Analyzing and Predicting Hospital Readmission Rates
For the 2014 Data Geek Challenge, I decided to build an analysis to look at one of the most costly issues resulting from a surgical procedure: complications requiring re-admission to the hospital. In my dataset, I track a set of patients that were successfully discharged from Smalltown Hospital after a routine medical procedure and determine whether they were re-admitted to the hospital within 30 days. In order to share the results of this analysis with others, I have created a SAP Lumira Cloud Infographic.

The Problem
With the introduction of the Affordable Care Act, more emphasis is being placed on the ability to understand and reduce re-admissions because of the financial incentives offered to hospitals with low or improving re-admission rates. Smalltown Hospital has identified one particular surgical procedure as a high source of overall re-admissions. Smalltown contacted me to request an analysis of their patient data to determine if there are any general risk factors that can be used to identify at-risk patients before they are discharged.

Analysis Results
After examining overall patient distributions across risk factors and noting there is sufficient data to analyze hypertension, depression, smoking, BMI, and gender as risk factors, I proceeded to examine re-admission rates by factor, noting that the re-admission rate is much higher for patients with hypertension and much lower for patients reporting healthy behaviors, as shown in the pie charts below.

Patients with both smoking and depression indicators have a re-admission rate almost 7 times higher than those with neither indicator.
The Infographic for this analysis with the above charts and additional information has been shared via SAP Lumira Cloud.

**Identifying Patients Most At Risk**
Clearly there are some trends in the data indicating that key factors like hypertension, depression and smoking might be related to re-admission risks, and even that gender may play a role. But how can we combine these to minimize readmission costs?

I built a simple decision tree model that uses patient gender, smoking indicator, hypertension, and depression to determine the likelihood of re-admission. The decision tree is shown below. Key groups with >50% re-admission rates are male smokers with depression or hypertension, female smokers with hypertension, and male non-smokers with hypertension.
The hospital has developed a home monitoring program that eliminates the need for 75% of all re-admissions when complications do arise. The cost of the home monitoring program is $500 compared to the $2000 cost of re-admission. For the 2 month sample set of 425 patients with 114 eventually readmitted, the baseline cost is $228,000. By implementing the home monitoring program, we can reduce the cost to only $176,500, detailed in the table below. This results in a savings of $51,500 (22.5%), lower re-admission rates, and better patient outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Total Readmissions</th>
<th>Cost of Home Monitoring</th>
<th>Cost of Readmissions</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Model</td>
<td>114</td>
<td></td>
<td>$228,000</td>
<td>$228,000</td>
</tr>
<tr>
<td>After Model</td>
<td>66</td>
<td>$44,500</td>
<td>$132,000</td>
<td>$176,500</td>
</tr>
<tr>
<td>Cost of Model</td>
<td>-48</td>
<td></td>
<td></td>
<td>$51,500</td>
</tr>
</tbody>
</table>

The Smalltown Hospital management team agrees that this model and home monitoring system will benefit both the hospital and patients, and they would like to assist doctors and nurses in being able to quickly identify patients that should be enrolled in the program upon release.
**Implementing the Model**

One key to implementing this model is ensuring that Smalltown Hospital staff can easily determine whether to enroll the patient in the home monitoring program before leaving the hospital. To facilitate this, I converted the decision tree model into a quick 4 question survey that the staff can fill out to determine whether to release the patient or to hold them for additional monitoring in the home program. The dashboard is shown below and can easily be deployed on a desktop or mobile device. This mobile decisioning tool was designed with SAP Dashboards and can be deployed with a robust security model and usage tracking as a Dashboard through the SAP Business Objects environment.

![Smalltown Hospital Release Survey](image)

An interactive version of this decisioning dashboard is located here: [http://decisionfirst.com/SHReleaseSurvey.swf](http://decisionfirst.com/SHReleaseSurvey.swf)

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