (± 19,141.87)	$7,196.30 (± 11,424.46)	$9,057.14 (± 15,447.76)	$10,812.47 (± 17,700.24)	$13,912.73 (± 23,481.29)	$21,430.55 (± 33,388.65)
Medical Costs (Mean, SD)	$3,397.72 (± 17,739.94)	$4,864.84 (± 19,993.25)	$6,665.65 (± 14,386.27)	$8,055.77 (± 16,410.18)	$11,053.32 (± 22,489.08)	$17,897.72 (± 32,310.06)
Pharmacy Costs (Mean, SD)	$1,969.98 (± 4,156.85)	$2,460.37 (± 4,579.78)	$2,515.02 (± 4,262.26)	$2,878.10 (± 4,899.23)	$2,984.09 (± 4,701.17)	$3,663.53 (± 5,430.59)

Table 4: T2DM-related Total Healthcare, Medical, and Pharmacy Costs by DCSI Grouping - 2011

Cost Measure	DCSI=0	DCSI=1	DCSI=2	DCSI=3	DCSI=4	DCSI=5+
n	71,514	45,499	60,657	42,341	41,189	72,376
Total Healthcare Costs (Mean, SD)	$538.28 (± 1,015.46)	$698.15 (± 1,201.86)	$637.78 (± 1,241.18)	$755.92 (± 1,451.47)	$734.33 (± 1,477.38)	$1,102.45 (± 2,783.74)
Medical Costs (Mean, SD)	$230.49 (± 387.29)	$297.43 (± 475.93)	$271.13 (± 573.37)	$325.51 (± 289.47)	$321.72 (± 844.46)	$573.96 (± 2,383.78)
Pharmacy Costs (Mean, SD)	$307.78 (± 867.10)	$400.72 (± 1,008.77)	$366.66 (± 992.87)	$430.41 (± 1,091.68)	$412.61 (± 1,078.33)	$528.49 (± 1,216.77)

- There was an increase in the prevalence of complications with increasing age and male gender(Table 1). As complications increased, the percentage of Black and Hispanic members rose relative to that of Whites (Table 1).
- The prevalence of depression and hypoglycemia, common comorbidities of T2DM, was higher among members with higher DCSI scores; in the reference group with a DCSI score of 0, depression was common (Figure 1). Biguanides (metformin) and sulfonylureas were the most-often used antidiabetics; as DCSI scored increased there was a trend of decreased use of metformin and increased use of sulfonylureas (not shown).
- All-cause and T2DM-related service utilization, (inpatient and ER services) increased with DCSI severity (Figures 2 and 3).
- As DCSI increased, all-cause and T2DM-related costs increased. Most of these costs were medical, and the relative increase in medical costs associated with increased DCSI score was much higher than was seen in pharmacy costs (Tables 3 and 4).

Discussion/ Conclusions

- The findings are descriptive; but they suggest that T2DM complications pose an excess burden on HRU and costs. The the DCSI is a useful tool for predicting direct healthcare costs and HRU, and for identifying at-risk patient groups to whom preventive therapies and interventions can be targeted.
- The findings are consistent with previous literature suggesting a) an increased onset of T2DM complications with increasing age and duration of disease, b) a trend for patients with higher DCSI scores to have more comorbidities and more individual complications, and c) a bidirectional relationship between depression and T2D.
- Further investigation into the association between pharmacy utilization and medical outcomes could elucidate whether relatively small increases in drug costs (either through improved adherence or use of additional therapies) may result in total cost savings. Preventing or delaying the use of these services can play an important role in driving down costs in the diabetic population. Further studies are needed to build upon and confirm these findings.

Limitations

- Lack of certain information in the claims database (e.g. health behaviors and indirect costs); potential errors in claims, and limited generalizability, as data are from Humana members.
- DCSI scores of 5 and above were collapsed for all analyses.

References

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