Using Big Data and Predictive Models for Value-Driven Healthcare

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Ms. Wyatt has responsibility for CSC’s Healthcare Provider practice, providing consulting solutions for clinical and revenue cycle operating performance improvement engagements and IT implementation management for leading HIT software platforms. Ms. Wyatt has over 25 years experience in the provider, public accounting and software vendor settings as a senior strategist and service delivery executive. Ms. Wyatt’s clients have included several of the nation’s largest national and regional for-profit and not-for-profit health systems, academic medical centers and the Australian government.
Learning Objectives

Goal: Provide high level briefing of components, processes, applications and case examples of Predictive Analytics in a value-driven healthcare model

Topics

- Review value context
- Review steps to predictive analytics readiness
- Present case examples
- Vendor status
- Next Steps
Hard-working, well-trained and well-intentioned clinicians have attempted to provide value in patient care – which is care delivery at the lowest possible cost with the highest possible quality and/or outcome that matters to the patient – for decades…. 

…but most initiatives have marginally moved the value needle because they were too narrow in scope or missed the point altogether. 

Risk and performance based reimbursement models now make value delivery critical to survival….and timely, accurate, complete, and understandable information is key to leveraging value opportunities.
Key to implementing a value agenda is establishing the vision – which may include six operating components*

**Integrated Practice Units**
- Organized around the patient’s condition
- Deliver full care cycle
- Specialize in specific conditions
- Coordinate care efficiently

**Cost & Outcome Measures**
- Activity based costing at condition/patient level
- Measure value based on cost and predicted/actual outcome
- Outcomes measures from patient view

**Bundled Pricing and Payments**
- Payments for acute episodes
- Payments for chronic conditions over a period of time
- Primary/preventative care
- Adjustments for severity, outcomes

**Enterprise Integration & Geographic Reach**
- 2/3 of all hospitals are in IDNs
- Optimal scope of services at facility level
- Partnerships with specialized or community facilities
- Global relationships

**Provide the IT Platform**
- Patient centered architecture
- Data standardization and data governance
- Condition-based templates
- Comprehensive patient data
- Easily accessible and extractable

*Source: Harvard Business Review, September 2013, Michael Porter and Thomas Lee*
“What If?” Using Big Data and Predictive Analytics for Value-Driven Healthcare

Big data*, harnessed with advanced modeling tools, together with data sharing platforms are key to healthcare’s value transformation

Applications of Data Analytics in a Value Based Operating Model

**Integrated Practice Units**
- Adaptable condition specific protocols
- Patient surveillance
- Population management

**Cost & Outcome Measures**
- Cost/value analysis in treatment plans
- Clinical risk management
- Outcome analysis

**Bundled Payments**
- Cost modeling
- Contract modeling
- Payment allocation
- Gain-sharing model
- Payer collaboration in population health
- Revenue leakage
- Financial forecasts

**Enterprise Integration & Geographic Reach**
- Health information exchange
- System Interoperability

* "Big data" is vast quantities of diverse and rapidly multiplying data, structured and unstructured, that is available at or near real-time
While many hospitals can establish high level business cases for strategic initiatives, create budgets and measure results....

....Most lack the tools, resources or capability to create regression models using “big data” to drill down into performance issues or apply alternative assumptions to data points to optimize results....
Getting Started: Preparing for advanced and predictive analytics is a multi-step process

Data exists in multiple systems and is inconsistent across systems – there is no data management to assure clean data.

Data is standardized across systems to establish a common language and a data "source of truth" is recognized. Data stewardship is implemented at the enterprise level.

Unstructured data is integrated into the universe of data analysis and is accessible as a variable in predictive analysis.

Business priorities and strategy are established. Programs are designed; requirements are established; capabilities are assessed.

Getting Started: Preparing for advanced and predictive analytics is a multi-step process

- Visioning
- Standards & Governance
- Data Assembly
- Data Preparation
- Enterprise Vision
- Current IT State

At the Starting Gate
## Data Governance: Key Process Areas

<table>
<thead>
<tr>
<th>Process Area</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td>Definition of the objectives, processes and success criteria for Data Governance.</td>
</tr>
<tr>
<td><strong>Roles and Responsibilities</strong></td>
<td>Roles and Responsibilities for both Business and IT constituents in the Governance program. Includes overall Data Owner and Steward responsibilities, as well as specific roles such as Data Modeler, DBA, and Data Architect.</td>
</tr>
<tr>
<td><strong>Data Quality</strong></td>
<td>Establishment of ability to measure and improve quality of key information. Includes ability to audit.</td>
</tr>
<tr>
<td><strong>Metadata</strong></td>
<td>Establishment of ability to commonly define and understand the data environment, both business and technical. Business rules.</td>
</tr>
<tr>
<td><strong>Architecture</strong></td>
<td>Establishment of a formal architecture that enables the goals of the organization in regard to data access and usage. Includes the ability to determine appropriate technologies (Technology Stack).</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>Establishment of policies and procedures that enable the organization to protect its data assets and minimize risk.</td>
</tr>
<tr>
<td><strong>Data Management</strong></td>
<td>Establishment of a process to effectively manage the organization’s data assets. Includes Data Integration and Movement, Data Modeling and Database Administration.</td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td>Establishment of quantifiable metrics to measure the success of the Governance program, and a process to audit these metrics.</td>
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Data Assembly: Big Data will be both structured and unstructured, adding complexity and preparation steps

Some facts must be created from multiple cohorts, like a risk assessment

Facts from multiple systems must be normalized and reconciled

Certain facts must be invented, like cost data or a treatment plan

Needed facts required for study must be identified

Clinical Data
- Lab results
- Diagnostic images
- Medications
- Treatments
- Care Plans
- Supply Use
- Care provided

Diagnostic Information
- Diagnosis Codes
- Procedure Codes
- DRG Assignments
- Clinical History

Financial Information
- Account Data
- Insurance carrier
- Insurance Coverage
- Patient balances
- Charges/Costs
- Financial history

Patient demographics
- Patient Preferences
- Episodic History
- Health status
- Risk assessment
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Framework: Includes source data, data collection and management services, BI services and solutions

**Solution Model**

- **Data Consumers**
  - Researchers
  - Biostatisticians/Data Programmers
  - Study Recruiters
  - Clinicians

- **Solutions**
  - Exploratory Data Analysis
  - Protocol Feasibility & Recruitment
  - Outcomes & Economics Research
  - Safety & Public Health Surveillance
  - Quality Reporting & Improvement

- **Intelligence Services**
  - Data on Demand
  - Analytical Tools
  - Pre-Coded Queries & Reports
  - Intervention Triggers
  - Workflow

- **Data Management Services**
  - Data Collection
  - Data Integration
  - Data Management
  - Terminology Management
  - Metadata Management

- **Data Models**

Data Sources (Centralized and Distributed)

- Analysis Results from Distributed Sources
- Clinical Trial Data
- Safety Data
- Claims Data
- EMR Data
- Tissue Samples/Genomic Data
- Operational Data (e.g., CTMS)
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Understand the Possibilities

Example A

Example B

Payer Profitability by Decile

Payer Defection Impact

Activity-based cost, payer/plan, patient and reimbursement data gets us to Example A; a regression model applied to the same data gets us to Example B
Case Example: Population Management for High Risk Patients

Problem: Cost of care was too high and outcome expectations were not met for certain high risk patients

Provider Objective: Reduce cost, improve outcome measures and patient satisfaction for three high risk groups in partnership with a major payer

Approach

• Selected key measures from CMS applicable to commercial patients
• Payer shared key data for risk/spend assessment to isolate risk levels
• Provider invested in BI infrastructure to expand data sharing/analytics capability
• Added coaches to care teams to improve care integration, reduce ED, hospital and readmissions and facilitate successful transitions
• Measure results and share savings, losses

Data Available

• Patient clinical, charge, cost, episodic data and utilization of specific services from internal and payer systems to determine risk level and correlate risk to use specific services
• Note: payer data contains out-of-network data as part of analysis, measures leakage

Result for Targeted Groups

• Reduced ED usage and inpatient admissions
• Reduced inpatient readmissions by 26% and SNF readmissions by 30% and SNF LOS by approximately 30%
• 3.4% increase in in-network utilization – positive utilization trends in 7 of 8 categories
• 2% and 11% growth in HMO and PPO membership respectively – 11,000 members

Source: HFMA, March 2013
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Case Example: At the Starting Gate: Readmission Analysis

Problem: Readmissions and penalty risk are too high; need to manage risks

Client Objective: Determine principle reasons, diseases and costs of readmissions

80 Data Elements Required for Analysis

- Readmitted patients (based on certain selection criteria)
- Patient demographics
- Principle and secondary diagnosis
- Patient clinical data
- … (data)
- … (data)
- Discharge summary

Data Available

- **Structured data**: 30 elements present
- **Unstructured data**: Unknown number of elements present; inability to evaluate/use unstructured data

Result

- Replacing the EMR and re-architecting technology at the enterprise level
Case Example: Integrated, Accessible Data: Treatment Navigation

Clinical Problem: Patient treatment difficulty with Chronic Kidney Disease (CKD) due to variety of diseases, progression rates and risk of cardiovascular mortality

Objective: Determine progression risk of Chronic Kidney Disease (CKD) to Full Renal Failure (Need for Dialysis) in a population with CKD

Required for Analysis

- Patients with CKD of 3-5 (Dx + lab values)
- Patient age, gender, other demographic characteristics
- Selected Clinical documentation data
- Lab values for selected lab tests
- Outcome measures

Data Available

- **Structured data:** Patient demographics, lab data, outcomes
- **Unstructured data:** Clinical documentation

Methodology and Application in Patient Care

- Develop regression model using identified data and mapping/applying patient clinical and demographic data
- Observe patient progression and predict risk of kidney failure
- Apply risk factors to patients with CKD to assess risk; develop treatment plan
- Estimate treatment costs, reimbursement, predict outcomes

Source: JAMA, April 2011
What Two EMR Vendors Are Doing

**Cerner Millennium**

- “Health Intent Smart Registries” can stratify patient populations based on risk, conditions, and attributed physicians
- Predicting and preventing Sepsis using surveillance tools and risk protocols
- Open, Aware and Intelligent systems to shift the current cost baselines by 20%+
- Become the IT platform to discover, predict and prevent disease and enable a personalized experience
- 3 initiatives with IMH: contextual Care Process Models embedded in the workflow, summarized guides to clinical decision making and Time Driven – Activity Based Costing

**EPIC Cogito**

- Pre-built registries and analytical Data Marts for prevalent chronic conditions
- Current clinical intelligence and business intelligence based on role and workflow
- Revenue dashboards to actively manage and work their revenue cycle metrics.
- Clinical integration allows for easier analysis of charge data,
- Denial trends and AR composition.
- Growing library of SAP Business Objects Universes that aggregate and translate complex data structures into simple terms
The 10 Step Program Recapped:

1. Develop the enterprise implementation roadmap
2. Build and test prototype predictive models
3. Manage Value Agenda implementation – operations and HIT
4. Support ongoing BI needs
5. Measure results and evolve operating models and systems
6. Assess current data structure and data governance
7. Implement Data Governance & Data Management model
8. Define data requirements & align/acquire tools for key value initiatives
9. Build your BI modeling framework and collect facts
10. Create Value Agenda and Vision
Some parting thoughts:

- Value-based and predictive analytics are not about IT or data, it is minimally about survival and optimally about growth

- Top line improvement relates to efficient throughput and optimized capacity

- Bottom line improvement relates to understanding efficient IPU care delivery and associated cost structures, bundled pricing and payments

- A gain-sharing partnership between payers/employers and providers based on metrics that matter to both - with joint accountability seems to offer some promise

- Data governance and normalization is very difficult in today’s HIT environment, but using sophisticated BI tools depends upon timely, accurate, available and secure information that care teams can understand