Predictive Analytics and Technology Session

Eric Widen, CEO HBI Solutions
Population Health Colloquium
March 28th, 2017
Session Agenda

■ Introductions and Overview  Eric Widen
■ Session 1:  Michael Fuccillo, PhD
Financial Incentives and Smart Mobile Design for the Improvement of Population Health
■ Session 2:  Herb Fillmore
Making Predictive Analytics Actionable
■ Session 3:  Jerome H. Finkel, MD
Technology Driving Contemporary Care Management
■ Faculty Panel and Audience Q&A  Eric Widen
Introductions

■ Eric Widen
  ■ Chief Executive Officer, HBI Solutions, Palo Alto, CA (Moderator)

■ Michael Fuccillo, PhD
  ■ Chief Science Officer, Wellth, New York, NY

■ Herb Fillmore
  ■ Senior Director of Population Health and Strategic Innovation, 3M, New York, NY

■ Jerome H. Finkel, MD, MHA, FACP
  ■ President and Chief Executive Officer, Alliance Health; Medical Director, Greater Macomb Physician Hospital Organization; Regional Medical Director, Henry Ford Physician Network, Mt. Clemens, MI
Overview

- Predictive analytics uses data mining, machine learning, and artificial intelligence among other techniques to predict future outcomes and trends.

- In healthcare, predictive analytics is used to predict untoward patient outcomes including utilization, disease, and death.

- The goal in healthcare is to use predictive analytics to proactively identify the patients most likely to have poor outcomes, and enroll them in care programs to prevent the poor outcomes from occurring.
The US market is in flux, and organizations are not prepared for balancing multiple payment structures, as they move from volume to value-based care.

**Status Quo:** Fee for Service

**Pay for Performance**

**Episode Bundle Payments**

**ACO Shared Savings**

**Global Payment Capitation**

Market laggards will concentrate & remain here

Tomorrow’s leaders require new tools to manage

Reactive, deterministic solutions

Proactive, probabilistic intelligent solutions
HBI Company Background

- Healthcare analytics company located in Palo Alto
- Leader in real-time patient risk and precision health solutions
- Solutions are used by health systems, health plans, ACOs and HIEs

Unique talent and experience
- Stanford researchers and data scientists
- Frontline physicians
- Performance improvement practitioners
- Healthcare IT executives

Mission: Improve population health using data science to predict and prevent disease and unnecessary cost and utilization.
Spotlight Data Solution: A Predictive Analytics Solution

Differentiation

• Machine learning as a service; algorithms calibrated specifically to client data
• Real time predictive risk engine
• Population and acute episode risk scores
• Live on over 20 million patients
• Methods published in peer reviewed journals
• Integrated natural language processing
• Focus on care management and intervention automation
Population Health Model

Traditional Care Model

One Doctor

One EHR

One Patient

Population Health Care Model

Care Team

Precision Health Analytics

Millions of Patients
Predictive Analytics: Driving Population Health

- Identify the Target Population
  - Conduct client data quality analysis
  - Conduct machine learning on client data
  - Set targets

- Assess Population Needs and Risk

- Measure and Demonstrate Results

- Deploy Individualized Interventions

- Stratify Population and Predict Future Risk

Integration point with care management solutions

- Integrated care management workflow
- Identify care gaps and modifiable risks
- Engage and manage patients

Source: http://populationhealthalliance.org/research/understanding-population-health.html
Future health expenditures are highly concentrated in the upper 10% most costly patients. This population warrants proactive care and engagement to prevent unnecessary future utilization.


Upper 10% accounts for ~65% of all costs
Middle 40% accounts for ~30% of all costs
Lower 50% accounts for ~5% of all costs
Machine Learning as a Service, Available Models

Patient History

Risk Model Development

- 1000s of Patient Features
  - Age
  - Gender
  - Geography
  - Income
  - Education
  - Race
  - Diagnoses
  - Procedures
  - Chronic conditions
  - Visit and admission history
  - Outpatient medications
  - Vital signs
  - Lab orders and results
  - Radiology orders
  - Social characteristics
  - Behavioral characteristics

Multivariate Statistical Modeling / Machine Learning

Patient Risk of Event or Outcome

Available Risk Models

Population Risk Models (predicts future 12 months)
- Predicted future cost
- Risk of inpatient admission
- Risk of emergency dept (ED) visit
- Risk of acute myocardial infarction (AMI) event
- Risk of cerebrovascular accident (CVA) event
- 100s of chronic disease models, including:
  - Risk of asthma, CHF, COPD, diabetes, hypertension, 20+ more
- Risk of mortality

Admission Triggered Risk Models (predicts future 30 days post discharge)
- Risk of 30 day readmission
- Risk of 30 day ED re-visit
- Sepsis
- Mortality
Our Customers

Today: Large scale data experience. Live in production on over 20 million patients.

- Maine HIE - 1.4 million
- Mass Data Services - 6.6 million
- NYC / Long Island HIE – 16 million
Improving Performance with Natural Language Processing (NLP)

Results: Our NLP-based case finding algorithm prospectively found an additional 5756 uncodified cases (5756/64,168, 8.97% increase) with a positive predictive value of .90. Of the 21,720 diabetic patients identified by both methods, 6616 patients (6616/21,720, 30.46%) were identified by the NLP-based algorithm before a diabetes diagnosis was noted in the structured EMR (mean time difference = 48 days).
Peer-Reviewed Publications

1. Web-based Real-Time Case Finding for the Population Health Management of Patients With Diabetes Mellitus: A Prospective Validation of the Natural Language Processing–Based Algorithm With Statewide Electronic Medical Records

2. Prospective stratification of patients at risk for emergency department revisit: resource utilization and population management strategy implications

3. Risk Prediction of Stroke: A Prospective Statewide Study on Patients in Maine

4. Risk prediction for future 6-month healthcare resource utilization in Maine

5. Development, Validation and Deployment of a Real Time 30 Day Hospital Readmission Risk Assessment Tool in Maine Health Information Exchange

6. Online Prediction of Health Care Utilization in the Next Six Months Based on Electronic Health Record Information: A Cohort and Validation Study

7. NLP based congestive heart failure case finding: A prospective analysis on statewide electronic medical records

8. Real-Time Web-Based Assessment of Total Population Risk of Future Emergency Department Utilization: Statewide Prospective Active Case Finding Study

9. Risk Prediction of Emergency Department Revisit 30 Days Post Discharge: A Prospective Study
Predictive Analytics & Population Health Case Study

1. Identify the Target Population
2. Assess Population Needs and Risk
4. Deploy Individualized Interventions
5. Measure and Demonstrate Results

Source: http://populationhealthalliance.org/research/understanding-population-health.html
HealthInfoNet is a Maine-based health ISO that operates Maine's only statewide health information exchange (HIE)

Provides a secure, standardized electronic system, where healthcare providers can share important patient health information for treatment purposes

- Real-time data from provider electronic health record systems
- 36 hospitals and over 400 ambulatory sites
- 1.4 million patients (EMPIs)
- 6,000,000+ annual encounters (admissions and visits)

St. Joseph Healthcare System, Bangor, Maine
- 112 bed acute care community hospital
- Primary care and specialty physician practices
- 25,000 covered lives
- Partner with local health centers
- Part of Maine HIE, using HBI risk solutions

ACO Participation
- Medicare shared savings
- Medicaid
- Commercial Insurers
Predictive Analytics & Population Health Case Study: Identify the Target Population: St. Joe’s 18,000 Member ACO

- Identify the Target Population
- Assess Population Needs and Risk
- Deploy Individualized Interventions
- Measure and Document Results

Population Utilization Risk

Total Patients: 18,360

Age Group Distribution
- 0-4: 20.00%
- 5-9: 12.00%
- 10-14: 10.00%
- 15-19: 10.00%
- 20-24: 10.00%
- 25-29: 5.00%
- 30-34: 5.00%
- 35-39: 5.00%
- 40-44: 5.00%
- 45-49: 5.00%
- 50-54: 5.00%
- 55-59: 5.00%
- 60-64: 5.00%
- 65-69: 5.00%
- 70+: 10.00%

Gender Distribution
- Female: 45.00%
- Male: 55.00%
- Unknown: 0.00%

Payor Distribution
- [Pie chart showing distribution]

Data Updated Through 2017-02-15 17:02:13

- 2014 – leadership interviews showed emergency department was overutilized by patients using it for primary care

- Leadership sought to target patients at the higher risk for utilizing the emergency department and enroll them into proactive primary care programs
Predictive Analytics & Population Health Case Study: Stratify Population and Predict Future Risk

Target ACO patients > 40% likelihood of future ED visit
Predictive Analytics & Population Health Case Study: Stratify Population and Predict Future Risk

Target patients in the ED > 30% likelihood of return ED visit
Predictive Analytics & Population Health Case Study: Stratify Population and Predict Future Risk

Target patients rising in ED visit risk
Predictive Analytics & Population Health Case Study: Deploy Individualized Interventions

ED risks and care gaps

ED Risk Score Care Gaps and Interventions

Modifiable Risk or Care Gap Measure

- Blood pressure
  - Indicated by: ICD 79.02 Elevated blood pressure reading without diagnosis of hypertension

Intervention

- Assess and improve diet. Limit fat, sugar, sodium, and alcohol. Start heart-healthy diet: increased fruits and vegetables, whole grains, fish, lean meats, and low or non-fat dairy. Avoid foods high in saturated fat.
- Lose weight if overweight, increase physical activity including exercising regularly.
- Improve stress management.
- Consider alternative contraceptive method, if on birth control pill.
- Quit smoking if smoking.
- Assess medications for managing hypertension.
Predictive Analytics & Population Health Case Study: Measure and Demonstrate Results

St. Joe’s 3 year results:
• 10% decline in ED returns
• 10% below adjusted target
Client Potential Return on Investment

- Reduced medical cost spend PMPY: 5-15%
- Reduced readmission rate: 10-20%
- Reduced Medicaid ED utilization: 10-20%
- Increase in disease case finding: 10-40%
Next Session

■ Session 1: Michael Fuccillo, PhD

Financial Incentives and Smart Mobile Design for the Improvement of Population Health
Population Health Framework

- Identify the Target Population
- Assess Population Needs and Risk
- Measure and Demonstrate Results
- Stratify Population and Predict Future Risk
- Deploy Individualized Interventions

Source: http://populationhealthalliance.org/research/understanding-population-health.html