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 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

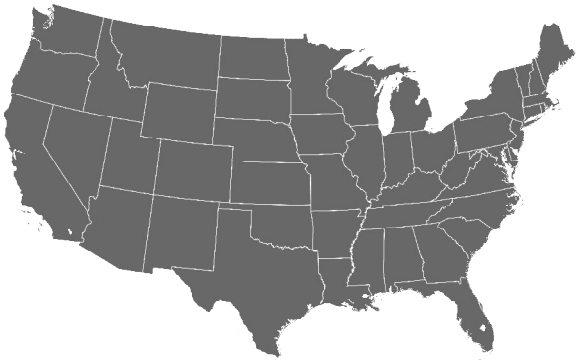
The Changing US Environment

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.

ACOs
Population Management

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

HBI Team Collective Experience

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

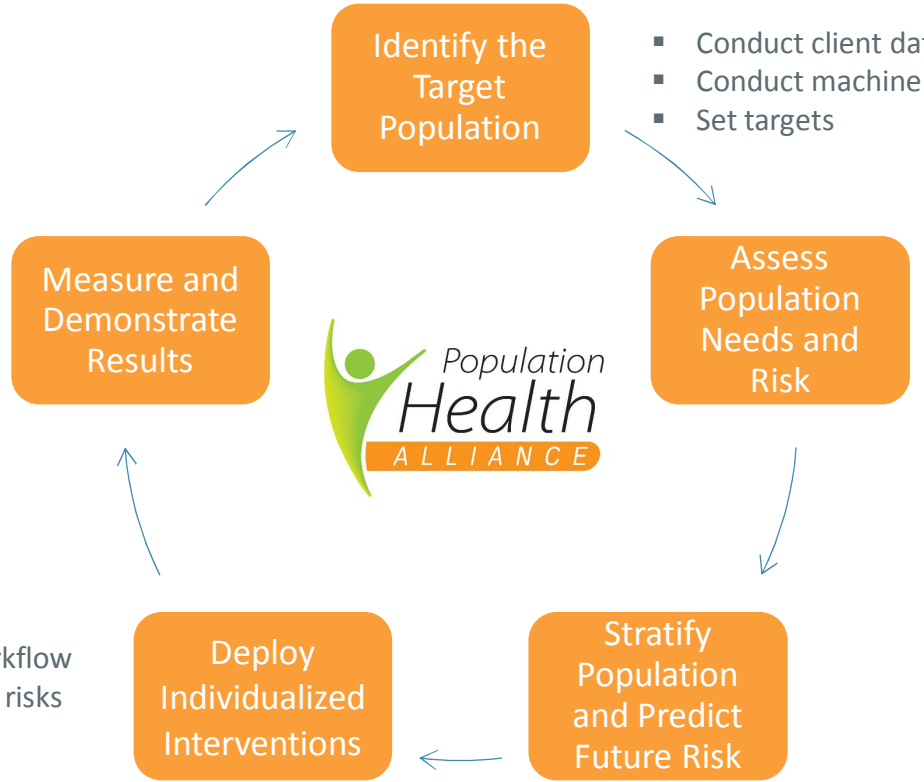
One Doctor

One EHR

One Patient

Population Health Care Model

Predictive Analytics: Driving Population Health



- Conduct client data quality analysis
- Conduct machine learning on client data
- Set targets

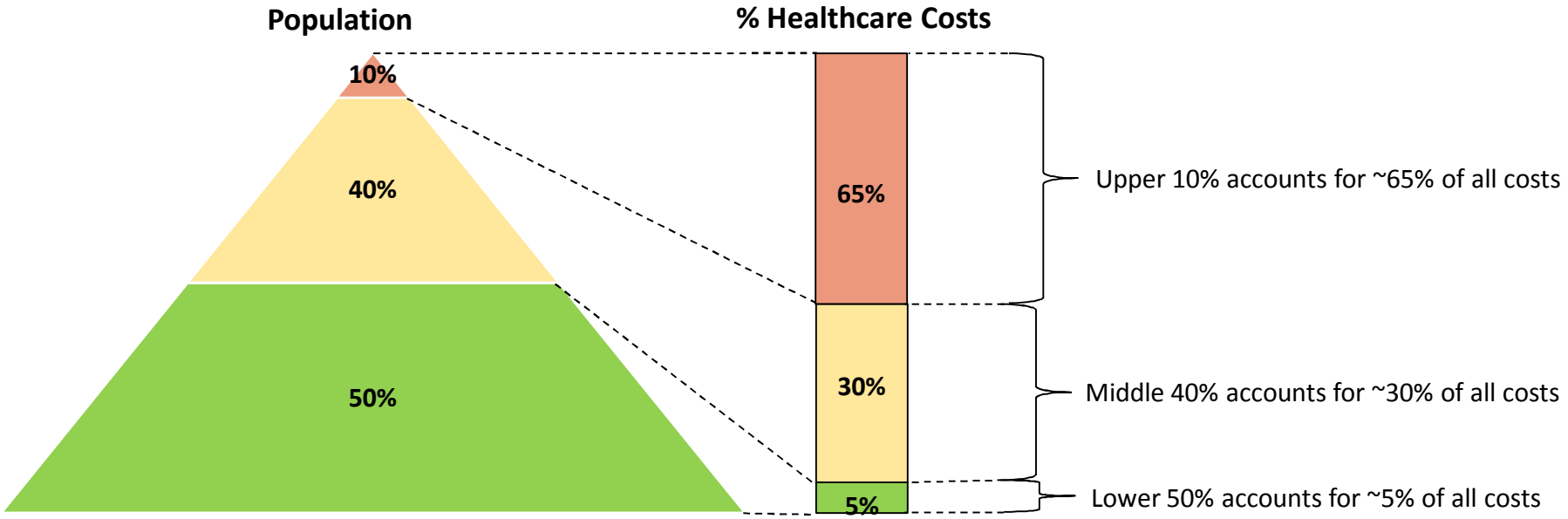
Integration point with care management solutions

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

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

Population Health Approach: Targeting *Future* High Cost Patients

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.



https://meps.ahrq.gov/data_files/publications/st421/stat421.shtml

US Population Distribution of Health Expenditures: 2010

Machine Learning as a Service, Available Models

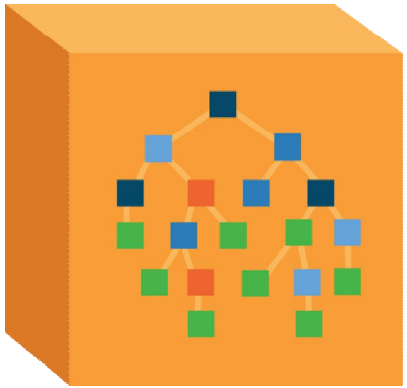
Patient History → **Patient Risk of Event or Outcome**

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



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.

HealthInfoNet

Maine HIE - 1.4 million

Massachusetts Health Data Consortium

Mass Data Services - 6.6 million

Healthix

NYC / Long Island HIE – 16 million

Improving Performance with Natural Language Processing (NLP)

JMIR MEDICAL INFORMATICS Zheng et al

Original Paper

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

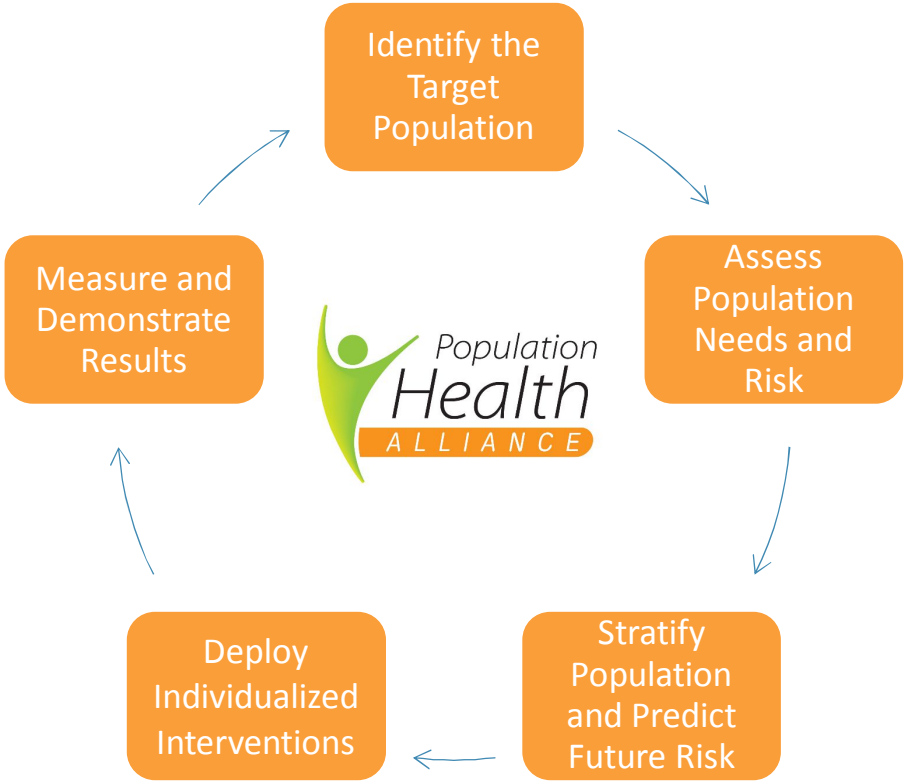
Results: Our NLP-based case finding algorithm prospectively found an additional 5756 uncodified cases (5756/64,168, 8.97% increase) with a positive predictive value of .90. Of the 21,720 diabetic patients identified by both methods, 6616 patients (6616/21,720, 30.46%) were identified by the NLP-based 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

http://hbisolutions.com/publications

Predictive Analytics & Population Health Case Study



HealthInfoNet

St. Joseph Healthcare
St. Joseph Hospital
Bangor, Maine
A Member of Covenant Health

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

Predictive Analytics & Population Health Case Study

HBI solutions

HealthInfoNet

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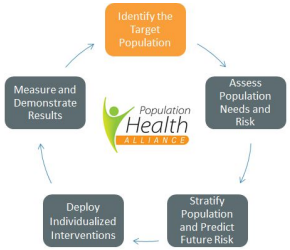
- St. Joseph Healthcare System, Bangor, Maine
  - 112 bed acute care community hospital
  - Primary care and specialty physician practices
  - 25,000 covered lives
  - Partner with local health centers
  - Part of Maine HIE, using HBI risk solutions
- ACO Participation
  - Medicare shared savings
  -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

Predictive Analytics & Population Health Case Study: Identify the Target Population: St. Joe's 18,000 Member ACO



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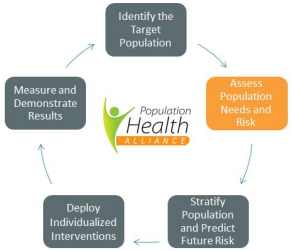
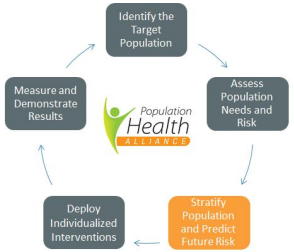
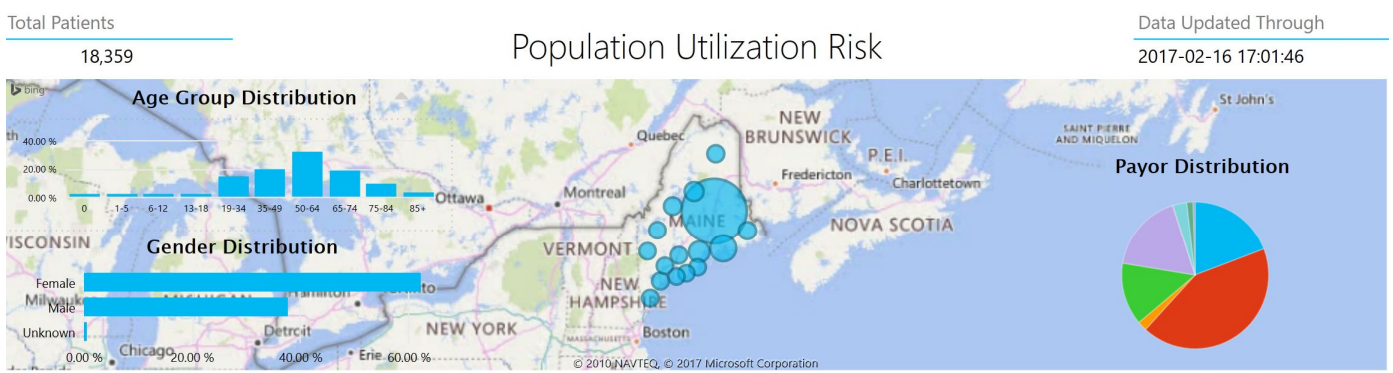
Predictive Analytics & Population Health Case Study: Assess Population Needs and Risk



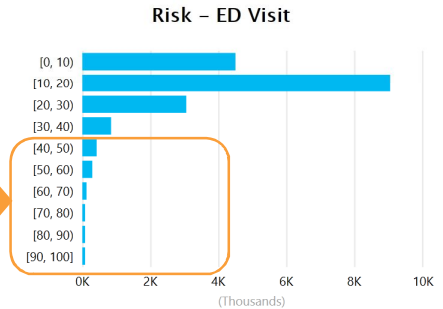
- 2014 – leadership interviews showed emergency department was overutilized by patients using it for primary care
- Leadership sought to target patients at the higher risk for utilizing the emergency department and enroll them into proactive primary care programs

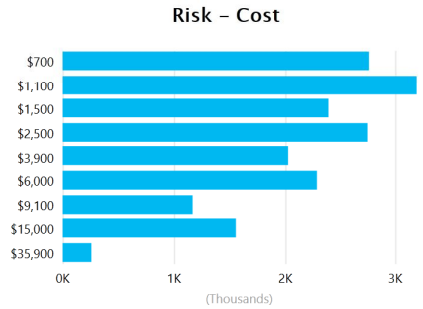
Predictive Analytics & Population Health Case Study: Stratify Population and Predict Future Risk

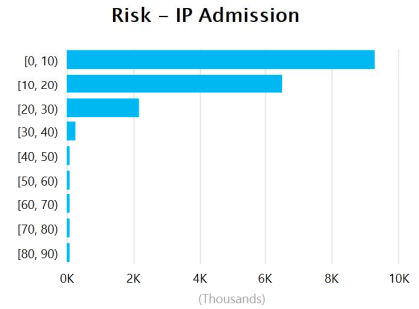




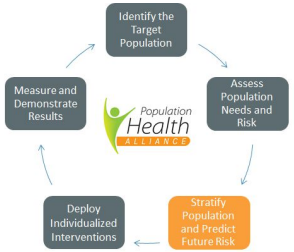
Target ACO patients > 40% likelihood of future ED visit

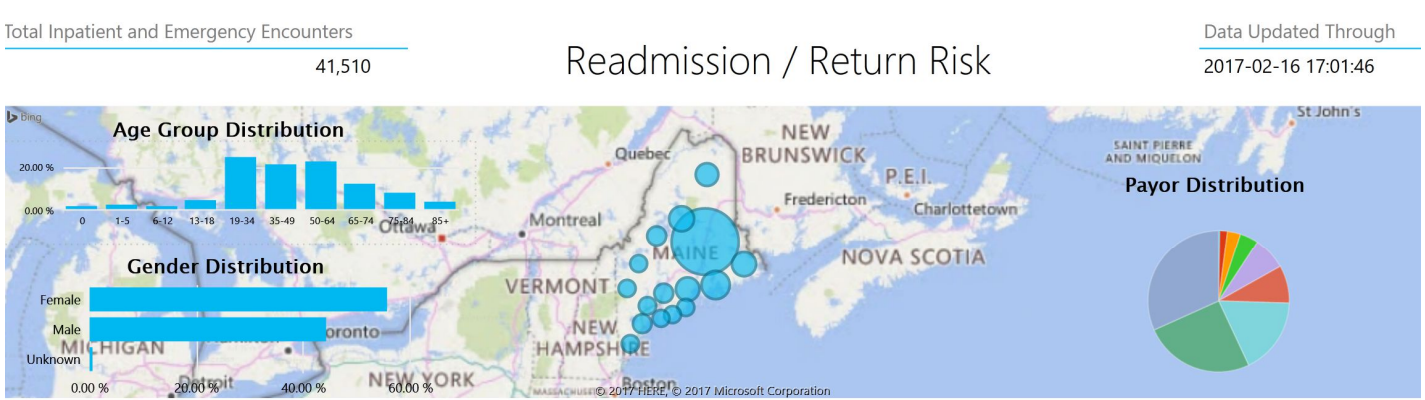




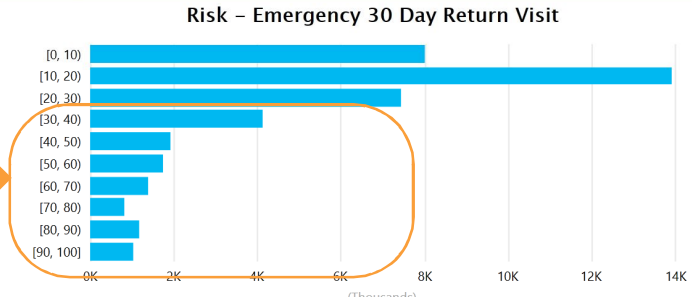


Predictive Analytics & Population Health Case Study: Stratify Population and Predict Future Risk

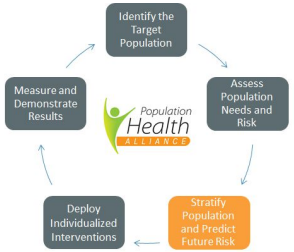




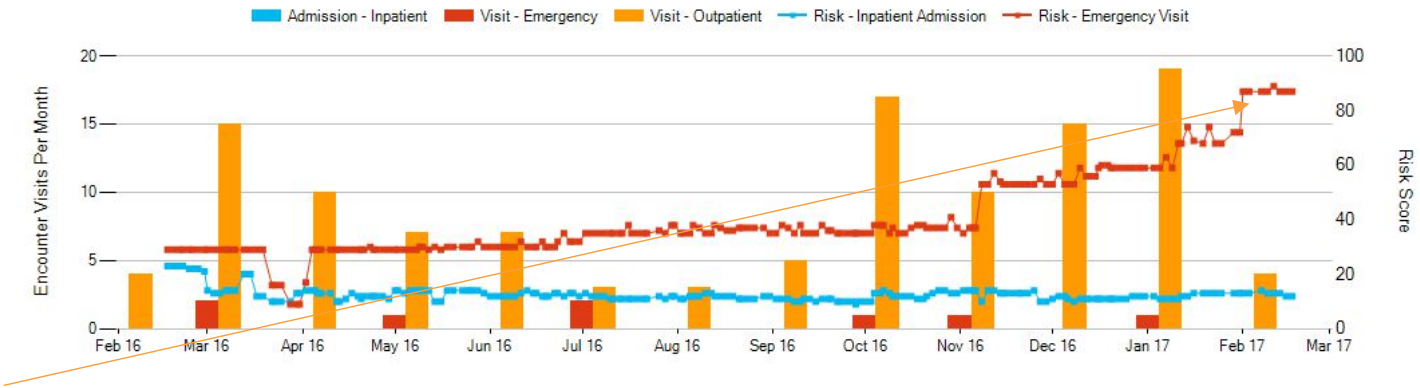
Target patients in the ED > 30% likelihood of return ED visit



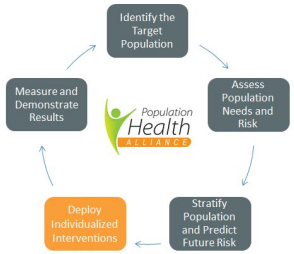
Predictive Analytics & Population Health Case Study: Stratify Population and Predict Future Risk



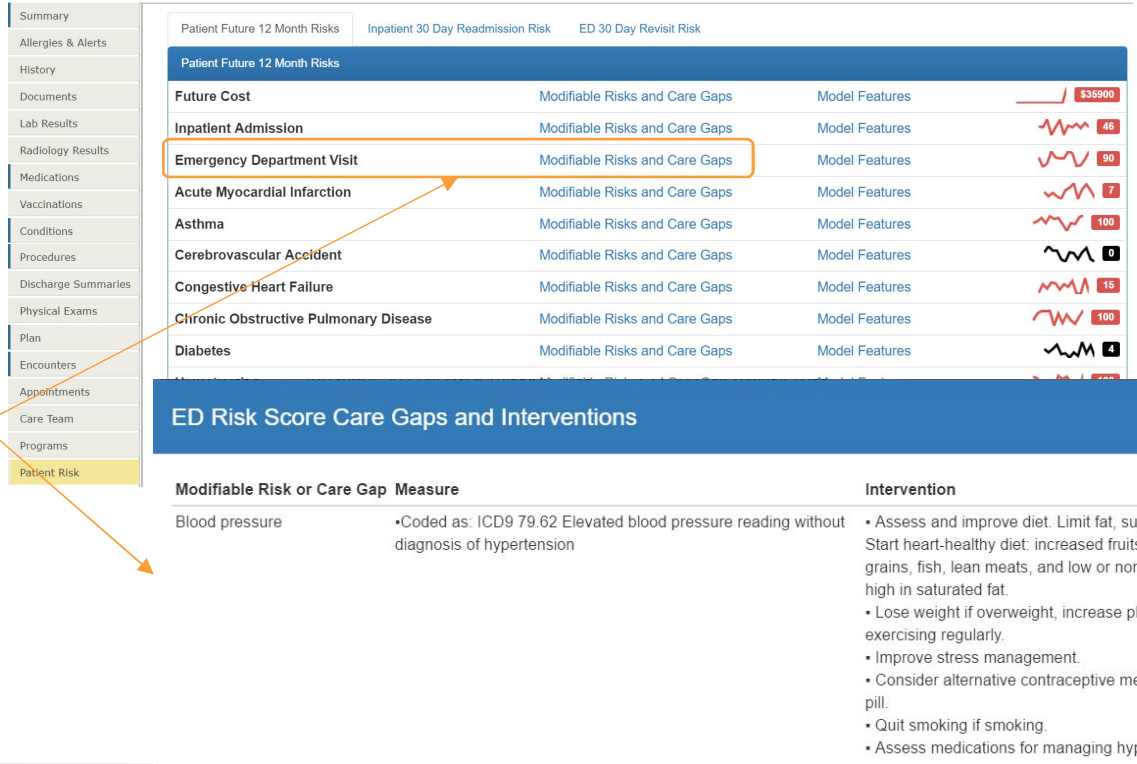
Target patients rising in ED visit risk



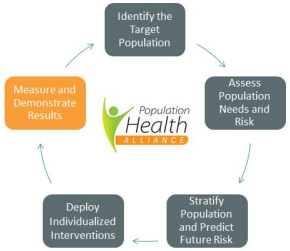
Predictive Analytics & Population Health Case Study: Deploy Individualized Interventions

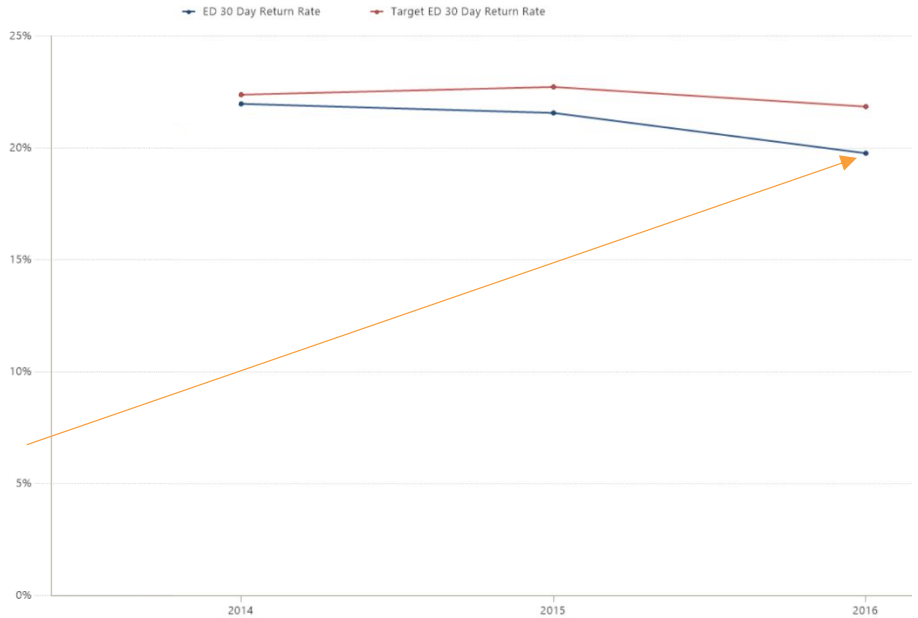


ED risks and care gaps



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

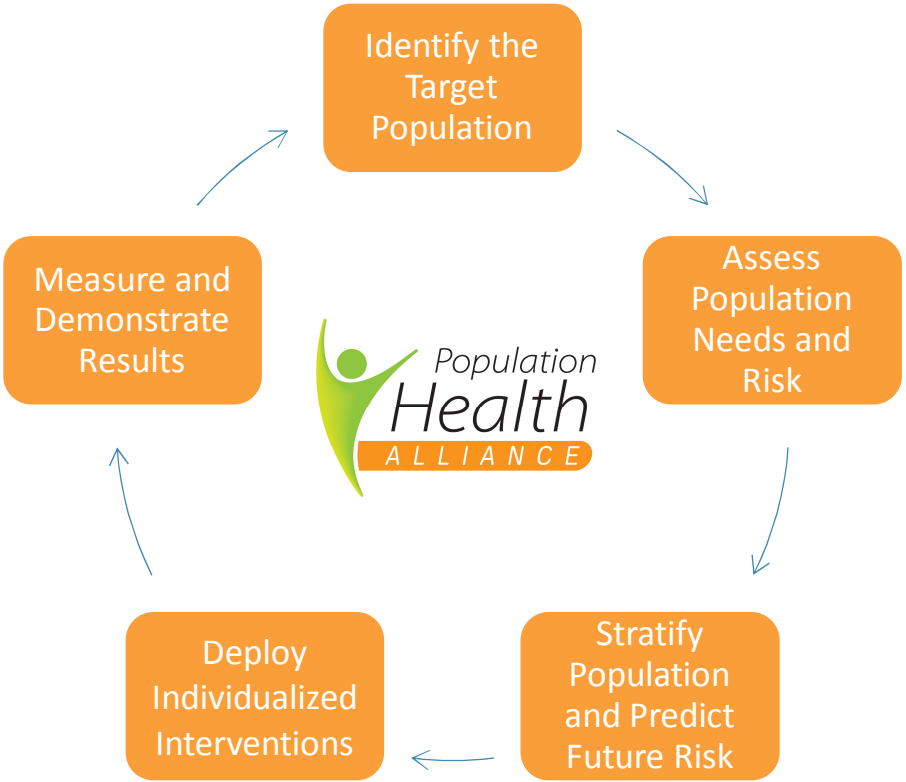
- Reduced medical cost spend PMPY: 5-15%
- Reduced readmission rate: 10-20%
- Reduced Medicaid ED utilization: 10-20%
- Increase in disease case finding: 10-40%

Next Session

- Session 1: Michael Fuccillo, PhD

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

Population Health Framework



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