TAHOE HEALTHCARE SYSTEMS

Data Challenge 2014

Team 18:
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WHAT ABOUT BOB?
INTRODUCTION

Problem
Patient hospital readmissions generate monetary and strategic costs so a solution is needed to reduce readmissions

Our task
Design a simple data-based program to reduce readmissions
Use **comorbidity** and **severity** scores to determine whether to enroll a patient in CareTracker

- Comorbidity <= 110, no CareTracker
- Comorbidity > 185, CareTracker
- Comorbidity 110-185, look at severity
RESULTS

Our model will reduce readmissions which will ultimately reduce costs

Reduce Readmissions 19%
Reduce AMI Costs $1 Million
Potential Cost Reduction $3 Million
COSTS OF READMISSIONS

- Patient Readmission
  - $8,000 Medicare Fee
  - $1,200 CareTracker treatment
  - $10,000 assumed costs

- Direct costs group
  - Patient mortality
  - Reputation risk

- Opportunity costs group
  - Medical staff time
  - Lost revenue (bed)

- Patient Centric Costs
ANALYSIS METHODOLOGY

• Analyzed 4,382 records of Acute Myocardial Infarction (AMI) – heart attack
• Prepared variables
  – Normalized distribution of continuous variables using square root and logarithmic transformation
  – Removed anomalies
• Built model using decision tree
• Discovered decision rules based on comorbidity values
ASSUMPTIONS

• Data is representative
• Nurses are collecting data at POC (scores et al)
• Annual figures were calculated as one third
• Conservative estimate $10,000 for total treatment cost
• CareTracker program is ready and effective
• Hospitals have access to readmission data
• Hospitals use EMRs which are customizable
WHO IS READMITTED?

- % Admitted to Emergency Room
- Average comorbidity score
- Average severity score
- % Admitted in Flu Season
- % Female
- Average age

Bar chart comparing various factors for readmitted and not readmitted patients.
Comorbidity is by far most impactful
Severity & flu season are the next most impactful
Other variables have low impact
Don’t enroll if not flu season
• 125 patients (9%)
• 35 readmitted (28%)
• 0 fewer readmissions

Enroll in CareTracker
• 53 patients (4%)
• 25 readmitted (47%)
• 5 fewer readmissions (15%)

Don’t enroll in CareTracker
• 948 patients (65%)
• 122 readmitted (13%)
• 0 fewer readmissions

Enroll during flu season
• 86 patients (6%)
• 21 readmitted (24%)
• 21 fewer readmissions (50%)

Don’t enroll in CareTracker
• 127 patients (9%)
• 30 readmitted (24%)
• 0 fewer readmissions

Enroll in CareTracker
• 121 patients (8%)
• 18 readmitted (15%)
• 56 fewer readmissions (76%)
MODEL RESULTS

<table>
<thead>
<tr>
<th>SAVINGS MODEL</th>
<th># Enrolled in CareTracker</th>
<th># Readmitted</th>
<th>% Decrease Readmission</th>
<th>Total Costs</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>0</td>
<td>333</td>
<td>--</td>
<td>$5.9 M</td>
<td>--</td>
</tr>
<tr>
<td>All patients enrolled in CareTracker</td>
<td>1461</td>
<td>200</td>
<td>40%</td>
<td>$5.4 M</td>
<td>$0.6 M</td>
</tr>
<tr>
<td>Model for CareTracker enrollment</td>
<td>254</td>
<td>271</td>
<td>19%</td>
<td>$5.2 M</td>
<td>$0.8 M</td>
</tr>
</tbody>
</table>

- PREDICTIVE ACCURACY – 79%
- SENSITIVITY – 44%

CLASSIFICATION RESULTS

<table>
<thead>
<tr>
<th>Actual</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>438</td>
</tr>
<tr>
<td>0</td>
<td>344</td>
</tr>
</tbody>
</table>

TABLE
- All figures are annual
- Total costs include CareTracker program costs, Medicare readmission penalties, and re-treatment costs
IMPLEMENTATION

Alpha – (testing)
- 4 months
- Small hospital
- Low stress environment
- Passionate and competent HC workers
- Evaluate and correct flaws

Jan. 2015

Beta – (validation)
- 6 months
- 2 hospitals
- High rates of readmission
- High stress environment
- Refine for scale

Feb. 2015

Training
- 3 months
- Education and coalition building
- IT integration and validation

May. 2015

FULL IMPLEMENTATION
- Ongoing
- Monitor
- Evaluate
- Change

Aug. 2015
CONTINUAL EVALUATION

• Assess CareTracker enrollment rules periodically
• 6 month Review:
  • Ease of Use
  • Search for hidden costs
  • Scope for corresponding beneficial data
• Audit IT systems to evaluate change viability
• Determine comorbidity proxies if scoring is time and capital intensive
• Post-alpha and -beta analysis can determine value
  • Revert to all CareTracker if model fails and costs hold
FUTURE OPPORTUNITIES

• Take steps to reduce penalties
  • Collect more data on all patients including low- and high-readmission risk patients
  • Determine what if any actions are increasing risk and cost

• Segment cutoff for comorbidity scores based on individual patient groups or disease states
WHAT ABOUT BOB?
## APPENDIX: RESULTS DETAIL

### Per Patient Costs

<table>
<thead>
<tr>
<th></th>
<th>CareTracker</th>
<th>MediCare Readmit Penalty</th>
<th>Re-Treatment Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CareTracker</td>
<td>$ 1,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MediCare Readmit Penalty</td>
<td>$ 8,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-Treatment Costs</td>
<td>$ 10,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Using CareTracker

<table>
<thead>
<tr>
<th>Plan Description</th>
<th># Enrolled in CareTracker</th>
<th># Readmitted</th>
<th>CareTracker Costs</th>
<th>MediCare Readmit Penalty</th>
<th>Re-Treatment Costs</th>
<th>Total Costs</th>
<th>Savings from Base</th>
<th>More than model</th>
<th>Readmit decrease from Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>No CareTracker (Base)</td>
<td>0</td>
<td>333</td>
<td>$ -</td>
<td>$ 2,664,000</td>
<td>$ 3,330,000</td>
<td>$ 5,994,000</td>
<td>$ 809,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All CareTracker</td>
<td>1461</td>
<td>200</td>
<td>$ 1,753,200</td>
<td>$ 1,600,000</td>
<td>$ 2,000,000</td>
<td>$ 5,353,200</td>
<td>$ 640,800</td>
<td>$ 168,800</td>
<td>133</td>
</tr>
<tr>
<td>Use this model</td>
<td>254</td>
<td>271</td>
<td>$ 305,200</td>
<td>$ 2,168,533</td>
<td>$ 2,710,667</td>
<td>$ 5,184,400</td>
<td>$ 809,600</td>
<td>$ 62</td>
<td>19%</td>
</tr>
</tbody>
</table>

All numbers are annual
## APPENDIX: CORRELATION

<table>
<thead>
<tr>
<th></th>
<th>age</th>
<th>female</th>
<th>flu_season</th>
<th>ed_admit</th>
<th>severity score</th>
<th>comorbidity score</th>
<th>readmit30</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>0.149257</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flu_season</td>
<td>-0.01157</td>
<td>0.014966</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ed_admit</td>
<td>0.139642</td>
<td>0.122485</td>
<td>-0.01286</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>severity score</td>
<td>0.281042</td>
<td>0.095394</td>
<td>0.003079</td>
<td>0.335556</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>comorbidity score</td>
<td>0.16116</td>
<td>0.00532</td>
<td>-0.01291</td>
<td>0.030971</td>
<td>0.196759</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>readmit30</td>
<td>0.102466</td>
<td>0.042248</td>
<td>0.121551</td>
<td>0.054564</td>
<td>0.250942</td>
<td>0.383048</td>
<td>1</td>
</tr>
</tbody>
</table>
## APPENDIX: VARIABLE OVERVIEW

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>Average of ed_admit</th>
<th>Average of comorbidity score</th>
<th>Average of severity score</th>
<th>Average of flu_season</th>
<th>Average of female</th>
<th>Average of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not readmitted</td>
<td>0.7975</td>
<td>82.8495</td>
<td>19.8998</td>
<td>0.3755</td>
<td>0.4577</td>
<td>76.4075</td>
</tr>
<tr>
<td>Readmitted</td>
<td>0.8486</td>
<td>135.0380</td>
<td>30.6723</td>
<td>0.5180</td>
<td>0.5080</td>
<td>78.3386</td>
</tr>
<tr>
<td>All patients</td>
<td>0.8092</td>
<td>94.7355</td>
<td>22.3532</td>
<td>0.4080</td>
<td>0.4691</td>
<td>76.8473</td>
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