Quality Renal Care - A Data Analytics Approach

Speakers:

Janakiraman Pandian, Senior Data Architect
Terry Richardson, Director
Clinical and Business Analytics: Processes and Collaborative Work

- **Problem Definition**
  - Who is the customer?
  - What problem are we trying to solve?
  - Is this the right problem?
  - What is the value added?

- **Research**
  - Literature Review
  - Security Review

- **Data Discovery**
  - Identify data sources
  - Collect new data if needed
  - Merge, join, augment as appropriate

- **Descriptive Analytics**
  - Understand the structure of the data sets. Establish the meaning of the data.
  - Identify errors, outliers, case-deficient groups, etc.
  - Understand statistical properties of the data set.

- **Predictive Analytics**
  - Methodology Assessment
  - Train Model
  - Test Model

- **BI Development**
  - Validate
  - Automate
  - Integrate
  - Train

- **Implementation**

- **Requirements Scope Project Management**

- **QA/Training**
  - Clinical and Business Analytics: Processes and Collaborative Work
Clinical and Business Analytics: Software Development

Currently

• 50+ Applications in Production

• 10 Applications currently in Development

• 50+ Additional Care Process Models (CPMs)
Clinical and Business Analytics: Business Intelligence

We build Analytics applications that help users get information from their data so they can… Measure What Matters.

• Mission Analytics builds applications through collaborative work with customers and partners.
• Deliver new ways to analyze large amounts of data.
• Create displays that are pleasing, appropriate, and easily interpreted.
• Key to getting predictive analytics recommendations integrated into the workflow.
• Our projects are organized, and end-user focused because of project management and collaboration.
• Our data is validated, reliable, and regularly refreshed because of our Data Architects and Sourcing teams.
• Our work is forward-thinking because of the work and research of our Data Scientists.
• Our work pushes limits because the Training and Quality Assurance team teaches users how to get the most out of our applications.
Clinical and Business Analytics: Business Intelligence

- Data Presentation
- User Experience
- Guided Analytics
Clinical and Business Analytics:
Training and Quality Assurance Materials

- User Guides
- Applications Training Classes
- Quick Reference Guides
- Use Case Scenarios
- Application Quality Assurance
Capability – Influence Model

Analytics Scope of Influence

- What is the best course of action?
- How can I influence the future?
- What are likely future outcomes?
- Why did this occur?
- What happened?
- What exactly is the problem?
- How many, how often, where?
- What action is needed?

Data Science Skillsets

- Reporting/Dashboard Skillsets
- Alerts and Triggers
- Statistical Analysis
- Forecasting
- Predictive What-if Analysis
- Recommender Systems

Analytics Capability

- Data
- Insight
- Foresight
- Optimization

Mission Health
Clinical and Business Analytics: Working towards the future

- Mobile-Friendly Applications
- Device-Adaptive Designs
- Larger Datasets
- Faster Rendering of Data
- Custom and self serve reporting
- Predictive Analytics
- Recommender Systems
- Geo-Analytics
Quality Renal Care

A Data Analytics Approach
About Kidneys
The kidneys are two bean shaped organs located on both sides of the spine, behind the stomach. Kidneys are vital to your health, although you need just one functioning kidney to live a normal, healthy life. Each kidney is made up of about a million filtering units called nephrons. The nephron includes a filter, called the glomerulus, and a tubule.

Did you know
One fifth of the blood pumped by your heart goes to the kidneys, where it is processed and filtered. Excess water, salt, minerals and waste are sent to the bladder as urine and ‘clean’ blood is returned to circulation. It takes just five minutes for all of your blood to be filtered by the kidney which means in 24 hours, your kidneys will filter all of your blood 288 times.

Anatomy
Each kidney is made up of about a million filtering units called nephrons. The nephron includes a filter, called the glomerulus, and a tubule.

Function
The kidneys perform many important functions for your body. Some of these functions include:
• Filtering extra water and toxins from the blood
• Produce hormones
• Absorb minerals
• Balancing electrolytes
• Maintaining a normal pH level
• Controlling blood pressure
• Red blood cell production
Acute kidney injury (AKI), formerly called acute renal failure (ARF), is commonly defined as an abrupt decline in renal function, clinically manifesting as a reversible acute increase in nitrogen waste products—measured by blood urea nitrogen (BUN) and serum creatinine levels—over the course of hours to weeks. The vague nature of this definition has historically made it difficult to compare between scholarly works and to generalize findings on epidemiologic studies of AKI to patient populations. Several classification systems have been developed to streamline research and clinical practice with respect to AKI.

Classification Systems for Acute Kidney Injury
Classification Systems for Acute Kidney Injury

Rifle Classification

In 2002, the Acute Dialysis Quality Initiative (ADQI) was created with the primary goal of developing consensus and evidence-based guidelines for the treatment and prevention of acute kidney injury (AKI). The first order of business was to create a uniform, accepted definition of AKI; hence, the RIFLE criteria were born. **RIFLE is an acronym of Risk, Injury, and Failure; and Loss; and End-stage kidney disease.**

---

Acute Kidney Injury Network (AKIN)

AKIN was formed in September 2004. AKIN advised that the term acute kidney injury (AKI) be used to represent the full spectrum of renal injury, from mild to severe, with the latter having increased likelihood for unfavorable outcomes.

<table>
<thead>
<tr>
<th>Risk, Injury and Failure; and Loss; and End-stage kidney disease (RIFLE)</th>
<th>GFR / Serum CR (SCr)</th>
<th>Urine output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk</td>
<td>SCr x 1.5; or GFR ↓ by &gt; 25%</td>
<td>&lt; 0.5ml/kg/hr for 6 hours</td>
</tr>
<tr>
<td>Injury</td>
<td>SCr x 2; or GFR ↓ by &gt; 50%</td>
<td>&lt; 0.5ml/kg/hr for 12 hours</td>
</tr>
<tr>
<td>Failure</td>
<td>SCr x 3; or SCr ≥ 4mg/dL; or GFR ↓ by &gt; 75%</td>
<td>&lt; 0.3ml/kg/hr for 24 hours; or anuria for 12 hours</td>
</tr>
</tbody>
</table>

**Acute Kidney Injury Network (AKIN)**

1. Serum creatinine increase ≥26.5 μmol/l (≥0.3 mg/dl) OR increase to 1.5–2.0-fold from baseline <0.5 ml/kg/h for 6h
2. Serum creatinine increase >2.0–3.0-fold from baseline <0.5 ml/kg/h for 12h
3. Serum creatinine increase >3.0-fold from baseline OR serum creatinine ≥354 μmol/l (≥4.0 mg/dl) with an acute increase of at least 44 μmol/l (0.5 mg/dl) OR need for RRT <0.3 ml/kg/h for 24h OR anuria for 12h OR need for RRT
Outcomes

1. Increased patient satisfaction

2. Efficient and Effective Care

3. Patient Education and understanding
Outcome Metrics

What are Readmissions and why Readmission is increasingly an important metric?
Outcome Metrics

Interventions effected Mortality Rates

Mortality Rate Criteria

Interventions and variations for O/E LOS

O/E LOS Criteria
Hemodialysis and ways to perform that? How does this measure help Physicians?

AV Fistulas Care

AVF Care Maintenance
Patients Needing Placement

Fistula Monitoring

At Risk Fistulas

Process Metrics – AV Fistula

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>CVC Access Reason</th>
<th>CVC Reason Date</th>
<th>Vascular Appointment</th>
<th>Vascular Consult In-Hospital</th>
<th>Recent Vein Mapping Date</th>
<th>Fistula Procedure Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Needs Referral for AV Access</td>
<td>2017-02-02</td>
<td>Yes</td>
<td>No</td>
<td>2017-02-06</td>
<td>2017-02-20</td>
</tr>
<tr>
<td></td>
<td>Referred for AV access</td>
<td>2017-01-27</td>
<td>No</td>
<td>No</td>
<td>2017-01-22</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Referred for AV access</td>
<td>2017-02-11</td>
<td>Yes</td>
<td>No</td>
<td>2017-03-08</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Needs Referral for AV Access</td>
<td>2017-01-23</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Patients With Fistulagram Performed within 180 Days

- Patient Name: [Patient Name]
- Fistulagram Performed within 180 Days: [Y]
- Recent Fistulagram Date: [2017-04-13]
- Fistula Surgeon: [Y]
- Carolina Vascular Appt Scheduled: [Y]
- Fistulagrams within 180 days: [3]
- Fistulagrams within 90 days: [1]
- Declot within 90 Days: [-]
- Declot within 180 Days: [-]
- Total Fistulagrams: [8]

Patients With >2 Fistulagrams Performed within 180 Days

- Patient Name: [Patient Name]
- Fistulagram Performed within 180 Days: [Y]
- Recent Fistulagram Date: [2017-01-27]
- Fistula Surgeon: [Y]
- Carolina Vascular Appt Scheduled: [No]
- Fistulagrams within 180 days: [3]
- Fistulagrams within 90 days: [1]
- Declot within 90 Days: [-]
- Declot within 180 Days: [-]
- Total Fistulagrams: [8]
How an Alert is fired?

Approaches to the “Alert fired” patients
Patient List & Rothman Index

Holistic view of Patient details

Rothman Index

Patient List
- MRN/FIN
- Encounter ID
- Patient Name
- Arrive Date
- Discharge DTS
- Age
- Palliative Care Admit Mode

General
- Patient Age
- Patient Name
- Gender
- Race
- Location
- Mode of Arrival
- Admit Source

All Diagnosis Codes
- Priority
- Diagnosis Codes

Dialysis
- Patient on Dialysis
- Hemodialysis Access
- CVC Access Reason
- Renal Diagnosis

Patient Flow

Labs

Procedures

Rothman Index

Rothman Index Score

Referral for transplant

Dialysis Education/Arm Protection:
Nephrologist Consult Needed:
Vein Mapping, Fistula/S graft Placement

Patient Milestones **if needed**

Mission Health
How to incorporate Heart Failure Patients data who are part of Renal Dialysis Cohort?

Care for Renal Patients, who are either chronic or AKI, having a Sepsis infection

Application to be widely expanded to the Ambulatory settings
Questions?