The Center for Medicaid and Medicare Services (CMS) created plan Star ratings that indicate the quality of Medicare plans. In 2011, CMS added three pharmacy measures that focus on member medication adherence, i.e., oral anti-diabetic medications, hypertension medications (Renin-Angiotensin System Antagonists – ACE/ARB), and cholesterol lowering medications (statins).

To prospectively identify patients at risk for non-adherence, a multi-variate regression prediction model was developed to create adherence risk scores. Model accuracy was 70%.

**Objectives**
- This study examined the relevant factors in predicting drug non-adherence and created risk scores for use in predicting patients who are likely to be non-adherent.

**Background**

**Policy Implications**
- In 2011, the Centers for Medicare & Medicaid Service (CMS) included drug adherence as a quality measure within the five-star rating system.
- Based on a three-year CMS demonstration project from 2012 to 2014, quality bonus payments (QBP)s will be awarded to plans achieving or exceeding a rating of 3 stars in its overall star rating.

**Drug adherence measures** are weighted 3 times as high as most other measures for Medicare Part D. Thus, adherence measures are a key component to improving overall star ratings and obtaining associated QBPs.

**Cost of Non-Adherence**

The World Health Organization has identified medication non-adherence as the leading cause of preventable morbidity, mortality, and health care costs.

- Direct costs of medication non-adherence in the United States are a minimum of $100 billion.
- The New England Healthcare Institute estimates that non-adherence along with suboptimal prescribing, drug administration, and diagnosis, costs the health care system as much as $240 billion per year—or 13 percent of total health care expenditures.
- Improving medication non-adherence is central to our efforts to reform the health care system.

**Methods**

**Study Design**
- Retrospective database study that used eligibility, medical, and pharmacy claims data from a large US health care organization.

**Inclusion Criteria**
- Prescription drug claim for cholesterol lowering medication (Statin Drugs), blood pressure (Renin-Angiotensin System Antagonists – ACE/ARB), and oral anti-diabetic medications (OADs - biguanides, sulfonylureas, TZDs, DPP-IV Inhibitors).

**Conduct of Study**
- Covariates were collected on pharmacy coverage for at least 12 months prior to baseline period and 12 months after the index date.
- Inclusion of a Medicare Part D plan. Patients were age 65+.

**Study Design**
- Variable of interest was the proportion of days covered (PDC), as determined over the 12 months following the index date. Patients with PDC ≥ 80% were considered 'adherent'.

**Logistic Regression was used to examine the effects of socio-economic, clinical, and past drug usage variables on non-adherence.**

- 70% of the patients were selected randomly into the test group with simple random sampling without replacement. The test group was used to create the multivariate regression model.

**The remaining 30% sample was considered the validation group.**

- Parameter estimates from the test group final regression model were retained and used on the validation group to create the DAI.

**Results**

**Regression Results**
- Logistic regression models were evaluated based on c-statistics, sensitivity, specificity, false positive, false negative, Hosmer and Lemeshow goodness of fit test, and AIC. Sensitivity and specificity hovered at 71% for all models (Table 1).
- Inclusion of medical characteristics did not increase the power of the multivariate models. Final models included socio-economic and drug regimens, allowing for the ability to risk score a larger population with similar power (Table 2).
- Past drug usage were the most significant predictors of PDC, with the most significant predictors shown in (Table 3).

**Risk Scores**
- There was a positive correlation between average PDC and risk score (Figure 2).
- Model correctly identified 70% of the non-adherent patients, and mis-identified 30% of the adherent patients as non-adherent (Figure 1). The 70% success rate was similar to other prediction models.

**Conclusions**

- Adherence to previous medication regimen(s) were the most significant predictors of future drug utilization.
- Adherence intervention programs that target the entire patient population are unnecessary and may not be cost effective. Proactive identification of patients at risk for future non-adherence can allow managed care organizations to target the right patients in need of drug adherence intervention programs.
- The Drug Adherence Index™ is an effective tool that may help to avoid adherence intervention costs with patients who are already adherent to their medication(s).

**Limitations**

- Presence of a claim for a filled prescription does not indicate that the medication was consumed nor that it was taken as prescribed.
- Medications filled over-the-counter or provided as samples by the physician will not be observed in the claims data.
- Certain information is not readily available in claims data that could have an effect on study outcomes, such as certain clinical and disease-specific parameters.
- Additionally, the design of this study was retrospective, which is limited in their ability to account for the unobserved differences between study cohorts. Multivariate analyses adopted in this study adjusted for only the observed characteristics. Additionally, plan benefit design was not included in the model, which may increase model performance.

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**Table 3. Commonly Statistically Significant Variables**

<table>
<thead>
<tr>
<th>Category</th>
<th>Model Performance</th>
<th>Absolute Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug adherence</td>
<td>Model Type</td>
<td>Portal Type</td>
</tr>
<tr>
<td>Strength</td>
<td>Coefficients</td>
<td>Sensitivity</td>
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<tr>
<td>0.05%</td>
<td>0.10%</td>
<td>0.05%</td>
</tr>
<tr>
<td>0.01%</td>
<td>0.10%</td>
<td>0.05%</td>
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<tr>
<td>0.00%</td>
<td>0.10%</td>
<td>0.05%</td>
</tr>
</tbody>
</table>

**Figure 1. Risk Scoring Results**

<table>
<thead>
<tr>
<th>Diabetes</th>
<th>Statin</th>
<th>ACE/ARB</th>
</tr>
</thead>
<tbody>
<tr>
<td>70%</td>
<td>68%</td>
<td>67%</td>
</tr>
<tr>
<td>75%</td>
<td>65%</td>
<td>64%</td>
</tr>
<tr>
<td>80%</td>
<td>62%</td>
<td>61%</td>
</tr>
</tbody>
</table>

**Figure 2. Comparison of Average PDC to Risk Score**

**Poster Presentation at the ISPOR 17th Annual International Meeting, June 2-6, 2011, Washington, DC, USA**

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