How AI Enabled a Community Hospital to Tackle Clinical Variation
And Reduce Length-of-Stay
Topics I will cover

- Why use AI for Managing Clinical Variation
• Topics I will cover
  • Why use AI for Managing Clinical Variation
  • What we at Flagler Hospital have done
• Topics I will cover
  • Why use AI for Managing Clinical Variation
  • What we at Flagler Hospital have done
  • How we operationalized it
Topics I will cover

- Why use AI for Managing Clinical Variation
- What we at Flagler Hospital have done
- How we operationalized it
- Our Results
Why reducing Clinical Variation Is Important

• $750+ B wasted on unnecessary care
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• Medical mistakes are now the 3rd leading cause of death in the USA
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Why reducing Clinical Variation Is Important

• $750+ B wasted on unnecessary care
• Medical mistakes are now the 3rd leading cause of death in the USA
• Now the 3rd leading cause of death in Canada
• WHO reports 95,000 deaths in Europe due to Medical Errors (15th ?)
$750 B

2012 Institute of Medicine

Percent

- Necessary
- Unnecessary
- Deaths
Variation in Healthcare Expenditures 2011 AHA

Unexplained
Types of Variation

• Common Cause Variation

• Special Cause Variation
Types of Variation

• Common Cause Variation
  • It is always present

• Special Cause Variation
Types of Variation

• **Common Cause Variation**
  • It is always present
  • It is inherent in the process

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• **Not knowing the difference will create wasted time & effort**
• Hospitals have tried for years to reduce clinical variation
• We gather the data we think is important
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  • We gather the data we think is important
  • We analyze the data then try to implement our findings
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  • We gather the data we think is important
  • We analyze the data then try to implement our findings
• By the time we act, the data may have changed significantly
Over the past several years, three things have changed:

- We now have massive computational power.
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- We now have massive computational power
- Our EMR has massive amounts of data
- AI systems like Ayasdi can now look at all the data and answer questions we did not know to ask.
Methods of AI
Methods of AI

• Supervised Learning
Methods of AI

• Supervised Learning

• Unsupervised Learning
Methods of Al

• Supervised Learning
• Unsupervised Learning

• Ayasdi uses unsupervised learning and a branch of mathematics called Topology
Methods of AI

• Supervised Learning
• Unsupervised Learning
• Ayasdi uses unsupervised learning and a branch of mathematics called Topology
• Euler, in 1736 solution to the 7 bridges of Konigsberg
Topological Map of our Pneumonia Pilot
Or Team
• What did we need to do?
  • 2,500 lines of SQL code to extract the data
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  • Perform Semantic and Syntactic Validation
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• Generate the Treatment Groups
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  • Upload to Ayasdi
  • Perform Semantic and Syntactic Validation
  • Generate the Treatment Groups
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  • Ayasdi generates the CarePath GL Cohort
• Begin monitoring our providers
Pneumonia20180810 | Population Explorer

BASE

All Patients in Cohort | 1605 patients | encounter_UD_CarePathVersion has BASE

All Patients in Cohort

125 Patients at $3384

125 Patients
$3,384 Avg. Cost
$3,197 Median Cost

4.54 days Avg. Length of Stay
4.00 days Median Length of Stay

Flagler Hospital (Mode: 125)

- copd (36.0%)
- hypertension (77.5%)
- readmitted (3.8%)
- diabetes (67.1%)
- heart_failure (27.2%)

Choose a treatment group to see their
<table>
<thead>
<tr>
<th>COLUMN NAME</th>
<th>KS SCORE</th>
<th>P-VALUE</th>
<th>DISTRIBUTION</th>
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### Pneumonia/200810

<table>
<thead>
<tr>
<th>Event</th>
<th>Time (in minutes)</th>
<th>Description</th>
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<tbody>
<tr>
<td>ED.</td>
<td>6</td>
<td>PULM Pneumonia</td>
</tr>
<tr>
<td>PNA-Admit Date/Time</td>
<td>6</td>
<td>MED. Pneumonia, Comm. Acquired (CAP)</td>
</tr>
<tr>
<td>Electrocardiogram</td>
<td>6</td>
<td>ADHESION</td>
</tr>
<tr>
<td>CXRBS Profile</td>
<td>6</td>
<td>Excess Time</td>
</tr>
<tr>
<td>Comprehensive Metabolic Panel</td>
<td>6</td>
<td>Equivalent event</td>
</tr>
<tr>
<td>CR CHEST AP</td>
<td>6</td>
<td>Any MED</td>
</tr>
<tr>
<td>Urinalysis and Microscopic</td>
<td>6</td>
<td>Find an event</td>
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<tr>
<td>Preceded</td>
<td>6</td>
<td>PULM Neumonia/Pneumonia</td>
</tr>
<tr>
<td>Vital Signs</td>
<td>6</td>
<td>Adverse Reaction</td>
</tr>
<tr>
<td>Blood Culture</td>
<td>6</td>
<td>Adverse Reaction Range</td>
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<tr>
<td>Pneumonia</td>
<td>6</td>
<td>Adverse Reaction Range Prefix</td>
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<tr>
<td>Antibiotic Order</td>
<td>6</td>
<td>Adverse Reaction Range Suffix</td>
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<td>Oxygen Therapy</td>
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### Physician Analysis

<table>
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<tr>
<th>PHYSICIAN</th>
<th>NUM</th>
<th>ADH</th>
<th>DVC</th>
<th>STAY</th>
<th>READM</th>
<th>COPD</th>
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<td>127</td>
<td>No events</td>
<td>$2,878.99</td>
<td>5.34 days</td>
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<td>No events</td>
<td>$1,647.32</td>
<td>4.60 days</td>
<td>0.10 day</td>
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<td>75</td>
<td>No events</td>
<td>$1,564.20</td>
<td>7.70 days</td>
<td>1.00 day</td>
<td>1.00 day</td>
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<td>No events</td>
<td>75</td>
<td>No events</td>
<td>$4,853.87</td>
<td>3.54 days</td>
<td>2.00 day</td>
<td>2.00 day</td>
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<td>No events</td>
<td>$4,196.43</td>
<td>3.66 days</td>
<td>6.00 day</td>
<td>6.00 day</td>
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<td>61</td>
<td>No events</td>
<td>$1,561.84</td>
<td>4.15 days</td>
<td>6.00 day</td>
<td>6.00 day</td>
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<td>5.05 days</td>
<td>4.00 day</td>
<td>4.00 day</td>
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<td>6.20 days</td>
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<td>4.20 days</td>
<td>4.00 day</td>
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<td>$1,185.01</td>
<td>5.97 days</td>
<td>0.00 day</td>
<td>0.00 day</td>
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<tr>
<td>No events</td>
<td>45</td>
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<td>$1,561.82</td>
<td>6.00 days</td>
<td>2.00 day</td>
<td>2.00 day</td>
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<td>$4,797.79</td>
<td>3.07 days</td>
<td>0.00 day</td>
<td>0.00 day</td>
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<tr>
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<td>7.65 days</td>
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<td>5.77 days</td>
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<tr>
<td>No events</td>
<td>30</td>
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<td>$1,034.65</td>
<td>3.00 day</td>
<td>3.00 day</td>
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<tr>
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<td>20</td>
<td>No events</td>
<td>$4,029.68</td>
<td>4.93 days</td>
<td>3.33 day</td>
<td>3.33 day</td>
</tr>
</tbody>
</table>
Comorbid Conditions

Pneumonia

- Cohort 216: Diabetes 2.3%, COPD 8.9%, CHF 12.1%, Hypotension 14.8%, Mortality 24.4%
- Cohort 124: Diabetes 1.6%, COPD 8.5%, CHF 16.5%, Hypotension 18.5%, Mortality 31.5%
- Cohort 108: Diabetes 4.6%, COPD 13.5%, CHF 16.5%, Hypotension 13.5%, Mortality 31.0%
- Cohort 103: Diabetes 8.8%, COPD 9.8%, CHF 13.5%, Hypotension 10.0%, Mortality 36.6%
- Cohort 41: Diabetes 4.6%, COPD 16.5%, CHF 13.5%, Hypotension 13.5%, Mortality 36.6%
- Cohort 38: Diabetes 8.8%, COPD 9.8%, CHF 13.5%, Hypotension 10.0%, Mortality 34.2%
- Cohort 35: Diabetes 6.6%, COPD 12.5%, CHF 16.5%, Hypotension 10.0%, Mortality 20.0%
- Cohort 30: Diabetes 3.3%, COPD 10.0%, CHF 13.3%, Hypotension 0.0%, Mortality 25.7%
Cohort Analysis
Septic Shock

- Cohort 89: LOS $13.05, DVC/k 12.30, Readmit 9.0%, Mortality 1.1%
- Cohort 69: LOS $4.21, DVC/k 3.49, Readmit 0.0%, Mortality 0.0%
- Cohort 64: LOS $5.19, DVC/k 4.91, Readmit 9.4%, Mortality 1.6%
- Cohort 57: LOS $3.21, DVC/k 2.89, Readmit 0.0%, Mortality 0.0%
Total Savings
$198,445.04

Savings Booked to Date

- Pneumonia: $35,310.79
- COPD: $17,634.29
- CHF: $49,316.00
- Septic Shock: $171,135.64
- Sepsis w/o Shock: $(74,951.68)
What do you need to do

- Need the SQL skills to retrieve the data
• What do you need to do
  • Need the SQL skills to retrieve the data
  • Bring physicians in early
• What do you need to do
  • Need the SQL skills to retrieve the data
  • Bring physicians in early
  • Recognized that it is an iterative process
• What do you need to do
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• Work hard
• What do you need to do
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  • Work hard
• We can change the world!