Using Midas+ Hospital Risk Adjusted Methodology to Drive Down Hospital Readmissions

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Jason Zepeda, Manager, Performance Improvement, Hoag Memorial Hospital Presbyterian
Our Agenda

• Overview of the Midas+ Hospital Risk Adjustment Methodology
• Future directions for Advanced Analytics
• The Hoag Experience
• Questions & Answers

"Sweetheart, my neural net predicts that you and I are 98.9% compatible. Will you be my Valentine?"
The Midas+ Hospital Risk Adjustment Methodology

- Mortality
- LOS
- Complications
- Readmission
- Individual Relative Weight
- Charges
The Source Data
Midas+ Hospital Risk Adjustment Methodology

- Facility
- Patient Demographics
  - Sex
  - Age
- Admission Source
- Admitting Service
- Admission Date
- Discharge Date
- Acute Care Status
- Discharge Disposition

(Continued on next slide)
The Source Data
Midas+ Hospital Risk Adjustment Methodology

• Final discharge abstract
  – ICD-9 and ICD-10 Diagnoses (all in the record)
  – ICD-9 and ICD-10 Procedures (all in the record)
  – MS DRG medical or surgical classification
  – DRG Relative Weight

• Total charges
Built for Accuracy
Using Machine Learning
Key Differentiators of Midas+
Advanced Analytics

- **Analytics Patient Centric Data Warehouse**
  - Links encounters across Midas+ Client Hospitals and Medicare data to a single patient record for longitudinal risk adjustment

- **Machine Learning Methodology**
  - Using R to train models on over 24 Million records from over 800 US Hospitals

- **Geocoded Data**
  - Links sociodemographic data from census data to patients

- **Natural Language Processing**
  - Allows unstructured data from clinical documentation to be transformed into structured ICD, RxNorm and LOINC codes

- **Product Agnostic**
  - Allows Midas+ Predictive Analytics to be consumed by other applications outside of Midas+ Products
Benefits of a Patient Centric Risk Model

- Existing model assigned the same mortality probability to all patients within the same risk subclass
- …but significant variation exists for individual persons within the same risk bucket
- Current classification models can’t see the variation that occurs in each risk subclass

Mortality Probabilities for Sepsis Subclass 4
.005 to .99
N = 300,000 encounters
Expected LOS

Sepsis LOS: APR SOI = 4

- Green line: Actual
- Orange line: Predicted
- Blue line: Normative

LOS (Days)

Patients

0 5 10 15 20 25 30
0 50000 100000 150000 200000 250000
The Transition to a Patient Centric Model

- Significant variation observed in existing risk classification model
- Greater precision realized with machine learning models
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How Many Variables (Features) Do We Need to Predict Something Well?

Data is analyzed using Lasso before we calculate the probabilities using the predictive models with the best fit for the data.

The number of variables we need to “lasso” to get to the best C-statistic possible before adding more variables just slows us down and won’t add additional insights.

Largest cluster was 637 for Septicemia (C-Statistic .92)

Acute MI Extreme Mortality Model
C Statistic = .96

Good
Excellent
Outstanding
Acceptable
Random Effect

352 (Acute MI)

0
# of Features
> 5,000

Insight-Driven Transformation - 2016 Midas+ Annual Symposium
**Statistical Performance of Midas+ Encounter Risk Model**

*Some examples (values compared to CMS models shown in red)*

<table>
<thead>
<tr>
<th>Clinical Cluster</th>
<th>c-statistic</th>
<th>MAE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mortality</td>
<td>30-day Readmits</td>
</tr>
<tr>
<td>Acute MI</td>
<td>0.96</td>
<td>0.69 (0.66)</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.95</td>
<td>0.62 (0.61)</td>
</tr>
<tr>
<td>Pneumonia (Bacterial)</td>
<td>0.95</td>
<td>0.69 (0.64)</td>
</tr>
<tr>
<td>Pneumonia (Viral)</td>
<td>0.96</td>
<td>0.69 (0.64)</td>
</tr>
<tr>
<td>COPD</td>
<td>0.97</td>
<td>0.64 (0.64)</td>
</tr>
<tr>
<td>Total Knee Replacement</td>
<td>0.50</td>
<td>0.69</td>
</tr>
<tr>
<td>Septicemia</td>
<td>0.94</td>
<td>0.68</td>
</tr>
<tr>
<td>Overall Across All Clusters</td>
<td><strong>.9777</strong></td>
<td><strong>.7645</strong></td>
</tr>
</tbody>
</table>
Midas+ Clinical Clusters  
(some examples)

172 Medical Clusters
- Abdominal and Thoracic Aneurysm
- Abdominal Hernia
- Abortion-related disorders
- Acquired Deformities
- Acute Myocardial Infarction
- Acute Renal Failure
- Adjustment Disorders
- Alcohol-related Disorders
- Anemia
- Angina and Chest Pain
- Anxiety Disorders
- Aspiration Pneumonia
- Atrial Fibrillation and Flutter

137 Surgical Clusters
- Abdominal Hysterectomy
- Abdominal Paracentesis
- Amputation of Lower Extremity
- Aortic Resection, Replacement or Anastomosis
- Appendectomy
- Arthroplasty Other than Hip or Knee
- Arthroplasty of Hip
- Arthroplasty of Knee
- Arthroscopy
- Biopsy of Liver
- Blood Transfusion
- Bone Marrow Transplant
Model Retraining for ICD-10

• Models to be retrained this summer using six months of ICD-10 data from over 800 Midas+ Hospitals
• Distribution of revised models scheduled for November 2016 DataVision and CPMS update
• Expect some changes due to changing coding practices and guidelines
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Geocoding Data

- Uses patient address from Midas+ to determine latitude and longitude of patient’s addresses
- Attributes characteristics of the city block to the patient
  - Income
  - Education
  - Housing
  - Transportation
  - Living Status
  - More!
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Midas+ Concurrent Care Outcome Models

Unstructured Data

- H & P
- Op Reports
- Consultant Notes
- Discharge Summary
- Imaging Reports

SyTrue NLP Engine

Structured & Normalized Data to be Consumed in Analytics Warehouse

- ICD-10 Codes
- SNOMED-CT
- RxNorm
- LOINC

REAL TIME PREDICTIVE ANALYTICS RETURNED TO CARE MANAGEMENT SYSTEM
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Midas+ Advanced Analytics is Application Agnostic
Patient Engagement

Patient Readmission Risk Reduction

Improving post-discharge compliance through patient engagement

Reducing excess unplanned hospital readmissions is critical to ensuring better clinical outcomes.

Palo Alto Research Center and Midas+ are developing a post-discharge Patient Engagement Information Service that combines real-time patient communication and data analytics to ensure optimal post-discharge patient care.
Population Health Management

- Predictive Analytics
- Disease Progression
- Gaps in Care

✓ Clinical and claims from ambulatory settings
## Phase 1: Midas Population Health Management

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Solution Deliverable</th>
<th>Applicable Populations</th>
</tr>
</thead>
</table>
| **Segmentation** | An organizational framework used to assign patients to a category of risk. They can be used as a filter to look at gaps in care or stratification in a particular market segment  
• Patients/enrollees can only be in one segment at a time  
• Patients could potentially move between segments | Midas to define each population segment for the following *(these are separate and independent from disease progression clusters)*:  
• Well/Prevention  
• Recent Acute Episode  
• Maternal  
• Chronic  
• Complex Chronic  
• End of life |
| **Stratification** | Develop predictive analytics to determine next 6 month probabilities for:  
• Risk of mortality  
• Risk of ED Utilization  
• Risk of acute care hospitalization  
• Expected Charges  
• Chronic Disease Progression | Develop for the total universe of patients *(inpatient and outpatient all payer claims)*.  
2629 demographic, clinical, utilization, and socio-economic variables used. |
| **Gaps in Care**  | Measures and alerts that align with well established clinical pathways. These will be embedded in Juvo and are applicable to ambulatory and post acute care services | Develop for all patients, but a deeper emphasis will be on CHF and DM initially |
Phase 2
• Real Time Gaps in Care ROI – Gaps in Care Simulations

If this patient had their stroke care provided, the risk profile on the patient would be reduced by this amount.

Phase 3
• Prescriptive Analytics – Care Transition Simulations

Question: Should I provide home health services for my patient?

Answer: Yes. If you provide home health services, you will save $80,000 per year and significantly lower the patient’s risk profile.
Midas+ Risk Model for 30-day Unplanned Hospital Readmission Probabilities

- Risk adjusted using same criteria for 30-day all-cause hospital-wide unplanned readmission as CMS uses (but Midas+ applies to all payers)
  - This means that readmission encounters can also be index cases for future readmissions, which is not the case for the CMS Readmission Reduction Program Cohorts
- No concept for “potentially preventable” readmissions BUT for the first time hospitals will be able to evaluate readmissions for patients with low probability of readmission
- Does not forecast CMS excess readmissions or financial penalties (like the Midas+ Readmission Forecaster Reports)
- Model is retrospective (unlike the Midas+ Concurrent model currently in development)
- Like mortality, each encounter has a unique probability based on their demographics and administrative data
Midas+ Risk Model Uses Machine Learning to Include Adjust Observed and Expected Readmissions for “non-same” hospitals
Variation in “Non-same” Hospital Readmission Patterns is Extreme But Predictable

Our Research Shows

<table>
<thead>
<tr>
<th>Topic</th>
<th>Average Non-Same Hospital Readmit</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute MI</td>
<td>26.68%</td>
<td>0 to 60.7%</td>
</tr>
<tr>
<td>COPD</td>
<td>17.92%</td>
<td>3.1 to 53.7%</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>19.76%</td>
<td>3.8 to 50%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>14.69%</td>
<td>0 to 66.7%</td>
</tr>
<tr>
<td>Total Knee/Hip</td>
<td>24.25%</td>
<td>0 to 100%</td>
</tr>
</tbody>
</table>
Midas+ Readmission Risk Model Creates a Level Playing Field for Comparison

Multi-facility Corporate Hospital

Without adjustment for non-same hospital readmissions
May have false low observed values;
which reduces the expected values
Midas+ Readmission Risk Model Creates a Level Playing Field for Comparison

Without adjustment for non-same hospital readmissions, may have higher than expected values when compared to multi-facility hospitals with smaller observed rates.

Regional Hospital

100 miles

100 miles
# DataVision Readmission Reports

## Midas+ Risk Model Lives/Days/Readmissions Saved

April 2015 through March 2016

Inpatients

Compared with All Participating Facilities

### Adjusted Readmissions

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th># Cases</th>
<th>Adjusted Observed</th>
<th>Adjusted Expected</th>
<th>Adjusted O/E Ratio</th>
<th>Adjusted O/E Percentile</th>
<th>50th Percentile</th>
<th>20th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>108</td>
<td>Anemia</td>
<td>277</td>
<td>118.19</td>
<td>93.43</td>
<td>1.26</td>
<td>89th</td>
<td>79.72</td>
<td>38.47</td>
</tr>
<tr>
<td>135</td>
<td>Complication or Malfunction of Device, Implant, or Graft</td>
<td>235</td>
<td>79.45</td>
<td>64.06</td>
<td>1.24</td>
<td>87th</td>
<td>57.84</td>
<td>21.61</td>
</tr>
<tr>
<td>139</td>
<td>Heart Failure</td>
<td>608</td>
<td>149.56</td>
<td>144.43</td>
<td>1.03</td>
<td>72nd</td>
<td>132.87</td>
<td>16.49</td>
</tr>
<tr>
<td>228</td>
<td>Pancreatic Disorders</td>
<td>216</td>
<td>51.01</td>
<td>42.11</td>
<td>1.21</td>
<td>84th</td>
<td>35.20</td>
<td>15.81</td>
</tr>
<tr>
<td>131</td>
<td>Chronic Obstructive Disease and Emphysema</td>
<td>305</td>
<td>75.48</td>
<td>69.10</td>
<td>1.09</td>
<td>80th</td>
<td>61.84</td>
<td>13.64</td>
</tr>
<tr>
<td>129</td>
<td>Cellulitis and Abscess</td>
<td>455</td>
<td>65.16</td>
<td>63.69</td>
<td>1.02</td>
<td>74th</td>
<td>52.51</td>
<td>12.65</td>
</tr>
<tr>
<td>187</td>
<td>Lower Gastrointestinal Disorders</td>
<td>509</td>
<td>100.64</td>
<td>95.87</td>
<td>1.06</td>
<td>73rd</td>
<td>88.26</td>
<td>13.78</td>
</tr>
<tr>
<td>107</td>
<td>Alcohol-related Disorders</td>
<td>115</td>
<td>37.73</td>
<td>27.77</td>
<td>1.36</td>
<td>85th</td>
<td>25.65</td>
<td>12.08</td>
</tr>
<tr>
<td>452</td>
<td>Insertion/Revision/Replacement/Removal Cardiac Pacemaker/Cardiovert/Defib</td>
<td>148</td>
<td>27.36</td>
<td>19.39</td>
<td>1.41</td>
<td>90th</td>
<td>16.87</td>
<td>10.49</td>
</tr>
<tr>
<td>134</td>
<td>Complication of Surgical Procedure or Medical Care</td>
<td>216</td>
<td>45.51</td>
<td>40.48</td>
<td>1.12</td>
<td>72nd</td>
<td>36.69</td>
<td>8.82</td>
</tr>
</tbody>
</table>
DataVision Readmission Reports

Heart Failure XRA 139 - Readmit w/in 30 days, O/E, ACA
Compared with All Participating Facilities

Heart Failure XRA 139 - Readmit w/in 30 days, Adj O/E, ACA
Compared with All Participating Facilities

Site Value | Site Percentile | Num | Den | Category
--- | --- | --- | --- | ---
Q4 15 | 1.08 | 71st | 39 | 35.99 | All Participating
Q3 15 | 1.11 | 72nd | 38 | 34.11 | All Participating
Q2 15 | 0.95 | 59th | 32 | 33.56 | All Participating
Q1 15 | 0.76 | 35th | 20 | 26.31 | All Participating
Q4 14 | 1.06 | 74th | 25 | 30.73 | All Participating

Site Value | Site Percentile | Num | Den | Category
--- | --- | --- | --- | ---
Q4 15 | 1.08 | 71st | 43.80 | 40.42 | All Participating Facilities
Q3 15 | 1.11 | 72nd | 42.67 | 38.31 | All Participating Facilities
Q2 15 | 0.95 | 59th | 35.94 | 37.71 | All Participating Facilities
Q1 15 | 0.76 | 54th | 22.46 | 29.55 | All Participating Facilities
DataVision Readmission Reports
Patient Centered Readmission Probabilities in DataVision Toolpacks

<table>
<thead>
<tr>
<th>Clinical Cluster Code &amp; Description</th>
<th>XRA Risk of Readmission (Same Server)</th>
<th>XRA Days to Readmission</th>
<th>XRA Expected LOS</th>
<th>XRA Expected Charges</th>
<th>XRA Adjusted Expected Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Failure</td>
<td>0.2128</td>
<td>2</td>
<td>5.17</td>
<td>27858.02</td>
<td>4</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.1763</td>
<td>25</td>
<td>5.54</td>
<td>42784.86</td>
<td>7</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2468</td>
<td>15</td>
<td>6.66</td>
<td>31718.89</td>
<td>5</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.1475</td>
<td>6</td>
<td>2.75</td>
<td>14671.6</td>
<td>5</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2198</td>
<td>30</td>
<td>3.97</td>
<td>21061.83</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2284</td>
<td>15</td>
<td>4.76</td>
<td>20280.96</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.0815</td>
<td>1</td>
<td>5.93</td>
<td>36096.34</td>
<td>6</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.1525</td>
<td>7</td>
<td>5.38</td>
<td>32526.64</td>
<td>5</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2016</td>
<td>6</td>
<td>3.2</td>
<td>21568.26</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2174</td>
<td>5</td>
<td>7.02</td>
<td>43595.52</td>
<td>7</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2291</td>
<td>9</td>
<td>5.33</td>
<td>31104.29</td>
<td>5</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2459</td>
<td>18</td>
<td>3.5</td>
<td>20137.71</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2041</td>
<td>6</td>
<td>5.86</td>
<td>38346.62</td>
<td>6</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.184</td>
<td>17</td>
<td>4.66</td>
<td>27742.89</td>
<td>4</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2567</td>
<td>21</td>
<td>5.79</td>
<td>37621.46</td>
<td>6</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.2897</td>
<td>25</td>
<td>3.24</td>
<td>21934.14</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.1863</td>
<td>21</td>
<td>5.8</td>
<td>20443.72</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.1897</td>
<td>17</td>
<td>3.51</td>
<td>20690.21</td>
<td>3</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>0.154</td>
<td>23</td>
<td>5.63</td>
<td>27076.38</td>
<td>4</td>
</tr>
</tbody>
</table>
Using Midas+ Hospital Risk Adjusted Methodology to Drive Down Hospital Readmissions

Dominic Shields, Strategic Analytics, Hoag Memorial Hospital Presbyterian
Jason Zepeda, Manager, Performance Improvement, Hoag Memorial Hospital Presbyterian

Insight-Driven Transformation
May 23-25, 2016
JW Marriott Starr Pass Resort, Tucson, AZ
Agenda

• Introducing the XRA model to your organization
• Data analysis using the XRA model
• Reducing readmissions using the XRA model
  – Operational Tactics
Introducing XRA

- Understand the model
- Educate key stakeholders
- Use the model to drive change
Introducing XRA

• Understanding the model
  – Core team invested in **fully** understanding XRA
    • Performance Improvement
    • Physician Leaders
    • Strategic Analytics
  – Deep dives with Midas+ assistance
Introducing XRA

- Educating key stakeholders
  - Executive Team
  - Quality Management System
    - Board → Clinical Teams
  - Leadership
  - Analysts

These analytics people think they know everything!
Introducing XRA

• Message
  – Compare to current process
  – Give confidence there is understanding
  – Provide \textit{just enough} detail
  – Describe benefits
Comparing Risk Adjustment Models

Basic principles of any risk adjustment model:
1. Get a large database with as much data as possible
2. Group patients into categories
3. Use database to create ‘expected’ values for each category
4. Run new data against model

<table>
<thead>
<tr>
<th></th>
<th>APR-DRG</th>
<th>Midas XRA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large Database</strong></td>
<td>Premier Database ~10m discharges</td>
<td>Midas ~8m discharges</td>
</tr>
<tr>
<td><strong>Categories</strong></td>
<td>APR-DRGs 3M 315 APRDRGs * 4</td>
<td>APR-DRGs 3M 315 APRDRGs * 4</td>
</tr>
<tr>
<td><strong>Model</strong></td>
<td>Average rate</td>
<td>Average rate</td>
</tr>
<tr>
<td><strong>Latency</strong></td>
<td>Monthly</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
1. Categorize as Medical or Surgical based on MS-DRG

2. Assign to CCS group based on primary diagnosis or procedure code (309 clinical clusters)

3. Assign to high or low risk based on presence of specific diagnoses / procedures (40 – e.g. severe sepsis, cardiac arrest, CPR, intubation)

4. Identify key independent variables (618 analyses)

5. Run logistic regression model for each group (618 models)
XRA Logistic Regression

The probability (of death or of readmission) is driven by huge numbers of different factors:

- Age
- Gender
- Admission Source (home, hospice, etc.)
- Discharge Disposition (home, SNF, hospice, etc.)
- LOS
- Charges
- Diagnosis Codes (primary and secondary)
- Procedure Codes (primary and secondary)
Logistic regression reminder

Multivariate regression where dependent variable is categorical

\[ P(y=1) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_n x_n)}} \]

- **Multivariate**: Lots of variables  
  *(XRA model can have >700 variables in a single model)*
- **Regression**: Each variable impacts the results by different amounts based on the correlations
- **Dependent variable**: The outcome (death or readmission)
- **Categorical**: In this case, binary:
  - Lives or dies
  - Is readmitted or is not
Introducing XRA to the Organization

- Compared to current process
  - Lower values than previously reported
  - Similar targets
  - Impact to organizational goals (timing)

Top Decile Targets

- APR-DRG: 0.83
- XRA: 0.82
Benefits of XRA Model

• Accuracy:
  – Since the XRA Model takes so many more factors into account, it can create much more robust and precise predicted values at the individual patient level

<table>
<thead>
<tr>
<th>Readmission o:e</th>
<th>Acute Only</th>
<th>All Inpatients</th>
</tr>
</thead>
<tbody>
<tr>
<td>APR-DRG top decile</td>
<td>0.83</td>
<td>0.80</td>
</tr>
<tr>
<td>XRA top decile</td>
<td>0.81</td>
<td>0.81</td>
</tr>
</tbody>
</table>

• Applications:
  – Since the model is at the patient level, we can analyze any population

• Latency
  – XRA model is updated daily
Challenges with XRA Model

• Interpretation:
  – Since models are machine learned, correlations are not always intuitive…and not necessarily causative
  – Variables can have a negative impact (reduce the risk)
  – Documentation & coding matter but need to re-learn which matter most
  – Predicts who will be readmitted, not necessarily who should

• Limitations:
  – Socio-economic factors significantly impact readmissions

• Stability:
  – Midas continues to update/enhance model
  – ICD-10 impact
  – Annual model updates vs. Hoag fiscal year

• System Comparisons
  – Comparing readmission rates with hospitals using other methodologies
Introducing XRA - Lessons Learned

• Educate early and often
  – Sr. Leaders, Clinical Teams, all those impacted
• Keep message simple - tailor to audience
• Discuss benefits of patient level risk model
• Ensure you know who the ‘usual suspects’ are
• Work closely with Xerox
Data Analytics Using XRA

• Using XRA to target interventions

• What’s driving readmission performance?
  – Documentation & coding?
  – Post-Acute performance?
  – LOS?
  – Other?

• It’s all about the “Observed / Expected”!
Acute Care Readmissions – o:e

Source: Midas+ XRA Readmission Index - Same Server.
Exclusions: Obstetric & newborn patients.
Updated: March 9, 2016 (data thru Jan 2016)
Acute Care Volume

- 4.5% of patients have a risk of >30%
- 53% of patients have a risk of >10%
Acute Care Readmissions

- 75% of readmissions occurred in patients with >10%
- 11% of readmissions occurred in patients with >30%

![Actual Readmissions by Risk Group](chart.png)
Acute Care Readmissions

Actual Readmission Rate by Risk Group

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%-10%</td>
<td>5.0%</td>
</tr>
<tr>
<td>10%-20%</td>
<td>13.3%</td>
</tr>
<tr>
<td>20%-30%</td>
<td>23.1%</td>
</tr>
<tr>
<td>30%-40%</td>
<td>27.6%</td>
</tr>
<tr>
<td>40%-100%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Not XRA Scored</td>
<td>13.2%</td>
</tr>
</tbody>
</table>

O:E Ratio by Risk Group

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%-10%</td>
<td>0.775</td>
</tr>
<tr>
<td>10%-20%</td>
<td>0.937</td>
</tr>
<tr>
<td>20%-30%</td>
<td>0.960</td>
</tr>
<tr>
<td>30%-40%</td>
<td>0.812</td>
</tr>
<tr>
<td>40%-100%</td>
<td>0.598</td>
</tr>
<tr>
<td>Not XRA Scored</td>
<td></td>
</tr>
</tbody>
</table>

July 2015 – Dec 2016 Data from Midas

Insight-Driven Transformation - 2016 Midas+ Annual Symposium
## Acute Care Readmissions – MS-DRG

### Discharges

<table>
<thead>
<tr>
<th>Condition</th>
<th>Discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia or Severe Sepsis</td>
<td>2557</td>
</tr>
<tr>
<td>Esophagusitis, Gastroent &amp; Misc Digest</td>
<td>861</td>
</tr>
<tr>
<td>Intracranial Hemorrhage or Cerebral</td>
<td>745</td>
</tr>
<tr>
<td>G.I. Hemorrhage</td>
<td>743</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>658</td>
</tr>
<tr>
<td>Major Small &amp; Large Bowel Procedures</td>
<td>637</td>
</tr>
<tr>
<td>Heart Failure &amp; Shock</td>
<td>610</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>600</td>
</tr>
<tr>
<td>Kidney &amp; Urinary Tract Infections</td>
<td>575</td>
</tr>
<tr>
<td>Laparoscopic Cholecystectomy W/O...</td>
<td>561</td>
</tr>
<tr>
<td>Respiratory Infections &amp;...</td>
<td>533</td>
</tr>
<tr>
<td>G.I. Obstruction</td>
<td>510</td>
</tr>
<tr>
<td>Nutritional &amp; Misc Metabolic Disorders</td>
<td>477</td>
</tr>
<tr>
<td>Cardiac Arrhythmia &amp; Conduction...</td>
<td>467</td>
</tr>
<tr>
<td>Simple Pneumonia &amp; Pleurisy</td>
<td>459</td>
</tr>
<tr>
<td>Infectious &amp; Parasitic Diseases W/O...</td>
<td>411</td>
</tr>
<tr>
<td>Perc Cardiovasc Proc W Drug-Eluting...</td>
<td>390</td>
</tr>
<tr>
<td>Craniotomy &amp; Endovascular...</td>
<td>387</td>
</tr>
<tr>
<td>Disorders of Pancreas Except...</td>
<td>386</td>
</tr>
<tr>
<td>Pulmonary Edema &amp; Respiratory...</td>
<td>371</td>
</tr>
<tr>
<td>Other Antepartum Diagnoses W...</td>
<td>340</td>
</tr>
<tr>
<td>Other Digestive System Diagnoses</td>
<td>318</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease</td>
<td>306</td>
</tr>
<tr>
<td>Cardiac Valve &amp; Other Major...</td>
<td>303</td>
</tr>
<tr>
<td>Other Kidney &amp; Urinary Tract Diagnoses</td>
<td>302</td>
</tr>
</tbody>
</table>

### Readmissions Rate

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia or Severe Sepsis</td>
<td>14.4%</td>
</tr>
<tr>
<td>Esophagusitis, Gastroent &amp; Misc Digest</td>
<td>13.2%</td>
</tr>
<tr>
<td>Intracranial Hemorrhage or Cerebral</td>
<td>10.1%</td>
</tr>
<tr>
<td>G.I. Hemorrhage</td>
<td>13.6%</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>16.6%</td>
</tr>
<tr>
<td>Major Small &amp; Large Bowel Procedures</td>
<td>11.6%</td>
</tr>
<tr>
<td>Heart Failure &amp; Shock</td>
<td>18.0%</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>9.3%</td>
</tr>
<tr>
<td>Kidney &amp; Urinary Tract Infections</td>
<td>14.6%</td>
</tr>
<tr>
<td>Laparoscopic Cholecystectomy W/O...</td>
<td>4.6%</td>
</tr>
<tr>
<td>Respiratory Infections &amp;...</td>
<td>17.6%</td>
</tr>
<tr>
<td>G.I. Obstruction</td>
<td>12.2%</td>
</tr>
<tr>
<td>Nutritional &amp; Misc Metabolic Disorders</td>
<td>14.9%</td>
</tr>
<tr>
<td>Cardiac Arrhythmia &amp; Conduction...</td>
<td>15.2%</td>
</tr>
<tr>
<td>Simple Pneumonia &amp; Pleurisy</td>
<td>11.5%</td>
</tr>
<tr>
<td>Infectious &amp; Parasitic Diseases W/O...</td>
<td>14.6%</td>
</tr>
<tr>
<td>Perc Cardiovasc Proc W Drug-Eluting...</td>
<td>6.4%</td>
</tr>
<tr>
<td>Craniotomy &amp; Endovascular...</td>
<td>14.5%</td>
</tr>
<tr>
<td>Disorders of Pancreas Except...</td>
<td>11.9%</td>
</tr>
<tr>
<td>Pulmonary Edema &amp; Respiratory...</td>
<td>15.9%</td>
</tr>
<tr>
<td>Other Antepartum Diagnoses W...</td>
<td>6.2%</td>
</tr>
<tr>
<td>Other Digestive System Diagnoses</td>
<td>15.1%</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease</td>
<td>13.7%</td>
</tr>
<tr>
<td>Cardiac Valve &amp; Other Major...</td>
<td>8.9%</td>
</tr>
<tr>
<td>Other Kidney &amp; Urinary Tract Diagnoses</td>
<td>18.2%</td>
</tr>
</tbody>
</table>

### O/E Ratio

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia or Severe Sepsis</td>
<td>0.84</td>
</tr>
<tr>
<td>Esophagusitis, Gastroent &amp; Misc Digest</td>
<td>1.02</td>
</tr>
<tr>
<td>Intracranial Hemorrhage or Cerebral</td>
<td>1.08</td>
</tr>
<tr>
<td>G.I. Hemorrhage</td>
<td>0.98</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>0.90</td>
</tr>
<tr>
<td>Major Small &amp; Large Bowel Procedures</td>
<td>0.94</td>
</tr>
<tr>
<td>Heart Failure &amp; Shock</td>
<td>0.91</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>0.86</td>
</tr>
<tr>
<td>Kidney &amp; Urinary Tract Infections</td>
<td>1.05</td>
</tr>
<tr>
<td>Laparoscopic Cholecystectomy W/O...</td>
<td>0.68</td>
</tr>
<tr>
<td>Respiratory Infections &amp;...</td>
<td>0.95</td>
</tr>
<tr>
<td>G.I. Obstruction</td>
<td>0.90</td>
</tr>
<tr>
<td>Nutritional &amp; Misc Metabolic Disorders</td>
<td>0.82</td>
</tr>
<tr>
<td>Cardiac Arrhythmia &amp; Conduction...</td>
<td>1.20</td>
</tr>
<tr>
<td>Simple Pneumonia &amp; Pleurisy</td>
<td>0.83</td>
</tr>
<tr>
<td>Infectious &amp; Parasitic Diseases W/O...</td>
<td>0.87</td>
</tr>
<tr>
<td>Perc Cardiovasc Proc W Drug-Eluting...</td>
<td>1.00</td>
</tr>
<tr>
<td>Craniotomy &amp; Endovascular...</td>
<td>1.28</td>
</tr>
<tr>
<td>Disorders of Pancreas Except...</td>
<td>0.88</td>
</tr>
<tr>
<td>Pulmonary Edema &amp; Respiratory...</td>
<td>0.79</td>
</tr>
<tr>
<td>Other Antepartum Diagnoses W...</td>
<td>0.83</td>
</tr>
<tr>
<td>Other Digestive System Diagnoses</td>
<td>0.76</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease</td>
<td>0.82</td>
</tr>
<tr>
<td>Cardiac Valve &amp; Other Major...</td>
<td>0.94</td>
</tr>
<tr>
<td>Other Kidney &amp; Urinary Tract Diagnoses</td>
<td>1.03</td>
</tr>
</tbody>
</table>

### Required Saves

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia or Severe Sepsis</td>
<td>9.4</td>
</tr>
<tr>
<td>Esophagusitis, Gastroent &amp; Misc Digest</td>
<td>22.2</td>
</tr>
<tr>
<td>Intracranial Hemorrhage or Cerebral</td>
<td>18.1</td>
</tr>
<tr>
<td>G.I. Hemorrhage</td>
<td>16.9</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>10.1</td>
</tr>
<tr>
<td>Major Small &amp; Large Bowel Procedures</td>
<td>9.2</td>
</tr>
<tr>
<td>Heart Failure &amp; Shock</td>
<td>11.4</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>2.6</td>
</tr>
<tr>
<td>Kidney &amp; Urinary Tract Infections</td>
<td>18.2</td>
</tr>
<tr>
<td>Laparoscopic Cholecystectomy W/O...</td>
<td>12.5</td>
</tr>
<tr>
<td>Respiratory Infections &amp;...</td>
<td>5.7</td>
</tr>
<tr>
<td>G.I. Obstruction</td>
<td>0.5</td>
</tr>
<tr>
<td>Nutritional &amp; Misc Metabolic Disorders</td>
<td>3.2</td>
</tr>
<tr>
<td>Cardiac Arrhythmia &amp; Conduction...</td>
<td>4.5</td>
</tr>
<tr>
<td>Simple Pneumonia &amp; Pleurisy</td>
<td>22.5</td>
</tr>
<tr>
<td>Infectious &amp; Parasitic Diseases W/O...</td>
<td>0.1</td>
</tr>
<tr>
<td>Perc Cardiovasc Proc W Drug-Eluting...</td>
<td>3.2</td>
</tr>
<tr>
<td>Craniotomy &amp; Endovascular...</td>
<td>3.2</td>
</tr>
<tr>
<td>Disorders of Pancreas Except...</td>
<td>3.2</td>
</tr>
<tr>
<td>Pulmonary Edema &amp; Respiratory...</td>
<td>9.6</td>
</tr>
<tr>
<td>Other Antepartum Diagnoses W...</td>
<td>0.2</td>
</tr>
<tr>
<td>Other Digestive System Diagnoses</td>
<td>3.2</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease</td>
<td>(0.1)</td>
</tr>
<tr>
<td>Cardiac Valve &amp; Other Major...</td>
<td>7.1</td>
</tr>
<tr>
<td>Other Kidney &amp; Urinary Tract Diagnoses</td>
<td>20.0</td>
</tr>
</tbody>
</table>

---

*July 2015 – Dec 2016 Data from Midas*

*Insight-Driven Transformation - 2016 Midas+ Annual Symposium*
Optimizing Readmission Work Streams

• CMS Conditions vs. Organization Goals
• Non-CMS Conditions
• Organize Clinical Care Teams
  – Physician
  – RN
  – Navigator
• DRG Focus
## Acute Care Readmissions

### DischargeDisposition

<table>
<thead>
<tr>
<th>Discharge Disposition</th>
<th>Discharge Disposition Rate</th>
<th>Readmit Rate</th>
<th># Readmitted Patients</th>
<th>o:e ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>58%</td>
<td>9%</td>
<td>1441</td>
<td>0.83</td>
</tr>
<tr>
<td>Home Health</td>
<td>20%</td>
<td>17%</td>
<td>974</td>
<td>1.12</td>
</tr>
<tr>
<td>SNF</td>
<td>14%</td>
<td>19%</td>
<td>739</td>
<td>1.02</td>
</tr>
<tr>
<td>Hospice</td>
<td>3%</td>
<td>2%</td>
<td>20</td>
<td>0.10</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
<td>11%</td>
<td>179</td>
<td>0.66</td>
</tr>
</tbody>
</table>

- SNF and Home Health patients have higher readmission rates
- SNF and Home Health patients have higher o:e ratios
Acute Care Readmissions Language

- 92% of patients are English speaking
- 4.8% speak Spanish, Persian or Vietnamese
Acute Care Readmissions

Payer

- Similar o:e ratios across financial classes

*July 2015 – Dec 2016 Data from Midas*

*Insight-Driven Transformation - 2016 Midas+ Annual Symposium*
Acute Care Readmissions
Discharge Time

- 18% of patients discharged 6am-1pm
- Readmission risk increases with time of discharge
  - more complex pts
  - poor discharge process
- o:e ratio also increases
- Causation vs. correlation?
Readmissions Program Structure

• Organizational Goals
• Governance Structure
• Process Improvement Structure
  – Clinical Care Teams
  – Navigators
  – Preferred Network Partners
  – Strategic Analytics
• Limited Resources → Targeted Efforts
Operational Tactics

1. Goal Alignment with Clinical Care Teams
2. SNF/Home Health Preferred Partners
3. Hospitalist rounding at SNFs
4. Care Navigator
Clinical Care Teams

• Education on organizational goals
• Data analysis
• Chart reviews
• Improvement opportunities
  – Documentation/coding
  – Educating post-acutes
  – Patient health literacy
• Identify patients in ED
SNF/HHA Preferred Partners

- Network of post-acute providers
- Optimize care transition
- Accountability for readmissions
- Wrap-around
- Most patients ‘in-network’ → patient choice
Hospitalist Rounding at SNFs

- Primary Hospitalist Group at Hoag
- 6 of 7 preferred SNF partners
- Hoag patients only
- Track service utilization → labs, meds, imaging, etc.
- Discharge summary to PCP
Care Navigator

- Pilot project → 75 patients
- Goal → Reduce day readmissions
- LCSW
- Sociodemographic challenges
- Coordinate post-acute activity
  - Clinical Care teams
  - SNF/HHA
  - Pharmacy
  - DME
Question and Dialogue Time

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