The Impact of Predictive Analytics at Parkland

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Vice-President of Finance, PCCI

Organizational Background

A 501c(3) non-profit research and development corporation specializing in the development of clinical prediction and surveillance software for U.S. hospitals and health systems. PCCI is a controlled affiliate of Parkland Health & Hospital System.

www.pccipieces.org
Mission & Vision

**Mission**
“To Help Save A Life”

**Vision**
“To Deploy Predictive and Surveillance Solutions Around the World that Make Healthcare Safer, Simpler, and Less Stressful”

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Agenda

- The Problem
- Parkland’s Solution
- Results
- Questions
The Problem

- Reduced reimbursement from CMS
  - $0 reimbursement for readmission within 30 days for the same primary diagnosis
  - $0 reimbursement for Hospital Acquired Conditions (HAC)
  - Readmission penalties
  - HAC penalties
  - Value Based Payments
- Medicaid & Commercial Payers will follow CMS lead

Readmission Penalties

- 2013 – 1% max
- 2014 – 2% max
- 2015 – 3% max
Hospital Acquired Conditions

- Deficit Reduction Act of 2005

- Discharges occurring on or after October 1, 2008

- Reporting requirements

HACs

- Reduced payments already in effect

- Starting FY2015, 1% penalty on the hospitals in the lowest quartile for performance
Value Based Payments

• Hospital Inpatient Quality Reporting Program
  – CMS provides ↑ annual update to payment rates for successful reporting & ↓ to payment rates for not reporting
  – Hospital Compare website

• Value Based Purchasing
  – Transform from Passive Payer to Prudent Purchaser
  – 13 of 45 quality measures used to reduce reimbursement in 2013
  – 3 mortality measures added in 2014
  – Funding will result in winners & losers

Parkland’s Medicare Reimbursement

• Medicare patients make up 17% of Parkland’s patients
• Parkland’s HF readmission rate in 2008 was 30%
• 2013 National average for measurement purposes was 24.7%
• Maximum potential loss in reimbursement for Parkland from CMS readmission penalty
  – $612,640 in 2013
  – $1,262,038 in 2014
  – $1,949,848 in 2015
National Focus on Hospital Readmissions

Percent of patients readmitted within 30 days following medical discharge among hospital referral regions (2010)


Parkland’s Solution

- Predictive Analytics
- Software
- Changes to Clinical Workflows

The Secret Sauce
Healthcare is Trending Towards Predictive Analytics to Achieve Better Patient Outcomes

**Present**
- **Measure Generation**
  - Measure development is focused on high burden disease areas, such as heart failure and diabetes, and high-cost events, such as readmissions
- **Pay-for-Performance**
  - Providers and health systems will be held accountable through payment incentives and penalties for their performance on metrics included in public and private reporting programs
- **Value-Based Purchasing**
  - Providers and health systems will also be incentivized for meeting and surpassing care delivery standards established to promote delivery of high quality care
- **Predictive Analytics**
  - Hospitals and health systems are looking to predictive analytics to assist clinicians in complex clinical decision-making

**Future**

**PCCI's predictive analytics system, Pieces™, can assist hospitals and health systems deliver high quality care to ensure optimal patient outcomes and efficient care delivery systems**

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**JAMA Systematic Review, October 19, 2011**

**Risk Prediction Models for Hospital Readmission: A Systematic Review**

*Devan Kassagura, MD, MCR*
*Honora Englebardt, MD*
*Amanda Salamone, MD, MS, MSPH*
*David Kagen, MD*
*Geordie Theobald, MD*
*Michele Freeman, MPH*
*Sumil Kripalu, MD, MSc*

In an increasing body of literature attempts to describe and validate hospital readmission risk prediction tools, interest in such models has grown for clinicians. Predicting hospital readmission risk is of great interest to identify which patients would benefit most from care transition interventions, as well as to risk-adjust readmission rates for the purposes of hospital comparison. Objective: To summarize validated readmission risk prediction models, describe their performance, and assess suitability for clinical or administrative use.

**Data Sources and Study Selection**
The databases of MEDLINE, EMBASE, and the Cochrane Library were searched from inception through March 2011, the EMBASE database was searched through August 2011, and hand searches were performed of the retrieved reference lists. Dual review was conducted to identify studies published in the English language of prediction models tested with medical patients in both derivation and validation cohorts.

**Data Extraction**
Data were extracted on the population, setting, sample size, follow-up interval, readmission rate, model discrimination and calibration, type of data used, and timing of data collection.

**CLINICIAN'S CORNER**

*1688 JAMA, October 19, 2011—Vol 306, No. 15*
Readmission risk models intended for clinical use have requirements and limitations. [They must] provide data prior to discharge, discriminate high- from low-risk patients, and be adapted to the settings and populations in which they are to be used. [Out of 7,785 approaches reviewed], few models met all these criteria, and only 1 of these had acceptable discriminative ability. (Amarasingham et al.)

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Pieces™ Architecture

How Pieces™ Thinks
Natural Language Processing

“68 yo WF presents with acute on chronic non ischemic systolic and diastolic chf, severely depressed ef and grade ii diastolic dysfunction.”

<table>
<thead>
<tr>
<th>Disease/ Symptom</th>
<th>Time</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Heart Failure</td>
<td>current and primary</td>
<td>• Systolic, severely depressed systolic;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Diastolic dysfunction, grade 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Non-ischemic</td>
</tr>
<tr>
<td>Chronic Heart Failure</td>
<td>historic</td>
<td></td>
</tr>
</tbody>
</table>

Natural Language Processing

“54 yo HM with history of diastolic chf and primary hypoventilation syndrome, htn, who presents to ed with back pain”

<table>
<thead>
<tr>
<th>Disease/ Symptom</th>
<th>Time</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive Heart Failure</td>
<td>Historic</td>
<td>Diastolic</td>
</tr>
<tr>
<td>Primary Hypoventilation Syndrome</td>
<td>Historic</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>Historic</td>
<td></td>
</tr>
<tr>
<td>Back Pain</td>
<td>Current and Primary</td>
<td></td>
</tr>
</tbody>
</table>
Natural Language Processing

“55 yo m c h/o dm, cri. now with adib rvr, chfexac, and rle cellulitis going to 10W, tele”

<table>
<thead>
<tr>
<th>Diagnosis Present</th>
<th>Acute</th>
<th>Body part</th>
<th>Location</th>
<th>Severe</th>
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</thead>
<tbody>
<tr>
<td>Heart Failure</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>Yes</td>
<td>Leg</td>
<td>Right</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Data Mining

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Acute</th>
<th>Body part</th>
<th>Location</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Failure</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Physical Exam: +S3
- Review of Systems: Paroxysmal Nocturnal Dyspnea
- Pro-NT BNP ordered
- IV lasix given

90% likelihood that heart failure will be the final coded diagnosis on discharge.
Pieces™ Readmission Predictive Modeling Workflow

Real-Time HL7 based interface EMR application

Interventional Approach

Identification of HF patients in Real-Time Using Natural Language Processing and Data Mining
Pieces™

2 Ranking of HF Patients into Risk Categories

Intervention Approach

3 Notification of Specialized Care Transition Team. HF nurse practitioner, pharmacist, nutritionist, case manager sees and evaluates patient enrolling 1-2 patients per day Monday through Friday. No additional staff except for .5 FTE.
**Intervention Approach**

1. Discharge Plans Established. HF appointment in 7 days, home visit in 2 weeks, guaranteed COPC 30 days, free medications and visits for uninsured.

**Pieces™**

5. Monitoring of Inpatient and Outpatient Activity. Completion of appointments, phone calls, home visit.
• Concentrated care management efforts on ¼ of the patients
• 26% relative reduction in odds of readmission
• Absolute reduction of 5 readmissions per 100 index admissions
Parkland’s Results

- Parkland’s HF readmission rate:
  - 2008: 30%
  - 2013: 23.90%
- 2013 National average – 24.7%
- No loss in reimbursement from CMS penalty
- Approximately $61,000 in cost savings from reduced readmissions

Improved Treatment Cost

<table>
<thead>
<tr>
<th>MS-DRG 292</th>
<th>2008</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td># Enctrs</td>
<td>286</td>
<td>443</td>
</tr>
<tr>
<td>Average Direct Cost</td>
<td>$4,000</td>
<td>$3,800</td>
</tr>
<tr>
<td>Average Total Cost</td>
<td>7,000</td>
<td>7,288</td>
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Average direct cost reduction = $200

After adjusting for inflation:
2012 average direct cost = $3253
Average direct cost reduction = $747
Percent reduction = 18.6%
Value of PIECES

• Avoiding Medicare Readmission & Value Based Payment Penalties
• Avoiding future Medicaid penalties (Plan to follow Medicare’s lead)
• Reducing costs of:
  – Readmission
  – Treatment

Media Accolades
Questions

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