Targeted Discharge Interventions Using Predictive Analytics

Monday, April 13, 2015

Deidere Miller, BSN, Catholic Health Initiatives, National Director of Acute/Post-Acute Care Management

Elizabeth Brooks, MS, RHIT, PMP, Catholic Health Initiatives, Analytics Center Of Excellence, Analytics Consultant

DISCLAIMER: The views and opinions expressed in this presentation are those of the author and do not necessarily represent official policy or position of HIMSS.
Conflict of Interest

• Deidere Miller, BSN, National Director of Acute/Post-Acute Care Management
  Has no real or apparent conflicts of interest to report.

• Elizabeth Brooks, MS, RHIT, PMP, Analytic Center Of Excellence Consultant
  Has no real or apparent conflicts of interest to report.
1. Explain CHI’s goals as they relate to readmission reduction and post-acute care outcomes.

2. Describe CHI’s readmission strategy and implementation in targeted markets and the desired effects on outcomes.

3. Demonstrate the use of the LACE predictive scoring tool to focus Project RED interventions on target populations. Show how prediction is made actionable by deploying high-risk interventions to the patient sub-population whose LACE score was calculated at 11 and higher.

4. Evaluate triple aim results by utilizing analytics representing experience of care, population health and per capita cost.

5. Differentiate results between two CHI markets, one using and one not using the readmission reduction strategy.
Catholic Health Initiatives (CHI)

- Integrated Health Company managing 105 hospitals, over 800 clinics, and 20+ long-term care organizations
- Expanding our portfolio into Health Information Technology companies, Health Plans, Practice Management and Revenue Cycle Management Companies
- Value Based Programs: 10 Medicare Shared Services Programs, 3 Comprehensive Primary Care Initiative, and 35+ Bundled Payment Care Initiatives

*Orange states represent the CHI health & wellness footprint.*
Introducing The Team -

Executive Sponsor: Christopher Stanley, MD, MBA, Vice President of Population Health

Operational Owner: Deidere Miller, BSN, National Director of Population Health Utilization Effectiveness

Enterprise Intelligence (EI) Operations: Kelly MacCarroll, Program Director, EI Operations

Lead Business Analyst, EI Operations: Pratibha Bajwa

Lead Data Engineer, EI Operations: James A Taylor

Analytics Consultant, Analytics Center of Excellence: Elizabeth Brooks, MS, RHIT, PMP
CHI’s Strategic Journey to Readmissions Reduction

The Big Why:

• Not unique from other Integrated Health Companies!
  – Rising readmission rates
  – Rising Cost of Care
    • Increasing Penalties for readmissions
    • Decreasing reimbursement for care provided
  – Patient Satisfaction
  – Quality of Care!
• Integral to CHI’s transition to a Population Health Strategy
• All built on a platform of Health Information Technology and Analytics
Our Future: Better Care, Better Health, Lower Costs

Yesterday: Fee for Service

Today: Manage the Episode (Traditional Sources)

Tomorrow: Manage Population Health

TRIPLE AIM

- Improved patient experience
- Improved population health outcomes
- Decreased cost
Moving toward Population Health

Accountable Payment Models

Performance Risk
- Cost of Care
- Quality of Care

Utilization Risk
- Volume of Care

Bundled Pricing
- Bundled payments for care improvement program
- Commercial bundled contracts

Pay-for-Performance
- Value-based purchasing
- Readmissions penalties
- Quality-based commercial contracts

Shared Savings
- Medicare Shared Savings program
- Pioneer ACO program
- Commercial ACO contracts
An Enterprise Wide Consistent Approach To Readmission Reduction

Through the development of a standard approach utilizing analytic capabilities, evidence based training and a multi-disciplinary process, we aim to provide the following value:

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>• An increase in patient satisfaction evidenced by an upward trend in specific, related Patient Experience Metrics (HCAHPS).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment/Clinical</td>
<td>• Benefits of an evidence-based approach in reduction of readmissions.</td>
</tr>
<tr>
<td>Electronic Information/Data</td>
<td>• The value of the LACE score result communicated to the EHR during the inpatient stay for the care team.</td>
</tr>
<tr>
<td>Prevention/ Patient Education</td>
<td>• The prevention of unnecessary re-hospitalizations for our most high-risk patients.</td>
</tr>
<tr>
<td>Savings</td>
<td>• Improved identification of high-risk patients to enable the targeting of additional resources on patients who need it the most.</td>
</tr>
</tbody>
</table>
Phase One: Develop the Program

- Research and identify CHI Standard approach to readmission reduction
- Obtain executive approval from Corporate Leadership Councils
- Develop an implementation plan for enterprise wide adoption of standard readmission program
CHI Readmissions Quality Goal

FY15: CHI facilities will reduce readmissions by at least 7% compared to baseline FY13
## Top and Bottom Performance FY14

**Top Performance**

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NE</td>
<td>-16%</td>
</tr>
<tr>
<td>2</td>
<td>WA</td>
<td>-16%</td>
</tr>
<tr>
<td>3</td>
<td>KY</td>
<td>-18%</td>
</tr>
<tr>
<td>4</td>
<td>ND</td>
<td>-22%</td>
</tr>
<tr>
<td>5</td>
<td>KY</td>
<td>-26%</td>
</tr>
<tr>
<td>6</td>
<td>KY</td>
<td>-33%</td>
</tr>
<tr>
<td>7</td>
<td>NE</td>
<td>-33%</td>
</tr>
<tr>
<td>8</td>
<td>KY</td>
<td>-34%</td>
</tr>
<tr>
<td>9</td>
<td>ND</td>
<td>-37%</td>
</tr>
<tr>
<td>10</td>
<td>IA</td>
<td>-40%</td>
</tr>
</tbody>
</table>

**Bottom Performance**

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1**</td>
<td>MN</td>
<td>33%</td>
</tr>
<tr>
<td>2</td>
<td>TN</td>
<td>25%</td>
</tr>
<tr>
<td>3**</td>
<td>ND</td>
<td>22%</td>
</tr>
<tr>
<td>4**</td>
<td>OR</td>
<td>19%</td>
</tr>
<tr>
<td>5**</td>
<td>MN</td>
<td>18%</td>
</tr>
<tr>
<td>6</td>
<td>KY</td>
<td>16%</td>
</tr>
<tr>
<td>7</td>
<td>IA</td>
<td>13%</td>
</tr>
<tr>
<td>8</td>
<td>PA</td>
<td>9%</td>
</tr>
<tr>
<td>9**</td>
<td>ND</td>
<td>6%</td>
</tr>
<tr>
<td>10</td>
<td>KY</td>
<td>6%</td>
</tr>
</tbody>
</table>

22 Facilities Met FY14 Goal  
29 Facilities Did not meet FY14 Goal  
15 Did **reduce** readmissions between 1-5%  

**Is program working/applicable to Critical Access Hospitals???
## The How: CHI Readmission Reduction Program Timeline

### 1QFY14
- Communications for CHI Enterprise Solution for Readmission Reduction (LACE/Project RED)
- LACE/Project RED Presentations to Market Executive Teams

### 2QFY14
- Market Implementation & Trainings

### 3QFY14
- Project RED Service Line Presentations:
  - Hospitalists
  - Cardiovascular
  - Oncology
  - Quality/EBP
  - Clinical Informatics

### 4QFY14
- Automated LACE score Delivery
- CHI Readmission Reduction FY 14 Goal met reduction = 5.6%

### 1QFY15
- Comparison analysis root cause and LACE score
- Set benchmarks using Premier Quality Advisor
- Markets have chosen Readmission Reduction as quality goal in FY15

### 2QFY15
- Track current RED implementation metrics: process and outcome
- Report out on RED metrics
- Continue CHI Readmission Reduction Implementations
CHI’s Strategic Journey to Readmissions Reduction

*The What:*

**Phase 1:** Develop the Program

**Phase 2:** Design and implement underlying Health Information Technology and Analytics

**Phase 3:** Staff Training

**Phase 4:** Analyze Data

**Phase 5:** Draw Conclusions

**Phase 6:** Evaluate and Modify

**Phase Two: Design and implement underlying Health Information Technology and Analytics**

Map and integrate disparate EHRs to the EI Patient Data Repository and data structures

Implement the LACE score algorithm

Return the LACE score as an HL7 result back to the correct EHR within 72 hours of admission
System Architecture & Data Flow

12 – 35 hours round-trip depending upon time of patient check-in.

Processing time begins at 3 a.m., LACE Algorithm runs at 9 a.m., Integration Engine picks-up LACE result messages and delivers them to the EMR where they are filed to the Patient’s EMR results area.

Patient Admit Process, CHI location USA, 24 hours midnight – midnight
Phase Three: Training the Staff

- Train staff on evidence-based practice:
  - risk stratification using the LACE score*
  - intervention, implementing Project RED** (Re-Engineered Discharge)

*van Walravon MD, Carl, Et Al, Derivations and Validation of an Index to Predict Early Death or Unplanned Readmission After Discharge From Hospital to the Community, Canadian Medical Association Journal *April 6, 2010*182(6)

**Brian Jack, MD, Boston University Project Re-Engineered Discharge, 2006
Care Management Training: CHI Care Pathway for High Risk Members

**Acute Care Management Team**
- Multidisciplinary Team Rounds
- Medication Reconciliation
- Follow Up Appointments Made
- Teachback Discharge Plan

**Transitions Management Team**
- Follow Up Phone Call
- Medication Reconciliation
- Review of Discharge Instructions
- Follow Up in Post-Acute Care Setting

**RN Population Health Coach**
- Transitions from Ambulatory Health Coach, if Participating Primary Care Practitioner

**Admission**
- Transitions Management Team
  - Liaison with Acute Care Management Team
  - Receives Discharge Instructions
  - Initial Patient Meeting

**Discharge**
- Transitions Management Team
  - Follow Up MD Appointment
    - Primary Care Practitioner has Discharge Summary and Care Management Notes
    - Patient Brings in Discharge Instructions and Current Medication List
    - Follow Up Testing Appointments Made
    - Meets/Transitions to Ambulatory Health Coach

**Within 72 hours**
- Transitions Management Team

**Within 7 days**
- Transitions Management Team

**Within 15 days**
- Transitions Management Team

**At 30 days and beyond**
- Transitions Management Team
Explaining the LACE Index Tool

The LACE Index Tool includes four data points:

- **Length of Stay** (Maximum Points 6)
- **Acute Admission** (Maximum 3 points)
- **Comorbidity Index** (Maximum 6 points)
- **Emergency Department visits within last 6 months** (Maximum 4 points)

**LACE Score > 10, triggers Project RED**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length of Stay</strong></td>
<td></td>
</tr>
<tr>
<td>1-3 days</td>
<td></td>
</tr>
<tr>
<td>4-6 days</td>
<td></td>
</tr>
<tr>
<td>7-13 days</td>
<td></td>
</tr>
<tr>
<td>14 or more days</td>
<td></td>
</tr>
<tr>
<td><strong>Acute (Emergent) Admission</strong></td>
<td><strong>No Emergent Admission</strong></td>
</tr>
<tr>
<td><strong>CoMorbidity (You can give 6 points max)</strong></td>
<td><strong>No Prior History</strong></td>
</tr>
<tr>
<td>History of Myocardial Infarction (Hx of MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease Range, Diabetes without complications (DM no complications)</td>
<td></td>
</tr>
<tr>
<td>Congestive Heart Failure (CHF), Chronic Obstructive Pulmonary Disease (COPD), Mild Liver Disease, Cancer</td>
<td></td>
</tr>
<tr>
<td>Dementia, Connective Tissue Disease</td>
<td></td>
</tr>
<tr>
<td>Moderate or Severe Liver Disease, HIV Infection</td>
<td></td>
</tr>
<tr>
<td>Metastatic Cancer</td>
<td></td>
</tr>
<tr>
<td><strong>Emergency Room Visits During the Past 6 Months</strong></td>
<td><strong>Em</strong></td>
</tr>
<tr>
<td>0 Visits</td>
<td><strong>er</strong></td>
</tr>
</tbody>
</table>
March 1, 2015
Mrs. Smith admitted 3 days ago with shortness of breath and weight gain of 6 pounds in 2 days over baseline weight.
Pt history: Diabetes, Acute Myocardial Infarction x1 and Congestive Heart Failure. Seen in the Emergency Department 2 times since October.
Dr. Jones started her on Intravenous Lasix 80mg twice daily and she has responded well. Switched to oral Lasix this morning. Planned discharge for tomorrow.

L= 3
A= 3
C= 5
E= 2
Total= 13
# Keeping Mrs. Smith Out of the Hospital: Components of Project RED

## 12 Mutually Reinforcing Principles

1. Ascertain need for and obtain language assistance.
2. Make appointments for follow-up medical appointments and post discharge tests/labs.
3. Plan for the follow-up of results from lab tests or studies that are pending at discharge.
4. Organize post-discharge outpatient services and medical equipment.
5. Identify the correct medicines and a plan for the patient to obtain and take them.
6. Reconcile the discharge plan with national guidelines.
7. Teach a written discharge plan the patient can understand.
8. Educate the patient about his or her diagnosis.
9. Assess the degree of the patient’s understanding of the discharge plan.
10. Review with the patient what to do if a problem arises.
11. Expedite transmission of the discharge summary to clinicians accepting care of the patient.
12. Provide telephone reinforcement of the Discharge Plan.
CHI’s Strategic Journey to Readmissions Reduction

The What:

Phase 1: Develop the Program
Phase 2: Design Health Information Technology and Analytics
Phase 3: Staff Training
Phase 4: Analyze Data
Phase 5: Draw Conclusions
Phase 6: Evaluate and Modify

Phase Three: Analyzing the Data

N=263
Why is there a spike with LACE score 7 & 8???
Facilities Under Study: Profiles

- **Control Hospital, KY**
  - Our control hospital represents the current method or standard procedure to which any new procedure would be compared.
  - Number of beds = 292
  - In other words: no LACE, no Project RED

- **Saint Joseph Medical Center, Tacoma, WA**
  - LACE being used
  - Number of beds = 343
  - Project RED not implemented, however discharge interventions are being used

- **CHI Health Immanuel, Omaha, NE**
  - LACE being used
  - Number of beds = 411
  - Project RED is implemented
Accuracy of LACE Score at CHI at Predicting Discharges

• We want to know how well the LACE score predicts a readmission. To understand this, Logistic Regression was performed.

• For the model,
  – The response variable or Y = success or failure (1 or 0) of a readmission arising from the parent admission. In other words, the dependent variable is discrete (categorical).
  – The explanatory variable X = 1 if the LACE score is > 10, 0 if the LACE score is <= 10
  – H0 (null hypothesis) Facility1 = Facility2 = Facility3
  – Ha (alternative hypothesis) Control Facility 1 > Both Facility 2 & 3

• We examined the R² obtained from running the model for each of the 3 hospitals.
• The R² statistic explains the variability of the response data around its mean; the higher the R² value the more reliable the model is in predicting a response.
• We expect a higher R² for our control hospital.
A Reminder: Quality Improvement is Scientific, But Not Research

Both Quality Improvement and Research use the scientific method, but in different ways.

**QI:**
- Uses the scientific method to help guide iterative ongoing changes, many of which are small in nature.
- Is conducted *in vivo* in messy environments.
- Can have a lower burden of proof.
- Failure=success. We rejoice in something learned.

**Research:**
- Uses the scientific method to establish “truth.”
- Is conducted in controlled environments with a high degree of regulation.
- Very high burden of proof.
- Failure=Failure.
Ability of the Model To Predict: Needs Improvement

- $R^2$ for all facilities very low, not a reliable predictor.
- Discovered data and logic issues, now being addressed.
- As expected, the control hospital has a higher $R^2$

<table>
<thead>
<tr>
<th>Facility</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Hospital, KY</td>
<td>Highest-&gt;</td>
</tr>
<tr>
<td>St Joseph Medical Center, WA</td>
<td>Next</td>
</tr>
<tr>
<td>Immanuel, Omaha, NE</td>
<td>Lowest</td>
</tr>
</tbody>
</table>

- The resulting interventions reduce readmissions where there was a readmission predicted so this reduces the $R^2$.
- This is why a control hospital is needed. Also, look at the RED facility. Note the $R^2$ lowest of all three. **Why is this good?**
- **And we can reject** $H_0$ (null hypothesis) $\text{Facility1} = \text{Facility2} = \text{Facility3}$
CHI’s Strategic Journey to Readmissions Reduction

The What:

Phase 1: Develop the Program
Phase 2: Design Health Information Technology and Analytics
Phase 3: Staff Training
Phase 4: Analyze Data
Phase 5: Draw Conclusions
Phase 6: Evaluate and Modify

Phase Five: Drawing Conclusions...
So, How Did We Do?

Notice Downward Trend-line for Immanuel!
Patient Experience (HCAHPS), Overall Rating

• H0 = All facilities have the same overall rating.

• HA = Facilities using Project RED or other non-EBP discharge intervention process have higher overall rating then the control facility.

• Statistical Method: Descriptive, trended monthly average

Overall Average for the time period:

- KY Control-70%,
- NE Immanuel-77%,
- St Joseph-70%

Check-mark HA.
Patient Experience (HCAHPS), Nurse Communication

- **H0** = All facilities have the same nurse communication rating.
- **HA** = Facilities using Project RED or other non-EBP discharge intervention process have higher nurse communication rating than the control facility.
- Statistical Method: Descriptive, trended monthly average

Overall Average for the time period:

- **KY Control-78%**,
- **NE Immanuel-84%**,
- **St Joseph-80%**

Check-mark HA.
Patient Experience (HCAHPS), Communication about Medicines

- H0 = All facilities have the same communication about medicines rating.
- HA = Facilities using Project RED or other non-EBP discharge intervention process have higher communication about medicine rating than the control facility.

Statistical Method: Descriptive, trended monthly average

Overall Average for the time period:

- KY Control-64%,
- NE Immanuel-70%,
- St Joseph-65%

Check-mark HA.
Patient Experience (HCAHPS), Discharge Information

- H0 = All facilities have the same discharge information rating.
- HA = Facilities using Project RED or other non-EBP discharge intervention process have higher discharge information rating than the control facility.
- Statistical Method: descriptive, trended monthly average

Overall Average for the time period:
- KY Control-87%
- NE Immanuel-92%
- St Joseph-92%

Check-mark HA.
Interpretation:

• We expect a flat or higher post-acute spend in markets that we have deployed RED.

• This graph shows that post-acute spend is higher in the Alegent market as expected.

• Also in the Alegent market we do see a flattening of the trend-line for post-acute spend.

• Data source: MSSP claims data

(Side note: administrative cost at RED markets increases due to additional Care Coordinator FTEs needed to support the initiative.)
Staff Satisfaction

**Interpretation:**

We expect staff satisfaction to be higher in facilities where both LACE/Project RED are implemented.

This bar chart shows that greater than 50% of staff agree use of the standard readmission program improves job satisfaction.

Also noted, dissatisfaction is higher among facilities not using standard readmission program.

- The automated LACE score improved the discharge process at my facility.
- Implementing Project RED has improved the discharge process at my facility.
- Use of LACE/Project RED has improved how I do my job.
- Use of LACE/Project RED has the time it takes do my job.
- Use of LACE/Project RED has improved my job satisfaction.
CHI’s Strategic Journey to Readmissions Reduction

The What:

Phase 1: Develop the Program
Phase 2: Design Health Information Technology and Analytics
Phase 3: Staff Training
Phase 4: Analyze Data
Phase 5: Draw Conclusions
Phase 6: Evaluate and Modify

Phase Six: Evaluate and Modify…
Conclusions: Lessons Learned and Needed Adjustments

1. Continued evaluation of LACE score required, data shows possible misses at scores between 7 & 9

2. Evaluate population by diagnosis code and consider exclusion diagnoses as majority triggers false positive.

3. Improved collaboration of the care team, as LACE score provides centering point for risk of re-hospitalization.

4. Challenge with disparate data systems. Analysis would be more informative at the patient ID level for all data sources (HCAHPS, MSSP claims, Enterprise Data Warehouse data.)

5. If possible, figure out a bridge solution for item 4 until analytic systems and data sources become more integrated.
6. Due to the nascent stage of healthcare analytics, healthcare data is a somewhat incomplete, somewhat unguided dataset. This requires the use of directional indicators and proxy measurements to point where a deeper dive is necessary.

7. Refine, refine, refine – the data collection system and the analysis. The refinements will enable improvements on subsequent analytic efforts. It is never too late to refine the system – it may be too late to reflect in the current experiment but not for the next. We should have made refinements earlier!

8. Think like a data scientist but also be OK with an evolving, imperfect analytic environment. Be clear on your question, set up the experiment parameters and locate (or set up) data collection systems early.

9. We are on the cusp of everything analytic.
### An Enterprise Wide Consistent Approach To Readmission Reduction

#### Value Measured!

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Satisfaction</strong></td>
<td>- HCAHPS Trends for the Project RED facility are higher than for non-Project RED facilities</td>
</tr>
<tr>
<td><strong>Treatment/Clinical</strong></td>
<td>- The Project RED facility shows a larger downward trend in readmissions over time than non-Project RED facilities.</td>
</tr>
<tr>
<td><strong>Electronic Information/Data</strong></td>
<td>- The LACE score allows the patient care team to focus on the patients that need the most discharge support. This has been a satisfier for direct patient care teams and is reflected in satisfaction surveys.</td>
</tr>
<tr>
<td><strong>Prevention/ Patient Education</strong></td>
<td>- We are beginning to see indication of the prevention of unnecessary re-hospitalizations for our most high-risk patients, as highlighted in the higher R² score of the control hospital.</td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td>- There is no obvious evidence at this time of cost savings. This is a multi-factorial question and requires aggregation of direct spend across multiple settings of care.</td>
</tr>
</tbody>
</table>
Questions?
Contact Information

- Deidere (Dee) Miller, BSN, Catholic Health Initiatives, National Director of Acute/Post-Acute Care Management
  
  deideremiller@catholichealth.net
  
  (720) 484-9296

- Elizabeth Brooks, MS, RHIT, PMP, Catholic Health Initiatives, Analytics Center Of Excellence (ACoE), Analytics Consultant
  
  elizabethbrooks@catholichealth.net
  
  (720) 839-8468