Advanced Analytics in Healthcare

Using data and analytics to improve quality and financial outcomes across the healthcare continuum
We are drowning in data but starving for knowledge!

- unknown author
Data in Healthcare

• 10 X 24th

• Growing at 40% annually

• Largely unstructured – audio dictation, clinical narratives, personal monitors and sensors, images, EMRs, email/text, social media, applications

• 1000’s of EMRs that don’t talk to one another

• Less than 10% of all healthcare organizations in the U.S. are focusing on analytics

• 60% haven’t even started!
The Value of Data

Operations
• Data and analytics drive end-to-end process optimization and improve competitiveness

Analytics
• Value-added descriptive and predictive methods are used to better understand customers and drive strategy

Standard Reporting
• Data is transformed and easily accessed to provide basic insight into key financial and operational business drivers

Raw Data
• Source data exists in a format difficult to get at for end users. Raw data doesn't add value for a company looking to differentiate from its competitors

Increasing Value of Data AND Increasing Levels of Competitiveness
The Healthcare Landscape

• Movement from a volume-based to a value-based business model

• PCP and Nursing shortages require greater efficiency to achieve patient-centric goals

• Entrenched inefficiencies in care caused by poor gathering, sharing and use of information

• Pervasiveness of chronic illnesses with patients living longer

• Patients not fully engaged in their care plans

• Growing complexity throughout the system
The Role of Analytics

- Improve clinical outcomes and care coordination
- Streamline operations and reduce practice costs
- Create actionable insights from data
- Improved understanding of at-risk populations
- Targeted marketing
- Manage patients with chronic illness or poor adherence individually and innovatively
Implementing Analytics - Considerations

- Data Volume
- Data Variety
- Data Integration
- Infrastructure
- Talent
Integrating Big Data in Healthcare
McKinsey 2011 (Big Data Study)

- Healthcare is positioned to benefit greatly from big data as long as barriers to its use can be overcome.

- Each stakeholder group generates huge pools of data, but they have historically been unconnected from each other.

- Recent technical advances have made it easier to collect and analyze information from multiple sources.

- Estimated $450B per year in savings in the health sectors.
BIG Data
BIG Data (con’t)

- Large pools of data that can be captured, communicated, aggregated, stored, and analyzed

- Unstructured data that doesn’t fit well into the relational database structure that we are used to with an EDW

- Nuances of small populations (e.g. gluten allergies) can be included in big data algorithms

- $Q = f(L, K, Data)$
  - Along with human capital and hard assets, data is becoming an ever-greater part of the production function
Oracle Big Data Survey

Organizational Importance of Big Data

- Vital: 40%
- Very: 18%
- Somewhat: 8%
- None: 4%
- Not Sure: 30%

The Lifetime Healthcare Companies
Polling Question

- How important will implementing a Big Data strategy be for your organization within the next 5 years? (Vital/Very/Somewhat/Not At All/Not Sure)
Polling Question

- Is anyone currently involved in a Big Data project within their organization? (Yes/No)

*Less than 10% of companies say they are involved in Big Data at the moment*
The Analytic Possibilities Curve

Business Value

Technical Complexity

Routine Reporting & Monitoring

Routine Analytics

Trending

Data Mining & Evaluation

Forecasting, Predictive Modeling & Campaigns
Advanced Analytic Shortage

“There will be a shortage of talent necessary for organizations to take advantage of big data. By 2018, the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions”(McKinsey)
The Advanced Analytic Process

- Identify Business Problem
- Data Preparation
- Data Exploration
- Transform & Select
- Analytical Modeling
- Validate Models
- Deploy Models
- Evaluate / Monitor Results

80%
Develop an Enterprise Data Roadmap (EDR)

Identify Analytics Goals

Analyze Business User Needs & Capabilities

Evaluate the Data Infrastructure

Identify Data & Process Gaps

The Lifetime Healthcare Companies
Big Data Analysis Techniques – Data Integration

• Data Warehouses (DW) – Combination of data across transactional systems and other sources with the primary purpose being to provide analytics and decision support
  • Internal Integration in healthcare involves integrating data for use by your organization
  • System-wide integration pulls together data from participants across the healthcare continuum

• Analytic Data Marts (ADM) – Targeted data solutions that are more flexible than a DW focusing on a specific department (e.g. Marketing) or function (improving the Quality of Care)

• Data Quality/Master Data Management – Systems to make data more useable and reliable
Big Data Analysis Techniques – Data Integration

• Generation 3 of the All Payer Claims Database (ACPD3) brings in population data in the form of benchmarks

• Costs for diabetic patients with CHF and obesity might be high in absolute value for your plan or ACO, but lower than benchmark → focus care management in other places

• Costs for ER might be lower than budget but high relative to other networks → target intervention programs in this area

• Incorporation of best practices and therapeutic pathways into the APCD system

• Combine with demographic and lifestyle data in a way that allows for individualized medicine
Big Data Analysis Techniques – Data Mining

• Analysis of large quantities of data to extract previously unknown, interesting patterns in data

• Retrospective

• **Cluster analysis** involves determining which records are closely grouped

• **Anomaly detection** looks for unusual records in the database

• **Association mining** attempts to determine where dependencies occur in the data
Big Data Analysis Techniques – Predictive Models

• A model or algorithm is developed that specifies the relationship between an outcome and a set of independent variables in order to predict what will happen when new data becomes available.

• **Regression** models describe the linear relationship between a target variable and a set of predictor variables.

• **Logistic regression** is used when the independent variable is binary.

• **Decision trees** models involve multiple variable analysis capability that enables you to go beyond simple one-cause, one-effect relationships.
Big Data Analysis Techniques – Predictive Models

- **Neural Networks** are a predictive technique that can recognize and learn patterns in data.

- **Simulation models** in healthcare allow for the replication of reality and exploration of possible changes and *what-if* scenarios.
Big Data Analysis Techniques – Next Generation

- **Text, Web and Sentiment Analytics**
  - 85% of healthcare data is in unstructured formats
  - Uses sophisticated linguistic rules and statistical methods to evaluate text
  - Automatically determines keywords and topics, categorizes content, manages semantic terms, unearths sentiment and puts things in context

- **Visualization** supports easy, perceptual inference of relationships that are otherwise more difficult to induce through typical tabular or graphically static formats

- **Real-Time** analytics in healthcare support active knowledge systems which use patient data to improve coordination of care and outcomes
Big Data Capability Analysis

Data Integration
- Data: LOW, MED, HIGH
- Hardware: LOW, MED, HIGH
- Talent: LOW, MED, HIGH

Data Mining
- Data: LOW, MED, HIGH
- Hardware: LOW, MED, HIGH
- Talent: LOW, MED, HIGH

Predictive Modeling
- Data: LOW, MED, HIGH
- Hardware: LOW, MED, HIGH
- Talent: LOW, MED, HIGH

Visualization
- Data: LOW, MED, HIGH
- Hardware: LOW, MED, HIGH
- Talent: LOW, MED, HIGH
Value of Analytics

• Advanced analytics provides opportunities for providers, facilities, insurers, and government entities to improve in the following areas:
  ➢ Disease Intervention & Prevention
  ➢ Care Coordination
  ➢ Customer Service
  ➢ Financial Risk Management
  ➢ Fraud & Abuse
  ➢ Operations
  ➢ Health Care Reform
Healthcare Examples

**Quality of Care**
- Monitoring refills for discharged patients and developing intervention protocols
- Integration of admin data and EMRs to predict preventable conditions/diseases
- Identification of patients at higher risk for a fall

**Coordination of Care**
- ER docs prepared for incoming patients with high severity
- Longitudinal treatment of returning nursing home
- Identification of patients most likely to adhere to a care plan

**Customer Service**
- Understanding the unique drivers of patient satisfaction for your office
- Technologies and processes to involve caregivers
- Coordination of satisfaction measures for entire episodes of care

**Risk Management & Financial Performance**
- Targeted marketing campaigns to reduce churn or defection
- Predictive analytics improving the ROI of care management programs
- Risk Adjustment

**Operations**
- Evaluating alternative clinical pathways to individualize treatment
- Operational KPI control charts allowing for faster recognition and correction of problems
- Standardization of processes to collect and share data

**Fraud & Abuse**
- Identification of ER frequent flyers
- Integration of consumer databases to identify fraud for subsidy eligibility
- Social network analysis to target members and providers abusing pain medications
Health Care Reform

Exchanges

ACO

Risk Adjustment

ICD-10

HCR
Beyond the Frontier

• Health Monitoring – sensors on pills, integrate scales with provider systems, swiping ID cards at gyms, etc.

• Matching products on the exchange with other preferences for health-related products (Amazon-style)

• Working with Health Concierge’s and Medical Advocates to control costs via personalized medicine

• Optimizing operational performance and adopting technology-enabled process improvements

• True Master Data Management and data quality across the enterprise – building a system of systems

• Integrating with databases for consumer products (e.g. person is flagged with a gym membership gets a gift card from Dick’s)
Case Study – Patient Satisfaction KPI

- Pediatric dental practice had extremely high web reviews but no internal patient satisfaction data
- Instituted a survey mechanism for parents at the conclusion of each visit
- First six months 98% of parents provided 4/5-star overall rating with a 40% responder rate
- Initial efforts focused only on the dissatisfied 2%
- Analytics showed 95% of those who responded (even if dissatisfied) kept their 6 month follow-up but only 61% of those who did not respond kept the appointment
- Processes put in place to ‘touch’ non-responders in the time before the next visit
- 92% of patients now keep their follow-up appointments
Case Study – Frequent Flyer Analysis

• Predictive modeling can be used to identify members who are likely to utilize the ER more than three times per calendar year

• Using demographic, medical claims, pharmacy claims, product and member-specific data we created models to identify members who are at a higher risk of becoming a frequent flyer

• Three different advanced analytics models were developed
  • Concurrent
  • Same-year Intervention
  • Prospective

• Prospective model correctly predicts roughly 69% of the Commercial frequent flyers

• Potential claim cost savings to the health plan (ER only) from successfully intervening on only 10% of true positives estimated at $1.5M/year
Case Study – Predicting Type 2 Diabetics

• Predictive modeling used to identify persons who are at increased risk for Type 2

• Model correctly predicts those who develop Type 2 in the next time period around 17% of the time in the Commercial (18-64) population and 19% of the time in the Medicare population
Polling Question

- Rate your organization’s level of Big Data readiness in the area of Expertise with Big Data techniques (High, Medium, Low)
Polling Question

- Rate your organization’s level of readiness in the area of Software/Hardware requirements for Big Data (High, Medium, Low)
Polling Question

- Rate the skill level in your organization of employees who will need to be involved with Big Data projects (High, Medium, Low)
Polling Question

- Rate the volume and quality of the data that is available to analytic units in your organization to implement a Big Data project (High, Medium, Low)
Recommended Priorities for Payors

- Improving data operations to leverage existing ‘basic’ analytics more quickly
- Effective data capture, improved data quality structures and data governance
- Partnering with providers, manufacturers and government to implement monitoring and intervention programs supported by analytic frameworks
Recommended Priorities for Providers

• Standardized and comprehensive data capture
• Reinforce the culture of information sharing
• Improving technology around clinical data
• Improving technology around operations
• Putting data to use in analytics to improve patient care and patient risk
Recommended Priorities for Manufacturers

• Focus on payer and customer value by clearly establishing the true, total cost of care for a product

• Incorporate output data as a function in all new products

• Establishing systems to monitor product efficacy and safety

• Collaboration throughout the entire healthcare system and with external partners to increase the rate of breakthrough scientific discoveries
Recommended Priorities for Government

• Continue to support the adoption of EMRs
• Support the integration of de-identified payer and provider data in cloud-based solutions
• Fund researchers to run retrospective clinical trials that analyze real-world outcomes of highly touted technologies
• Simplify processes around data for government programs to ensure program efficiency can be easily gauged
Recommended Priorities for Patients/Members

- Look to better understand data and choices regarding care
- Demand accurate security and storage of electronic health data and easier mechanisms to self-report
- Understand that your personal health data can benefit everyone
- Divulge information to providers regarding behavior and preferences that are not part of a patient record
- Take part in trials and pilots
Limitations to Big Data & Analytics

• Policy issues around privacy, security and liability in integrating the data pools across stakeholders

• Time to implement – Lag between the labor and capital investments and productivity gains

• **Investment in IT is NOT big data**

• Industry – Payors may gain at the expense of providers

• Cost for providers to implement EMRs

• Shortage of Talent
Implementing Big Data & Analytics

• Invest in talent & dedicate people to big data
• Have analysts work collaboratively with IT
• Develop cross-functional teams that understand data
• Recognize that data is an engine for growth instead of a back-office function
• Develop a process-orientation around data and analytics
• Educate the public. Develop policies that balance the interests of insurers with public privacy concerns
• Help providers to develop robust data infrastructures
Questions?