Segmentation of a Medicare Advantage population using the Diabetes Complications Severity Index (DCSI)

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Background

Diabetes mellitus, also known as diabetes, refers to a group of metabolic conditions that cause high blood sugar levels. Complications include heart disease and stroke, blindness, kidney failure, and lower-limb amputation. Some complications, especially those with microvascular origins, can be prevented with good glucose control. Additionally, comprehensive screening can identify complications early and help prevent further progression of the disease. The impact of diabetes to the U.S. healthcare system is substantial. In 2012, 9.3% of the U.S. population had diabetes.[1] The direct medical cost of diagnosed diabetes was $176 billion, with an additional $69 billion in reduced productivity.[2] Despite all that we know about this disease, there is still ample opportunity in the U.S. to improve population health management and support people with diabetes.

Humana is actively engaged in improving clinical outcomes and promoting life-long well-being for people with diabetes. We deploy a number of analytic models and techniques to identify, stratify, and support this population. We describe here our use of the Diabetes Complications Severity Index (DCSI) to estimate severity of diabetes in our Humana Medicare population. The index is a 13-point scoring instrument that uses the diagnosis of various diabetes complications to quantify severity of disease.[3] We have built upon this methodology by further segmenting our population into "Low", "Medium", and "High" severity to understand opportunities and deploy resources by segment.

Table 1. DCSI Overview

DCSI Index Conditions (possible scores)		DCSI Severity Ranges
Cardiovascular (0,1,2)	Neuropathy (0,1)	Low: 0-3
Cerebrovascular (0,1,2)	Peripheral vascular disease (0,1,2)	Medium: 4-7
Metabolic (0,1,2)		High 8-13
Nephropathy (0,1,2)	Retinopathy (0,1,2)	

Objectives

- To stratify our Medicare Advantage population with Type II Diabetes via Diabetes Complications Severity Index (DCSI)[3] into low, medium, and high segments
- Quantify prevalence, cost, utilization, and outcomes by disease severity

Methods

Study Design: Cross-sectional study. DCSI was used to segment the population of people with diabetes by severity in this dataset.
Data Source: This analysis was conducted using Medicare Advantage administrative claims data from Humana Inc., a health care company insuring over 9 million individuals in all 50 states.
Inclusion and Exclusion Criteria:
- Individuals with claims for diabetes between Jan 2011 and Dec 2012 had to meet at least one of the three following criteria:
  - Inpatient admission or emergency department visit with diabetes diagnosis
  - Two provider visits with diabetes diagnosis
  - Pharmacy claim for anti-diabetic medication
- The following diabetes ICD-9 codes were used: 249.xx, 250.xx, 357.2, 362.xx, and 648.xx . Individuals with Type I diabetes (ICD-9 codes 250.x1 and 250.x3) were excluded.

Outcomes:
- Diabetes severity was classified into low, medium and high based on the DCSI (see Table 1).
- Outcomes included the mean annual number of inpatient admissions and emergency (ER) visits per 1,000 persons; mean DCSI score; percent of patients with amputations, foot wounds, and retinopathy; and average comorbidities. These outcomes were reported overall and by DCSI severity.
- Outcomes were based on 2012 calendar year administrative claims.

Statistical analyses:
- ANOVA was used to report statistically significant differences in baseline demographic characteristics across segments. Summary statistics were used to describe prevalence, cost, utilization, and outcomes by disease severity.

Results

Table 1. Demographics

Demographics 2012 Cohort	Low Severity N=483,456 (73%)	Medium Severity N=165,584 (25%)	High Severity N= 12,237 (2%)	P-value	Total N= 661,277
Avg. Age (SD)	70.9 (9.2)	74.8 (9.2)	74.9 (9.3)	<0.01	71.9 (9.4)
Female (%)	259,600 (54%)	79,542 (48%)	5,532 (45%)	<0.01	344,674 (52%)
Caucasian (%)	385,395 (80%)	129,861 (78%)	9,259 (76%)	<0.01	524,515 (79%)
Disabled (%)	136,933 (28%)	45,412 (27%)	4,020 (33%)	0.72	186,365 (28%)

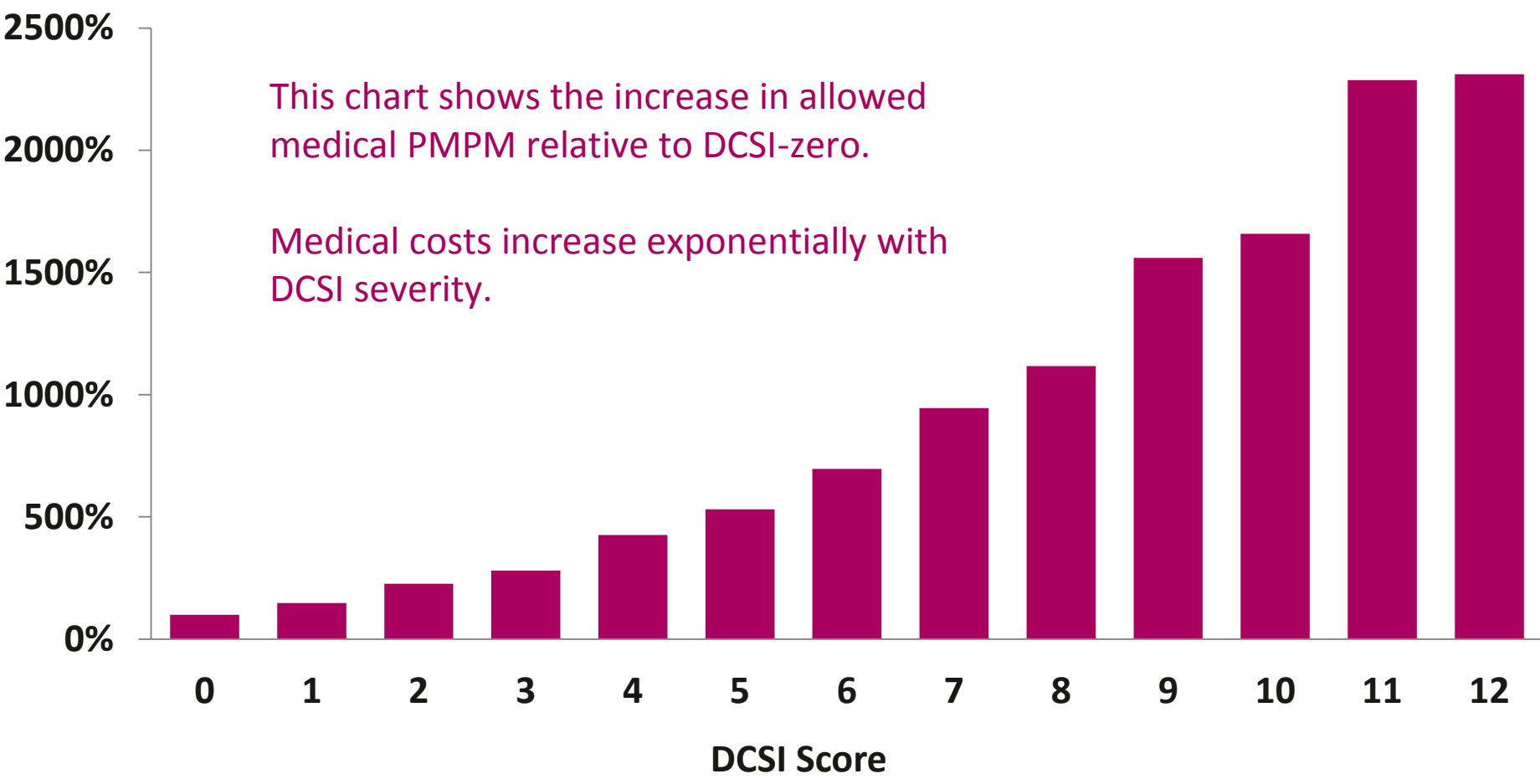### Figure 1. Increase in Medical PMPM by DCSI Score

This chart shows the increase in allowed medical PMPM relative to DCSI-zero.

Medical costs increase exponentially with DCSI severity.

Figure 2. Increase in Utilization by DCSI Score

For every point increase in DCSI, on average we observed a
- 25% increase in inpatient admissions
- 14% increase in emergency room visits

Figure 3. HbA1c by DCSI Severity

As severity increased, we saw a corresponding decrease in percent of diabetics that had controlled HbA1c.

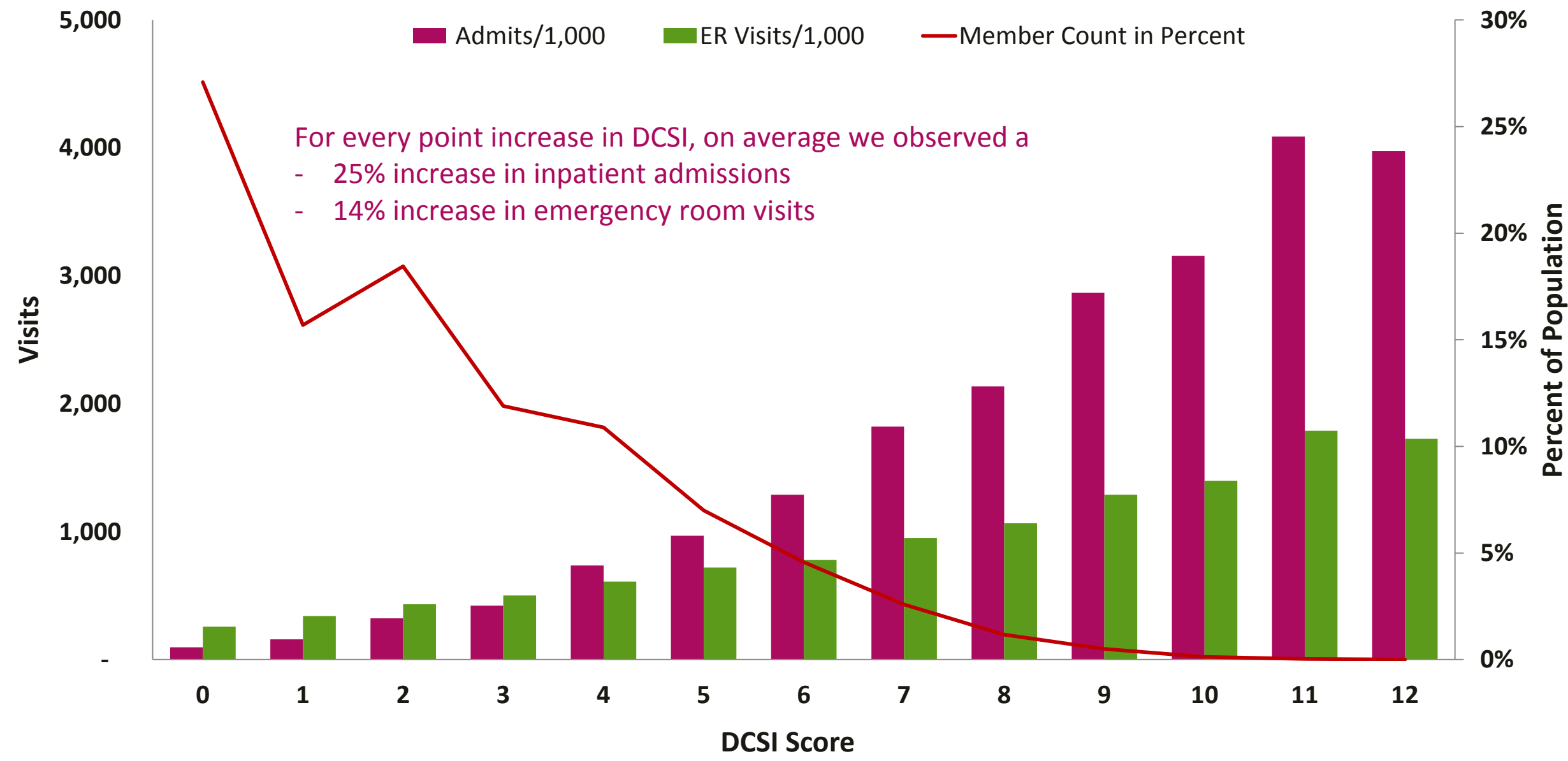Note: Figure 3 is limited to our HEDIS-eligible population. Controlled HbA1c is defined as having an HbA1c less than 8%
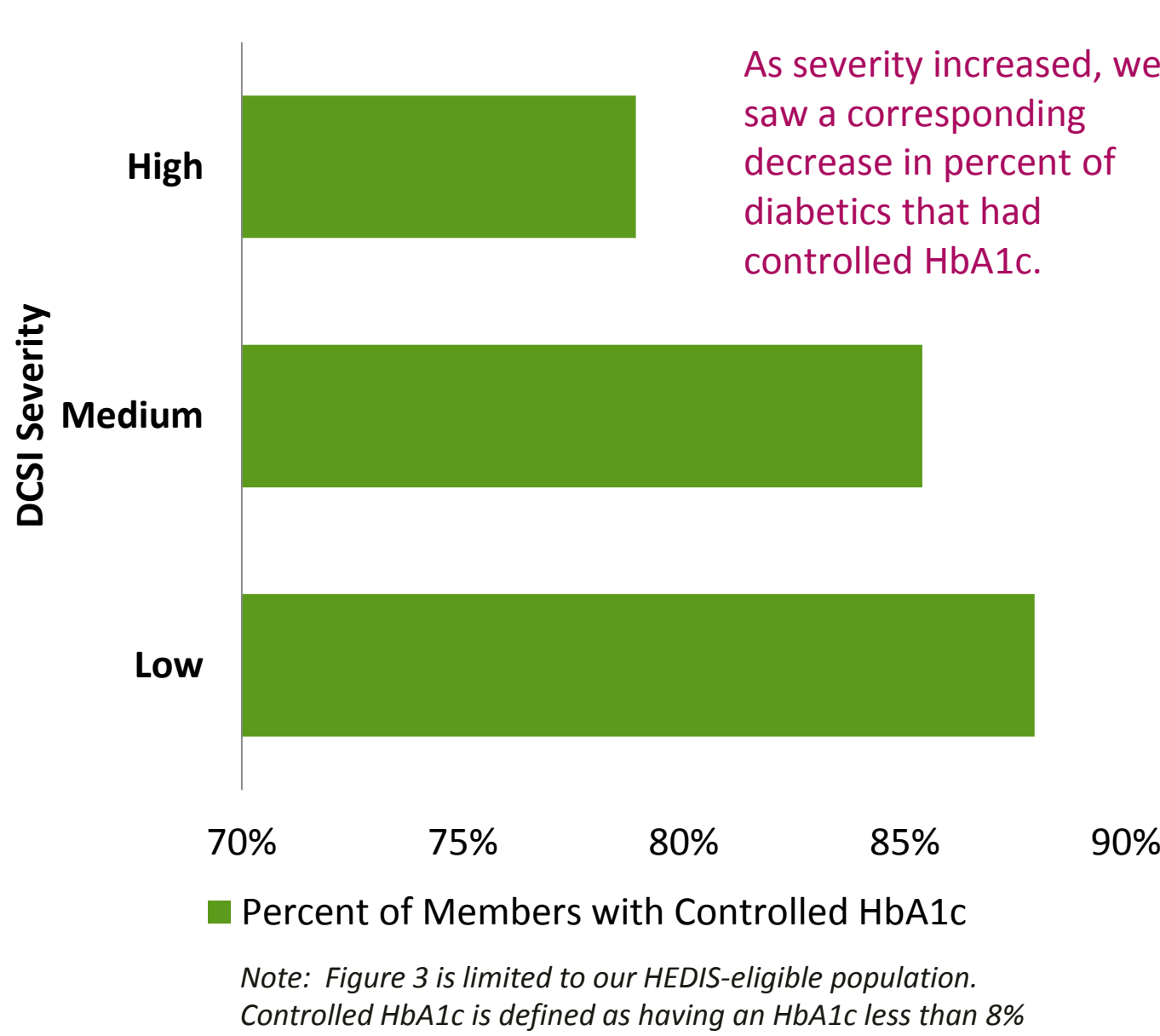
Table 2. Resource Utilization and Complications by DCSI Severity

DCSI Severity	Cohort (n)	Admits / 1000	ER Visits / 1000	Ketoacidosis Admits/1000	Percent with Foot Wounds	Percent with Diabetic Retinopathy	Percent with Amputations	Avg. DCSI	Avg. Comorbidities*
Low	483,456	221	360	0.3	0.8%	7.5%	0.0%	1.2	0.7
Medium	165,584	1,014	707	1.7	7.6%	19.3%	0.6%	5.0	2.1
High	12,237	2,449	1,165	6.1	29.7%	45.3%	4.5%	8.5	3.1
Grand Total	661,277	462	462	0.8	3.0%	11.2%	0.2%	2.3	1.1

*Comorbidities include any of the following: Congestive Health Failure, Coronary Artery Disease, Peripheral Vascular Disease, Cancer, COPD, and/or Chronic Kidney Disease

Prevalence of diabetic foot wounds was highest among the high severity group at 29.6% compared to 0.8% and 7.6% among low and medium severity groups.

Results

- The distribution of the population was skewed heavily towards the low severity group (73%), followed by medium (25%) and high (2%).
- On an average, we observed a 30% increase in medical costs for each point increase in DCSI. Similarly we found an average increase of 25% in Inpatient admissions and 14% increase in emergency room visits with every point increase in DCSI.
- Complications were more common in the high severity group compared to the low and medium groups, most notably foot wounds (30% prevalence vs. 0.8% and 8% respectively).

Conclusion

- The Diabetes Complication Severity Index is a useful instrument for segmenting the diabetes population. Each severity segment has distinct characteristics and challenges that inform a customized approach to population health management.

Limitations

- This cross-sectional analysis was limited to descriptive statistics, associations, and no inference around causality.
- The findings are representative of Humana's MAPD population with diabetes and may not be generalizable to younger individuals or the general U.S. population.
- Calculation of DCSI was based purely on administrative claims data and may not be as comprehensive as medical chart review or an in-person assessment.
- DCSI could have been underreported for a small proportion of the individuals as some left the health plan earlier than December 2012.

References

1. Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2014. Available at : http://www.cdc.gov/diabetes/pubs/statsrep ort14/national-diabetes-report-web.pdf Accessed: October 15, 2014..
2. American Diabetes Association. Economic costs of diabetes in the US in 2012. *Diabetes Care*. 2013:1-14.
3. Young BA, et al. Diabetes complications severity index and risk of mortality, hospitalization, and healthcare utilization. *Am J Manag Care*. 2008;14(1):15-23.

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