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

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 origin, 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. The direct medical cost of diagnosed diabetes was $176 billion, with an additional $69 billion in reduced productivity. 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 lifelong 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 18-point scoring instrument that uses the diagnosis of various diabetes complications to quantify severity of disease. 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

<table>
<thead>
<tr>
<th>Cardiovascular (0.1,2)</th>
<th>Nephropathy (0.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Neutropathy (0.1)</td>
</tr>
<tr>
<td>Medium</td>
<td>Peripheric vascular</td>
</tr>
<tr>
<td>High</td>
<td>Diabetes (0.1,2)</td>
</tr>
<tr>
<td>Low</td>
<td>Retinopathy (0.1,2)</td>
</tr>
</tbody>
</table>

Objectives
To stratify our Medicare Advantage population with Type 2 Diabetes via Diabetes Complications Severity Index (DCSI) 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 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.xx, 362.xx, and 648.xx. Individuals with Type 1 diabetes (ICD-9 codes 250.1 and 250.8) 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; DCSI score; percent of patients with amputations, foot wounds, and retinopathy; and average cost per medical condition. 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.

Table 2. Resource Utilization and Complications by DCSI Severity

<table>
<thead>
<tr>
<th>DCSI Severity</th>
<th>Cohort Size</th>
<th>Admits / 1000</th>
<th>ER Visits / 1000</th>
<th>EOS/Admits</th>
<th>Percent of Foot Wounds</th>
<th>Percent of Diabetes Retinopathy</th>
<th>Percent of Amputations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>465,416</td>
<td>221</td>
<td>300</td>
<td>0.3</td>
<td>0.8%</td>
<td>7.5%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Medium</td>
<td>165,564</td>
<td>1,054</td>
<td>707</td>
<td>1.7</td>
<td>7.6%</td>
<td>39.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>High</td>
<td>12,237</td>
<td>2,449</td>
<td>1,165</td>
<td>6.1</td>
<td>29.7%</td>
<td>40.5%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>663,277</td>
<td>2,449</td>
<td>1,165</td>
<td>6.1</td>
<td>29.7%</td>
<td>40.5%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

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 toward the low severity group (73%), followed by medium (25%) and high (2%).
- On an average, we observed a 20% 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 low and medium groups, most notably foot wounds (98% prevalence vs. 0.8% and 8% respectively).

Conclusion
The Diabetes Complications Severity Index is a useful instrument for segmenting the diabetes population. Each 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 MAOS 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 a medical chart review or an in-person assessment.
- DCSI could have been underestimated for a small proportion of the individuals as some left the health plan earlier than December 2012.

References
