Building a Clinical Data Warehouse

VITL Summit

Mike Gagnon, VITL CTO
• Today, VITL collects clinical data from many VT healthcare organizations as part of regular VHIE operations
• Over 4M clinical data messages per month are now being processed
• Data includes patient demographics, patient events, labs, transcribed reports, medications, immunizations and care summaries
The data collected are used for:

- Patient identification (MPI with 1.7M patients)
- Clinical data at the point of care (provider portal: VITLAccess)
- Processing transactions (lab orders, result delivery, immunizations)
- Population health data (Blueprint and VDH)
- Supporting ACOs clinical data needs
Clinical Data Roadmap

• With all the data VITL is collecting a next logical step in our maturity is to ready this data for analysis
• This takes new technology, processes and staff
• Three phases of data analysis
  o Clinical Data Management (VITL)
  o Data Warehousing & Reporting (VITL)
  o Analytics (ACO, Blueprint, VITL, others)
Need for Clinical Data Management, Warehousing and Analytics

- Needs for clinical data are changing
- What worked in the clinical setting is not always adequate for performance measures
- Data required is expanding (quality metrics are not always in standard interface)
- Need to measure and improve data quality
- Not all data coded to national standards
- Future claims and clinical data integration
Remediating Data

• The goal of data remediation is to make it complete, accurate and consistent

• For analysis
  o Data must be captured
  o Interfaces must exist
  o Data in the interface must be complete and accurate
  o Data must be formatted correctly
  o Data must be coded or normalized

• Interoperability among HIT systems is still evolving
  o Standards are not adopted or followed by EHR vendors

• In data remediation the source organization, VITL and the destination organization all play a role
  o Data can be remediated at the source, in the network (VITL) or at the destination (analytics)
# Steps to Data Quality

<table>
<thead>
<tr>
<th>Step</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data must be captured in the EHR</td>
<td>Source Org, ACO</td>
</tr>
<tr>
<td>Interface must be developed to the HIE</td>
<td>Source Org, Vendor</td>
</tr>
<tr>
<td>Data must be included in the interface</td>
<td>Source Org, Vendor</td>
</tr>
<tr>
<td>Data must be in the right fields</td>
<td>VITL, Source Org, Vendor</td>
</tr>
<tr>
<td>Inbound interface must be formatted correctly</td>
<td>VITL, Vendor</td>
</tr>
<tr>
<td>Data must be coded correctly</td>
<td>VITL, Source Org</td>
</tr>
<tr>
<td>Outbound interface must be formatted for receiving system</td>
<td>VITL</td>
</tr>
<tr>
<td>Data must be consistent and accurate</td>
<td>Destination Org, ACO</td>
</tr>
</tbody>
</table>
Types of Remediation

- Develop the interface (VITL and Vendor)
- Ensure the data is collected and in the interface (Source and ACO)
- Format the inbound interface (Vendor or VITL)
- Review basic completeness of data (VITL)
- Use standard codes or normalize (Source or VITL)
- Format outbound interface (VITL)
- Review data for consistency and accuracy (Destination)
Clinical Data Management Services

- Perform data translations as data are collected from sources using standard interfaces
- Collect data from source systems using “custom” formats
- Perform data normalization to map terms to standard code sets
- Analyze the data for quality and perform “cleansing”
- Provide “dashboards” of data quality to source organizations
Customers for Clinical Data Management

• Blueprint for population health reporting
• DVHA
• ACOs ability to manage beneficiaries health outcomes tied to payment
• VHIE Members
Clinical Data Management in Support of the Blueprint

- Master Patient Index
- Blueprint-VITL sprints for data quality review at the practices
- Data management tools for data quality analysis
- Capabilities for population health reporting
- DocSite replacement
- Early clinical-claims integration work
Clinical Data Management in Support of the ACOs

- ACOs ability to manage beneficiaries health outcomes tied to payment
- ACO Gateway in place
- Data Quality is in place
- Terminology Services are being developed now
- Joint Blueprint-ACO efforts at practices
- Electronic data is more timely and less costly than chart pulls
Health Catalyst

Platform References

Presented by:
Greg Robinson
Vice President Finance and Analytics

OneCare Vermont
One Care Informatics Current State

OCV Informatics team using legacy claims data warehouse
  • Also supporting 2 New York ACOs

NNEACC now defunct
  • No ongoing obligation

Signed Health Catalyst as new population health management platform
  • Official kick off July 21, 2015
  • Phase I Go-Live 1st Quarter 2016
VITL-OneCare Creating Value

Clinical Data Provisioning

- VITL “ACO Gateway” will help stream ACO specific data

Statewide Use of Foundational Data to Improve Care Outcomes

- Patient Ping deployment for care continuum patient care tracking
- Patient Care Management for high risk patients to receive advanced care services in partnership with ACOs and community providers

Statewide Data Integration and Analytics

- Expanded data collaboration with Vermont Blueprint for Health
# Goals for OneCare Informatics

OneCare’s comprehensive PHM Informatics Infrastructure will provide:

<table>
<thead>
<tr>
<th>Goals</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Aggregate clinical data</strong></td>
<td>across disparate EMRs to support quality tracking and reporting</td>
</tr>
<tr>
<td><strong>Cross-continuum reporting</strong></td>
<td>on cost, quality, and efficiency across the patient panel and attributed lives</td>
</tr>
<tr>
<td><strong>Severity-adjusted, multi-level data</strong></td>
<td>supporting utilization and quality analyses by diagnosis, specialty and physician, with ability to drill down to patient case level</td>
</tr>
<tr>
<td><strong>Predictive risk algorithms</strong></td>
<td>for individuals of risk for high cost events (mortality, ED utilization, hospitalization, readmission)</td>
</tr>
<tr>
<td><strong>Population segmentation</strong></td>
<td>to pinpoint high/ rising risk individuals based on clinical, claims, and psycho-social factors</td>
</tr>
<tr>
<td><strong>Network-wide patient utilization analyses</strong></td>
<td>to identify access barriers and drivers of care gaps, informing targeted improvement efforts</td>
</tr>
<tr>
<td><strong>Centralized, web-based workflow application</strong></td>
<td>integrating patient data</td>
</tr>
<tr>
<td><strong>Real time surveillance of acute events</strong></td>
<td>using ADT data to prompt care manager interventions</td>
</tr>
<tr>
<td><strong>Contract-specific performance tracking</strong></td>
<td>supporting comprehensive performance analyses by defined population under each risk contract</td>
</tr>
</tbody>
</table>
# Health Catalyst Accountable Care Apps

## Apps OneCare Will Implement in 2015

<table>
<thead>
<tr>
<th>Contract Risk Management</th>
<th>Network Management</th>
<th>Care Management</th>
<th>Performance Monitoring</th>
<th>Improvement Prioritization</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACO Explorer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor PMPM, leakage, utilization, and quality measure performance</td>
<td></td>
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</tr>
</tbody>
</table>

### Contract Risk Management

- **PMPM Analyzer**
  - Drill into claims data to identify opportunities to improve PMPM.

- **Bundled Payments**
  - Evaluate your performance on the 48 episodes of care.

### Network Management

- **Leakage and Referrals**
  - Identifying high costs and variation from best practice.

- **Network Optimization**
  - Overlay patient needs and provider population data to identify gaps.

### Care Management

- **Patient Risk Stratification**
  - Identify current and predict future high-risk, high-cost patients.

- **ACO Measures**
  - Monitor and improve performance on CMS ACO measures.

### Performance Monitoring

- **Cohort Builder**
  - Approximately 400 out-of-the-box patient registries.

### Improvement Prioritization

- **Claims-Based Population Explorer**
  - Leveraging claims data, explore your at-risk patient populations.

- **Claims-Based Key Process Analysis**
  - Use the 80/20 rule to identify cost-driving clinical areas and variation.
What’s next?

- Health Catalyst implementation
- Risk model development (financial and clinical)
- Predictive population health analytics (SAS/Qlik)
The Adaptive Data Warehouse Platform & Applications

Metadata: EDW Atlas Security and Auditing

Common, Linkable Vocabulary

- Financial Source Marts
- Claims Source Marts
- Patient Source Marts
- IDEA Source Mart

Foundational Apps
Advanced Workflow Apps
Advanced Clinical Apps

FINANCIAL SOURCES
ADMINISTRATIVE SOURCES
EMR SOURCE (e.g. Epic)
IDEA
CLAIMS (Medicare, Medicaid BCBSVT)
PATIENT SATISFACTION SOURCES

More Transformation
Less Transformation

Day 1 - Session 1: Exploring the Possibilities of Health Data Analytics
Foundational App Example: Pareto Tool
Advanced App Example: Heart Failure Readmission Tool

- **30-Day Readmits**
  - 20%
  - Target: 20%
  - Discharges: 391
  - Readmits: 77

- **90-Day Readmits**
  - 34%
  - Target: 27%
  - Discharges: 1142
  - Readmits: 407

- **90-Day ER Utilization**
  - 28%
  - Target: 30%
  - Discharges: 1142
  - Visits: 330

- **90-Day Observation Stay**
  - 48%
  - Target: 30%
  - Discharges: 1142
  - Stays: 512

**Interventions**

- **Medication Reconciliation**: 57%
- **Follow Up Phone Call**: 32%
- **Discharge Appointment**: 19%
- **All Interventions**: 5%

**Readmissions Over Time**

- Discharges
- 90-Day
- 30-Day

**Discharge Date**

- Month: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
- Days Since D/C

**Risk Filters**

- Physician Flag
- Charlestown Index
- Comorbidity Count
- Catalyst HF Risk Index

**Day 1 - Session 1: Exploring the Possibilities of Health Data Analytics**
Slash Reporting Costs

67% cost savings

97 to <30 hours average time to build reports

25% faster reporting time

Texas Children’s Hospital: TCH uses Healthcare Data Warehouse to Slash Reporting Costs

CLIENT BACKGROUND
To address the challenge of the impending transition to value-based reimbursement, Texas Children’s Hospital (TCH) launched a quality and safety initiative in 2008 to develop a comprehensive and integrated enterprise-level data management infrastructure. The first step was to implement an electronic health record (EHR) to collect raw clinical and financial data from across the enterprise.

Although the EHR has provided tremendous value as a means of digitizing core across the hospital, TCH’s IT leaders soon discovered that the newly digitized clinical data was hard to extract and combine with other data sources in a timely manner.

Our clinicians thought that the EHR would be a silver bullet to get the data they needed for quality improvement and operational reporting and they blamed IT when the information wasn’t forthcoming. Implementing an EHR should really be an appendix to the implementation of an EHR because the surge of data is just unbelievable and the appetite for it is huge.

Myra Davis, M.E., Senior Vice President of Information Services
Blueprint for Health Analytics: Using Linked Claims & Clinical Data Sources

KARL FINISON
Director of Analytic Development
Onpoint Health Data
About Onpoint Health Data

- Independent, non-profit based in Portland, ME, founded in 1976
- Comprehensive set of end-to-end health data management and analytic services for clients across the country, spanning government, provider, purchaser, and researcher organizations
- Supporting the APCD community – CT, MN, OH-KY, RI, VT
- Current analytic projects:
  - Connecticut public consumer reporting portal
  - Minnesota pediatric atlas study
  - Episode bundled-payment initiative
  - Ohio-Kentucky CPC initiative reporting
  - Vermont Blueprint for Health profiles and evaluation
VHCURES

VHCURES = Vermont Health Care Uniform Reporting and Evaluation System

- Vermont’s All-Payer Claims Database (APCD)
- Managed by the Green Mountain Care Board (GMCB) since July 1, 2013
- Data collection required by Vermont law
- Integrated set of commercial, Medicaid, and Medicare data
  - Medicare data provided by the Centers for Medicare & Medicaid Services (CMS)
- Onpoint builds value-adds required for Blueprint analyses (e.g., 3M Clinical Risk Groups, HealthPartners’ Total Cost of Care, HEDIS, AHRQ PQI, expenditure, utilization, BRFSS, ACO payment and reporting measures)
Welcome to the 2014 Blueprint Hospital Service Area (HSA) Profile from the Blueprint for Health, a state-led initiative transforming the way that health care and comprehensive health services are delivered in Vermont. The Blueprint is leading a transition to an environment where all Vermonters have access to a continuum of seamless, effective, and preventive health services.

Blueprint HSA Profiles are based primarily on data from Vermont’s all-payer claims database, the Vermont Health Care Uniform Reporting and Evaluation System (VHCURES). Data include all covered commercial, Full Medicare, and Medicare members attributed to Blueprint practices that began participating on or before June 30, 2014.

Blueprint HSA Profiles for the adult population cover members ages 18 years and older; pediatric profiles cover members between the ages of 1 and 17 years. Practices have been rolled up to the HSA level.

Utilization and expenditure rates presented in these profiles have been risk adjusted for demographic and health status differences among the reported populations.

These profiles use three key sources of data: VHCURES, the DocSite clinical database, and the Behavioral Risk Factor Surveillance Study (BRFSS), a telephone survey conducted annually by the Vermont Department of Health.

This reporting includes only members with a visit to a primary care physician, as identified in VHCURES claims data during the current reporting year or the prior year. Rates for HSAs reporting fewer than 30 members for a measure are not presented in alignment with NCHS HEDIS guidelines.

### Demographics & Health Status

<table>
<thead>
<tr>
<th>HSA</th>
<th>Statewide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Members</td>
<td>7,198</td>
</tr>
<tr>
<td>Average Age</td>
<td>50.7</td>
</tr>
<tr>
<td>% Female</td>
<td>56.2</td>
</tr>
<tr>
<td>% Medicaid</td>
<td>22.1</td>
</tr>
<tr>
<td>% Medicare</td>
<td>21.9</td>
</tr>
<tr>
<td>% Maternity</td>
<td>1.9</td>
</tr>
<tr>
<td>% with Selected Chronic Conditions</td>
<td>39.7</td>
</tr>
</tbody>
</table>

### Total Expenditures per Capita

- **HSA: Randolph**
  - Total Expenditures: $25,500

### Total Expenditures by Major Category

- **HSA: Randolph**
  - Medical: 45%
  - Pharmacy: 25%
  - Services: 30%

### Total Expenditures Excluding Long-Term Care

- **HSA: Randolph**
  - Total Expenditures: $20,000

### Total Resource Utilization (RUS) Excluding Long-Term Care

- **HSA: Randolph**
  - Total Resource Utilization: 100

Publicly available Vermont Blueprint for Health Community Profiles

[blueprintforhealth.vermont.gov/](http://blueprintforhealth.vermont.gov/)
Expenditures per Capita & Total Utilization

A practice’s risk-adjusted rate (red dot) compared to those of all practices in its Hospital Service Area (green dots) and to all other Blueprint practices statewide (blue dots)
Plan All-Cause Readmissions

The relative rate, including 95% confidence intervals, of continuously enrolled members, ages 18 years and older, that had an inpatient stay that was followed by an acute readmission for any diagnosis within 30 days during the measurement year; the blue dashed line indicates the statewide average.
DocSite & the Clinical Data Path

Day 1 - Session 1: Exploring the Possibilities of Health Data Analytics
VHCURES Members with Primary Care Visit (475,921)

Attributed to Blueprint Practices (361,316)
Non-Blueprint (114,605)

Linked to DocSite ID (305,051)
Unlinked (56,265)

Measures (162,118)
No Measures (142,933)

Examples of Patient Volume for Key Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th># of Patients with Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>142,600</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>140,286</td>
</tr>
<tr>
<td>BMI</td>
<td>122,428</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>44,639</td>
</tr>
<tr>
<td>LDL-C</td>
<td>43,652</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>28,779</td>
</tr>
<tr>
<td>HbA1c</td>
<td>21,418</td>
</tr>
</tbody>
</table>

*CY 2014 represents dates of services on and between 01/01/2014 and 12/30/2014
Community Profile ACO Measures

**Clinical**
- Diabetes HbA1c not in control (>9%)
- Hypertension with blood pressure in control (<140/90 mmHg)
- Influenza immunization (clinical and claims)

**Clinical/Diabetes Composite**
- HbA1c in control (≤9%)
- LDL-C in control (<100 mg/dL)
- Blood pressure (<140/90 mmHg)
- Tobacco non-use
- Aspirin use (not supported by data)

**Utilization**
- Plan all-cause readmissions (PCR)
- AHRQ PQI measures
- ACS admissions – Asthma or COPD
- ACS admissions – CHF
- ACS composite admissions (PQI 92)

**ACO, HEDIS, & Other**
- Developmental screening
- AWC, FUH, IET, AAB, CHL, BCS
- Pneumococcal vaccination (BRFSS)
- BRFSS measures
- CAHPS patient experience survey
### Adult Practice Profiles Using Clinical Data

<table>
<thead>
<tr>
<th>Measure</th>
<th>Practice N=664</th>
<th>HSA N=13,117</th>
<th>Statewide N=283,153</th>
</tr>
</thead>
<tbody>
<tr>
<td>% linked to clinical data</td>
<td>86%</td>
<td>51%</td>
<td>48%</td>
</tr>
<tr>
<td>% with BMI data</td>
<td>79%</td>
<td>42%</td>
<td>40%</td>
</tr>
<tr>
<td>% meeting obesity criteria</td>
<td>39%</td>
<td>35%</td>
<td>38%</td>
</tr>
<tr>
<td>% with blood pressure data</td>
<td>82%</td>
<td>45%</td>
<td>43%</td>
</tr>
<tr>
<td>% meeting hypertension criteria</td>
<td>20%</td>
<td>19%</td>
<td>20%</td>
</tr>
</tbody>
</table>

The proportion of distinct members linked to clinical data with valid body mass index (BMI) and blood pressure data meeting the criteria for obesity (BMI >= 30.0) and hypertension (mmHg >= 140/90)
## Diabetes: Obesity & Hypertension

<table>
<thead>
<tr>
<th>Measure</th>
<th>Practice N=46</th>
<th>HSA N=723</th>
<th>Statewide N=19,098</th>
</tr>
</thead>
<tbody>
<tr>
<td>% linked to clinical data</td>
<td>100%</td>
<td>71%</td>
<td>63%</td>
</tr>
<tr>
<td>% with BMI data</td>
<td>96%</td>
<td>57%</td>
<td>50%</td>
</tr>
<tr>
<td>% meeting obesity criteria</td>
<td>70%</td>
<td>69%</td>
<td>71%</td>
</tr>
<tr>
<td>% with blood pressure data</td>
<td>98%</td>
<td>57%</td>
<td>53%</td>
</tr>
<tr>
<td>% meeting hypertension criteria</td>
<td>24%</td>
<td>26%</td>
<td>27%</td>
</tr>
<tr>
<td>% with BMI and blood pressure data</td>
<td>96%</td>
<td>54%</td>
<td>50%</td>
</tr>
<tr>
<td>% meeting obesity and hypertension criteria</td>
<td>18%</td>
<td>18%</td>
<td>20%</td>
</tr>
</tbody>
</table>
The proportion, including 95% confidence intervals, of continuously enrolled members with hypertension, ages 18–85 years, whose last recorded blood pressure measurement in the clinical database was in control (<140/90 mmHg); the blue dashed line indicates the statewide average.
## Diabetes HbA1c Control & Outcomes

<table>
<thead>
<tr>
<th>Metric</th>
<th>HbA1c in Control *</th>
<th>HbA1c Not in Control *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>4,220</td>
<td>568</td>
</tr>
<tr>
<td>Average annual expenditures per capita</td>
<td>$12,507 ($12,059, $12,954)</td>
<td>$15,267 ($13,867, $16,667)</td>
</tr>
<tr>
<td>Inpatient hospitalizations per 1,000 members</td>
<td>181.7 (168.7, 194.7)</td>
<td>275.0 (231.1, 318.8)</td>
</tr>
<tr>
<td>Inpatient days per 1,000 members</td>
<td>877.8 (849.2, 906.4)</td>
<td>1,524.0 (1,421.8, 1,627.2)</td>
</tr>
<tr>
<td>Outpatient ED visits per 1,000 members</td>
<td>532.1 (509.8, 554.4)</td>
<td>725.2 (654.0, 796.4)</td>
</tr>
</tbody>
</table>

* Risk-adjusted rates and 95% confidence intervals; 99th percentile outliers excluded; HbA1c not in control >9%
Analytic Value of Linked Data Sources

- First cross-payer profiles combining claims and clinical data sources
  - Significant variation identified in Vermont
- Alignment of healthcare reform efforts (Blueprint/ACO) and payment modifications
- Claims and linked clinical measures are being used by practices and communities across Vermont to identify priorities and support community collaboratives
- Sprint processes are ongoing to improve the completeness of the clinical data source
HealthInfoNet
Real Time Predictive Analytics

Devore S. Culver
Executive Director and CEO
HealthInfoNet
HIE Connections

- 35 of 37 hospitals (all hospitals under contract)
- 38 FQHC sites
- 450+ ambulatory sites including physician practices, behavioral health, and long-term care facilities
- Live with VA (bi-directional)
What’s in the HIE system?

- Patient Identifier and Demographics
- Encounter History
- Laboratory and Microbiology Results
- Vital signs
- Radiology Reports
- Adverse Reactions/Allergies
- Medication History
- Diagnosis/Conditions/Problems (primary and secondary)
- Immunizations
- Dictated/Transcribed Documents
- Continuity of Care Documents (CCD)
Current HIE Statistics Of Note

- **562,348** Maine residents had encounter and clinical content added to the exchange in the past 12 months.
- **98%** of all Maine residents have clinical information in the exchange.
- **36,000** patients are accessed each month by clinical users of the exchange.
- **25,000** real time notifications of patient encounter activity generated each month.
- **185,000** automated laboratory results and syndromic surveillance messages sent to Maine CDC each month.
How Maine hospitals are predicting your next trip to the ER

Jessica Taylor, a nurse at St. Joseph Internal Medicine in Bangor has been using a predictive modeling tool that helps identify patients at risk of needing emergency room care or in need of support. Hospitals can use the real-time data to tailor care and lower readmission rates.
Risk Prediction of Emergency Department Revisit 30 Days Post Discharge: A Prospective Study

Shiying Hao¹,²§, Bo Jin¹, Andrew Young Shin³, Yifan Zhao¹, Chunqing Zhu¹, Zhen Li², Zhongkai Hu¹, Changlin Fu¹, Jun Ji¹, Yong Wang⁴,⁶, Yingzhen Zhao², Dorothy Dai¹, Devore S. Culver⁵, Shaun T. Alfreds⁵, Todd Rogow⁵, Frank Stearns¹, Karl G. Sylvester²‖, Eric Widen¹‖, Xuefeng B. Ling²*†

¹HBI Solutions Inc, Palo Alto, California, United States of America, ²Department of Surgery, Stanford University, Stanford, California, United States of America, ³Department of Pediatrics, Stanford University, Stanford, California, United States of America, ⁴Department of Statistics, Stanford University, Stanford, California, United States of America, ⁵HealthInfoNet, Portland, Maine, United States of America, ⁶Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing, China

Abstract

**Background:** Among patients who are discharged from the Emergency Department (ED), about 3% return within 30 days. Revisits can be related to the nature of the disease, medical errors, and/or inadequate diagnoses and treatment during their initial ED visit. Identification of high-risk patient population can help device new strategies for improved ED care with reduced ED utilization.

**Methods and Findings:** A decision tree based model with discriminant Electronic Medical Record (EMR) features was developed and validated, estimating patient ED 30 day revisit risk. A retrospective cohort of 293,461 ED encounters from HealthInfoNet (HIN), Maine’s Health Information Exchange (HIE), between January 1, 2012 and December 31, 2012, was assembled with the associated patients’ demographic information and one-year clinical histories before the discharge date as the inputs. To validate, a prospective cohort of 193,886 encounters between January 1, 2013 and June 30, 2013 was constructed. The c-statistics for the retrospective and prospective predictions were 0.710 and 0.704 respectively. Clinical resource utilization, including ED use, was analyzed as a function of the ED risk score. Cluster analysis of high-risk patients identified discrete sub-populations with distinctive demographic, clinical and resource utilization patterns.

**Conclusions:** Our ED 30-day revisit model was prospectively validated on the Maine State HIN secure statewide data system. Future integration of our ED predictive analytics into the ED care work flow may lead to increased opportunities for targeted care intervention to reduce ED resource burden and overall healthcare expense, and improve outcomes.

Analytic Platform: Current Adoption Update

General Acute Care Hospitals
- Budgeting and volume forecasting
- Throughput management - high risk ED patients / over utilizers
- 30-day readmission management

ACO – Pioneer CMS, State Employees, Commercial
- Population management – risk stratification and proactive care management

Medical Group with Insurance Product
- Population management – risk stratification and proactive care management

Medicaid SIM Project
- New enrollee risk identification and proactive care management
### Analytic Platform: Solution Road Map

**Available Today**

- Population health application
  - Utilization monitoring and trending
  - Disease prevalence
  - Risk of emergency visit, risk of inpatient admission, cost risk
  - Risk of diabetes, stroke, AMI, hypertension and mortality
  - Risk of 30 day readmission, risk of 30 day ED return
- Variation management application
- Performance benchmarking application
- Market share and patient origin application
- Natural language processing integration

**Available in the Future**

- New risk models – CHF, Coronary Artery Disease, COPD, Asthma
Case Study: Population Management: ED Utilization
Case Study: Population Management: ED Utilization

On the Population Utilization Risk landing page, the user views and understands the latest risk profile for their patients, including the number of patients at each risk level. This helps the user understand the best allocation of care management resources to at risk patients.
Day 1 - Session 1: Exploring the Possibilities of Health Data Analytics

Case Study: Population Management: ED Utilization

User views and gains insight on the distribution of future ED visit risk; decides to focus on the highest risk patients – those patients with a risk score (probability) greater than 40 - 40% or more likely to visit and ED in the future 12 months.
Case Study: Population Management: ED Utilization

To view individual patients at high risk for a future ED visit, user selects appropriate criteria in patient list filters.
Case Study: Population Management: ED Utilization

Selecting a patient from the patient list, user can see the risk and visit history of the patient. In this instance, the patient’s ED risk (red line) has risen significantly over the last 3 months.
Case Study:
Population Management: ED Utilization

Selecting a patient from the patient list, users can see the list of chronic diseases, and medications.

<table>
<thead>
<tr>
<th>Chronic Disease Profile</th>
<th>Medication List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Disease</td>
<td>Count: 20</td>
</tr>
<tr>
<td>Acute and unspecified renal failure</td>
<td>Count: 891</td>
</tr>
<tr>
<td>Asthma</td>
<td>Contour Next Strips 2/6/2015</td>
</tr>
<tr>
<td>Cardiac arrest and ventricular fibrillation</td>
<td>Furosemide 40 mg Tablet 2/5/2015</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>Furosemide Tab 40 mg Furosemide 2/5/2015</td>
</tr>
<tr>
<td>Conduction disorders</td>
<td>Clonidine Hcl 0.2 mg Tablet 2/4/2015</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>Clonidine Tab 0.2 mg Clonidine Hcl 2/4/2015</td>
</tr>
<tr>
<td>Deficiency and other anemia</td>
<td>Gabapentin 100 mg Capsule 2/4/2015</td>
</tr>
<tr>
<td>Diabetes mellitus with complications</td>
<td>Gabapentin Cap 100 mg Gabapentin 2/4/2015</td>
</tr>
<tr>
<td>Diabetes mellitus without complication</td>
<td>Promethazine 50 mg Tablet 2/4/2015</td>
</tr>
<tr>
<td>Disorders of lipid metabolism</td>
<td>Promethazine Tab 50 mg Promethazine Hcl 2/4/2015</td>
</tr>
<tr>
<td>Essential hypertension</td>
<td>Suboxone 8 mg-2 mg SL film 2/4/2015</td>
</tr>
<tr>
<td>Heart valve disorders</td>
<td>Suboxone Mis 8-2mg Suboxone 2/4/2015</td>
</tr>
<tr>
<td>Hypertension with complications and secondary hypertension</td>
<td>Atenolol 100 mg Tablet 1/22/2015</td>
</tr>
<tr>
<td>Nephritis; nephrosis; renal sclerosis</td>
<td>Atenolol Tab 100 mg Atenolol 1/22/2015</td>
</tr>
<tr>
<td>Other diseases of kidney and ureters</td>
<td>Suboxone Mis 8-2mg Suboxone 1/21/2015</td>
</tr>
<tr>
<td>Other lower respiratory disease</td>
<td>Suboxone 8 mg-2 mg SL film 1/21/2015</td>
</tr>
<tr>
<td>Other nervous system disorders</td>
<td>Suboxone 8 mg-2 mg SL film 1/21/2015</td>
</tr>
<tr>
<td>Pancreatic disorders (not diabetes)</td>
<td>Suboxone Mis 8-2mg Suboxone 1/21/2015</td>
</tr>
<tr>
<td>Pulmonary heart disease</td>
<td>Suboxone 1/21/2015</td>
</tr>
<tr>
<td>Retinal detachments; defects; vascular occlusion; and retinopathy</td>
<td>Bd Ultra-Fine Pen Ndl 5Mmx31G 1/19/2015</td>
</tr>
<tr>
<td></td>
<td>Bd Ultra-Fine Pen Ndl 5Mmx31G 1/19/2015</td>
</tr>
<tr>
<td></td>
<td>Bd Pen Needle/Mini-Ultra 1/19/2015</td>
</tr>
</tbody>
</table>
Case Study: Population Management: ED Utilization

Selecting a patient from the patient list, users can view interventions for specific patient risks including polypharmacy, chronic diseases, and emergency and inpatient utilization.

<table>
<thead>
<tr>
<th>Patient Risk</th>
<th>Data</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polypharmacy</td>
<td>43</td>
<td>• Medication specific education and strategies to mitigate adverse drug events</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Eliminate unnecessary medications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Simplify medication scheduling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assess adherence and complications 72 hours after an inpatient discharge</td>
</tr>
<tr>
<td>Multiple chronic diseases</td>
<td>20</td>
<td>• Discuss goals of care and chronic illness model discussed with patient/caregiver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Disease specific education with patient/caregiver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Action plan reviewed with patient/caregivers regarding what to do and who to contact in the event of worsening or new symptoms</td>
</tr>
<tr>
<td>Problem chronic diseases</td>
<td>congestive heart failure, Diabetes mellitus with complications, Diabetes mellitus without complication</td>
<td>• Discuss goals of care and chronic illness model discussed with patient/caregiver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Disease specific education with patient/caregiver</td>
</tr>
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<td></td>
<td></td>
<td>• Action plan reviewed with patient/caregivers regarding what to do and who to contact in the event of worsening or new symptoms</td>
</tr>
<tr>
<td>Two or more hospitalizations in last 6 or 12 months</td>
<td>4 in last 6 months, 4 in last 12 months</td>
<td>• Review reasons for re-hospitalizations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post discharge, follow-up phone call at 72 hours to assess condition, adherence and complications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post discharge, follow-up appointment with medical provider within 7 days of hospital discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post discharge, engage a transition coach</td>
</tr>
<tr>
<td>Two or more emergency visit(s) in last 6 or 12 months</td>
<td>3 in last 6 months, 5 in last 12 months</td>
<td>• Review reasons for multiple emergency visits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Post discharge, follow-up phone call at 72 hours to assess condition, adherence and complications</td>
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Population Management
ED Utilization

**Results:** this Maine organization has been successful in reducing the ED visits per 1000 members per month by 15%.

**ED Visits / 1000 / Month**

14% drop
Discussion/Questions