Readmission Model: From Thesis to Product

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#AnalyticsX
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- Bachelor’s degree in mathematics from Bucknell University
- Master’s degree in predictive analytics from Northwestern University
- Analytic engineer and program analyst
- Passionate about analyzing and manipulating existing data in new and creative ways to create a better future #data4good

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A healthcare technology, analytics, and clinical services company, dedicated to changing the way healthcare is delivered and improving the lives of the people we serve.

Provides services to more than 1 Million consumers and to hospital, employer, physician practice, and payer clients.
360° Data Enables Care-Based Perspectives

The Care Collaborator® Module

The Care Engager® Module

The Care Optimizer® Module

The Care Modeler® Module
Why should hospitals & payers reduce readmissions?

- The current annual cost of readmissions is **$26 billion**, of which $17 billion is avoidable.
- CMS (Centers for Medicare & Medicaid Services) can **withhold up to 3% of payments** if readmission rates are too high.
- Readmission rates are considered in **hospital ratings** published by CMS.

How do hospitals & payers reduce readmissions?

- **Predictive Analytics**
  - Provide the **same information to the entire care team**, from health plans to hospitals to primary care providers
  - Find **opportunities** for transitional care intervention
  - **Coordinate resources** where they are needed, when they are needed, **the first time**
Data: Centers of Medicare and Medicaid Services (CMS): the 2008 Public Use File

Tool: WEKA

Algorithm: Multilayer Perceptron (MLP)

Results: Model build took >24 hours and the RMSE was 56.99%

Needed a better way to optimize in order to productionalize
Utilized Data Integration Studio 4.9 for data preparation
  - Parameterized to maintain multi-tenancy
  - Schedule based on implementation timelines

Variables explored: utilization, cost, risk, inpatient metrics, comorbidities, Charlson index scores.
Champion Model: Gradient Boosting Model

- Significant Variables
  - Demographics,
  - Previous 2 years inpatient admits
  - Previous 2 years of ER visits
Posterior Probabilities of Validation Data Sets

Validation Set Posterior Probabilities

<table>
<thead>
<tr>
<th>Posterior Probabilities</th>
<th>0.00-0.05</th>
<th>0.05-0.10</th>
<th>0.10-0.15</th>
<th>0.15-0.20</th>
<th>0.20-0.25</th>
<th>0.25-0.30</th>
<th>0.30-0.35</th>
<th>0.35-0.40</th>
<th>0.40-0.45</th>
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Validation Set Summary:
- **0.00-0.05**: 38 cases
- **0.05-0.10**: 22 cases
- **0.10-0.15**: 9 cases
- **0.15-0.20**: 7 cases
- **0.20-0.25**: 10 cases
- **0.25-0.30**: 14 cases
- **0.30-0.35**: 3 cases
- **0.35-0.40**: 1 case
- **0.40-0.45**: 1 case
Implementation in place for the Care Optimizer® and the Care Collaborator® modules

Screenshots are specific to the Care Optimizer® module, but the Care Collaborator® module will also consume the information as part of Population Explorer and Patient Explorer

Dashlets allow end users to click and drill down to more specific information for each cohort of members
### Thesis: Model Development

#### Product Implementation

### Lessons Learned

![Image of Theon Care Optimizer dashboard](image-url)

**Peer Group: Health System**

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>Master Patient ID</th>
<th>Patient Phone Number</th>
<th>Patient Age</th>
<th>Readmi. Risk</th>
<th>Attributed PCP Name</th>
<th>Attributed PCP ID</th>
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Readmission Metric Dashlets in the Care Optimizer Module®

### Readmission Costs

- **Quarter 1**: $284,366.56
- **Quarter 2**: $211,006
- **Quarter 3**: $291,809
- **Quarter 4**: $217,893

### Top 10 Conditions Leading to Readmission

- **Top 10 By Cost**

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Thesis  | Model Development  | Product Implementation  | Lessons Learned
Inpatient Metric Dashlets in the Care Optimizer Module®
Optimize run times to produce output more frequently.

Utilize additional data sources to increase model accuracy: socioeconomic and clinical data.

Explore other data visualizations generated by the Theon platform to increase effective delivery of information.

Apply likelihoods to identify members for outreach and real-time care coordination.

Utilize results to develop more effective care plans.