# Table of Contents

Customer Success .................................................................................................................. 4

Three Systems are Key for Improving Outcomes .................................................................. 5
  Analytics System (Catalyst Analytics Platform) .................................................................... 6
  Content System (Analytic Applications) ............................................................................. 7
  Deployment System (Outcomes Improvement Services) ........................................................ 8

Products for Healthcare Improvement ..................................................................................... 9

Application Terms & Definitions ........................................................................................... 10

Improvement Applications ..................................................................................................... 11

Accountable Care / Shared Risk .............................................................................................. 12
  ACO Explorer .................................................................................................................... 13
  ACO Measures .................................................................................................................. 20
  Bundled Payments ............................................................................................................ 28
  Leakage & Referrals Explorer ............................................................................................ 35
  Patient Risk Stratification .................................................................................................. 38
  PMPM Analyzer ................................................................................................................ 44

Financial Analytics ................................................................................................................ 48
  Financial Management Explorer ....................................................................................... 49
  General Ledger Explorer ................................................................................................... 56
  Revenue Cycle Explorer: Hospital ..................................................................................... 61

Operational Efficiency & Performance Monitoring ................................................................. 68
  Labor Management Explorer ............................................................................................ 71
  Patient Experience Explorer .............................................................................................. 77
  Patient Flow Explorer ....................................................................................................... 82
  Practice Management: Patient Access ................................................................................ 88
  Practice Management: Professional Billing ......................................................................... 93

Population Health & Patient Injury Prevention ....................................................................... 98
  Breast Milk Feeding .......................................................................................................... 101
  Catheter Associated Urinary Tract Infection (CAUTI) Prevention ........................................ 105

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Central Line Associated Blood Stream Infections (CLABSI) Prevention ......................................................... 109
Cohort Builder .................................................................................................................................................. 115
Community Care .............................................................................................................................................. 120
Heart Failure ................................................................................................................................................... 126
Labor and Delivery ........................................................................................................................................... 133
Pediatric Appendectomy ................................................................................................................................... 137
Pediatric Asthma .............................................................................................................................................. 142
Population Explorer .......................................................................................................................................... 145
Readmission Explorer ....................................................................................................................................... 150
Sepsis Improvement .......................................................................................................................................... 156
Surgical Site Infections ..................................................................................................................................... 160
Translational Research .................................................................................................................................... 170
De-Identified Cohort Builder .......................................................................................................................... 171
De-identified Population Explorer .................................................................................................................. 176
IDEA for Research ........................................................................................................................................... 181
Late Binding™ Data Warehouse ......................................................................................................................... 182
Catalyst Analytics Platform ................................................................................................................................ 184
Metadata-Driven ETL Engine .......................................................................................................................... 186
Agile Data Models .............................................................................................................................................. 188
Linking and standardization .............................................................................................................................. 190
Master Data Management .................................................................................................................................. 192
Advanced Analytics ......................................................................................................................................... 193
Platform Applications ......................................................................................................................................... 194
Atlas Meta-Data Management ......................................................................................................................... 194
EDW Console ...................................................................................................................................................... 196
Security: Access Management .......................................................................................................................... 198
Security: Auditing .............................................................................................................................................. 199
Source Mart Designer ........................................................................................................................................ 202
Subject Area Mart (SAM) Designer .................................................................................................................. 205

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant Data Entry Applications (IDEA)</td>
<td>207</td>
</tr>
<tr>
<td>Data Acquisition and Storage</td>
<td>208</td>
</tr>
<tr>
<td>Source Mart Library</td>
<td>209</td>
</tr>
<tr>
<td>Contracted Sources (Roadmap)</td>
<td>210</td>
</tr>
<tr>
<td>Shared Applications</td>
<td>211</td>
</tr>
<tr>
<td>Attribution Modeler</td>
<td>212</td>
</tr>
<tr>
<td>Executive Dashboard Integration Tool (EDIT)</td>
<td>215</td>
</tr>
<tr>
<td>Key Process Analysis (KPA)</td>
<td>218</td>
</tr>
<tr>
<td>Risk Model Analyzer</td>
<td>223</td>
</tr>
<tr>
<td>Improvement Pathways</td>
<td>227</td>
</tr>
</tbody>
</table>
Customer Success

Health Catalyst’s top operating principle
Health Catalyst has established an ordered set of operating principles, which guide how we manage our company with respect to opportunities, clients, team members and community. Following the concept that you can’t manage what you don’t measure, we have established metrics for each of these principles. These metrics are measured and reported weekly with respect to our clients and projects.

Health Catalyst Operating Principles
- Customer Success
  - Our customer’s long-term success is our highest priority
  - We protect the private health data of our customer’s patients
  - We are passionate about our customer’s improvement
  - We create broad relationships with many customer stakeholders
  - We measure our success in improved health, reduced waste and enhanced patient experience
- Pragmatic Innovation
- Ownership
- Transparency

Health Catalyst is proud and honored to have received KLAS customer satisfaction scores well over 90% for the last two years. While our client base is small, our KLAS metrics would indicate they are very satisfied. The real story is why our clients are happy. Is it because we have the best products or support? That certainly helps, but the big reason is that we are committed to the long-term success of our clients. Success that is measured in improved and measureable outcomes defined as higher quality and lower costs.

What makes Health Catalyst different is that we have understood from the very beginning that great software products alone do not create great outcomes. This document, like our company is focused on the three key systems that are required for performance improvement and thus long term success at our clients.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Three Systems are Key for Improving Outcomes

Do any of these challenges sound familiar?

“My analysts spend way too much time collecting data and not enough time interpreting and understanding the data”

“We have all kinds of dashboards, but they are not helping me improve care. We are not looking at the relevant data”

“We seem to be able to improve care in specific areas, but it isn’t sustainable. As soon as we move to the next project the last improvement begins to degrade”

Successful performance improvement at Health Catalyst clients is based on using a balance approach of the Three Systems model shown below.

Three Ingredients of Outcomes Improvement

Many people in and out of the Health IT world believe that if you build it, they will come. This may happen in the movies, but following the principle of pragmatic innovation we know that “Every system is perfectly designed to get the results it gets.” – Dr. Paul Batalden

You must change the system to get better results, where do we begin? As a Health IT company and it a market that is focused on “products” let’s begin with the easy to understand Analytics System.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Analytics System (Catalyst Analytics Platform)

The analytics system, based on our Late Binding™ Data Warehouse can quickly help provide direction, with data-driven prioritization of current care process costs. Combining data from traditionally separate system siloes including clinical data from one or more EMR systems, financial data from billing, costing, general ledger and other financial systems, with patient experience and satisfaction data, enables an organization to understand where the greatest opportunities (yes plural) for improvement exist and just how big the impact of improvement could be.

Acquiring and integrating data from multiple HIT systems is a strength of the Catalyst Analytics Platform. The Health Catalyst Late Binding™ Data Warehouse supports multiple types of HIT systems (source data) and multiple HIT suppliers within each type of HIT system. One of those sources is the EMR system, or systems. Health Catalyst has successfully integrated data from Allscripts, Cerner, Epic, Cerner, McKesson, Meditech and NextGen to name a few.

Integration of this data by the Late Binding™ Data Warehouse enables analysts to spend less time finding and integrating data and more time understanding and analyzing that data while making the data timelier and quickly available to a larger number of people than ever before. Studies have shown that accurate and timely data is a key to performance improvement.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
**Content System (Analytic Applications)**

The Health Catalyst Knowledge System enables patient registry definitions, to be combined with data visualization applications, outcome goals & aim statements, improvement maps and other assets such as best practices processes and order sets to create an Improvement focused set of Analytic Applications.

Health Catalyst has categorized our analytic applications and knowledge assets into six categories of performance improvement.

- **Population Health & Patient Injury Prevention** - care process & quality improvements
- **Operational Efficiency & Performance Monitoring** – leverage Lean techniques
- **Accountable Care & Shared Risk** – value based payment & performance
- **Translational Research** – supporting new research and applying it to care

These analytic applications generally including outcome and balanced metrics to ensure that this specific improvement is not resulting in a decrease in performance, somewhere else in the system. Process and intervention metrics for volume and finally financial metrics leading to an understanding of ROI.
Deployment System (Outcomes Improvement Services)

Performance improvement requires more than an enterprise data warehouse and a set of analytic applications. Peter Drucker has been attributed with saying “Culture eats strategy for breakfast”.

Bill Aulet, a senior lecturer at the MIT Sloan School of Management, modified this quote to say “Culture eats strategy for breakfast, technology for lunch, products for dinner and then everything else”. This is a common and real problem, especially in health IT projects where the culture is based on craftsmanship (art and experience) versus a system of production. This is the number one reason that many data warehouse / business intelligence projects fail.

Performance improvement requires experts who understand the process of using data to create change and cultural transformation. There must be top down commitment and bottom up responsibility to change and/or redesign a particular operational or care process and to sustain the improvement over time.

The Health Catalyst team brings a unique combination of performance improvement techniques based on learning at Intermountain Health, Allina and others combined with our own client experiences. Our improvement services can range from supporting an established improvement team at a client, to embedding our team inside your organization, to an entirely outsourced service.
Products for Healthcare Improvement

The Health Catalyst Late Binding™ Data Warehouse is an enterprise solution for combining an Enterprise Data Warehouse (EDW), the Catalyst Analytics Platform with the Business Intelligence capability of our Analytics Applications. Health Catalyst products and applications cover a wide scope of capability and can be categorized into five areas of performance improvement:

- **Population Health & Patient Injury Prevention** for clinical quality improvement
- **Operational Efficiency & Performance Monitoring** focused on cost reduction
- **Accountable Care & Shared Risk** supporting value based care models
- **Financial Analytics** - applications focused on aggregated network analysis
- **Translational Research** capability for academic medicine

This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Application Terms & Definitions

Product Availability Status
- **Available** – These applications have been installed at one or more clients and are available for deployment at other clients.
- **In-Development** – These applications are in an active development program, initial deployment is expected in the next 3 to 6 months.
- **Roadmap** – These applications include concepts and prototypes that are considered interesting or useful, but are not in an active development program and thus are subject to change or removal, based on client and market demand.

Improvement Types
Applications are categorized into one of three types or levels based on actual or expected success measures. The improvement type for an application represents the highest level of success measurement achievable by the application. Success of an application is highly dependent upon client deployment and configuration.

- **Identify Opportunities** – these applications are used to discover patterns or trends in the data that could lead to an improvement program involving a *Process or Outcomes Improvement* application.
- **Process Improvement** – these applications include metrics/measures for managing changes in workflow or clinical processes associated with one or more AIM statements defined as part of a performance improvement program.
- **Outcomes Improvement** – these applications are a key component of a clinical, cost and/or quality improvement program supporting multiple AIM statements, interventions, outcomes and balanced metrics.

Application Fingerprinting
Process and Outcomes Improvement applications are generally configured to meet client needs as a standard part of the deployment process. It is not unusual for there to be variation in the clinical care processes and interventions from client to client. At Health Catalyst we call this *Fingerprinting* an application. Fingerprinting should not be confused with customization of an application to support new (or additional) outcomes, care process, interventions or metrics.
Improvement Applications

Improvement Applications from Health Catalyst are focused on the specific types of improvement:

- **Operational and workflow efficiency** across a health enterprise, categorized by service area and department.
- **Population Health** and clinical quality, categorized by care process and family.
- **Patient Injury Prevention**, categorized by hospital acquired condition.

Health Catalyst has performed a pareto analysis using Medicare and California OSHPD data for each of these potential areas for improvement and used that information to stratify our applications and knowledge assets based on overall opportunity size. The care processes with the greatest cost and volume opportunity potential have the richest set of outcome goals, improvement maps and other knowledge assets.

The following sections will provide specific information regarding the operational areas, service departments, care families and hospital acquired conditions which are supported by these analytic applications including examples of actual client success stories.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Accountable Care / Shared Risk

Description
Accountable Care applications from Health Catalyst go beyond basic indicators of population health management to focus attention on operational requirements of an accountable care organization including clinically integrated networks, bundled purchasing and value based reimbursement. Data sources can begin with membership and claims enabling a better understanding of patient leakage patterns and per member per month statistics. Adding clinical EMR and member satisfaction data sources can enable a near real-time view of the most common accountable care reporting metrics. Billing and costing data can be used to create a robust view of potential areas for cost and/or quality improvement. These applications help organizations better understand patterns and trends associated with high-cost patient populations. Integration of payer claims with clinical and patient experience data at the patient level helps your organization determine total cost of care and support a performance improvement agenda focused on the IHI Triple Aim of patient experience, health, and cost.

Applications

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
ACO Explorer

Description
ACO Explorer is an executive-level dashboard for monitoring ACO health. Review trends and performance against targets on key metrics for per-member-per-month performance, leakage, and utilization. The performance dashboard will include ACO measure performance if the organization has deployed ACO Measures as well.

<table>
<thead>
<tr>
<th>Type:</th>
<th>Identify Opportunities</th>
<th>Status:</th>
<th>Available</th>
<th>Updated:</th>
<th>2015-04-09</th>
</tr>
</thead>
</table>

ACO Explorer

PMPM

<table>
<thead>
<tr>
<th>Contract</th>
<th>Members</th>
<th>Current Year</th>
<th>Target PMPM</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aetna</td>
<td>2363</td>
<td>$945.17</td>
<td>$750.00</td>
<td>26.6%</td>
</tr>
<tr>
<td>BCBS</td>
<td>8034</td>
<td>$890.31</td>
<td>$600.00</td>
<td>12.3%</td>
</tr>
<tr>
<td>Cigna</td>
<td>10072</td>
<td>$979.60</td>
<td>$700.00</td>
<td>25.7%</td>
</tr>
<tr>
<td>CMS</td>
<td>18095</td>
<td>$890.72</td>
<td>$600.00</td>
<td>44.6%</td>
</tr>
<tr>
<td>United</td>
<td>7085</td>
<td>$890.44</td>
<td>$650.00</td>
<td>37.6%</td>
</tr>
</tbody>
</table>

Leaked PMPM

<table>
<thead>
<tr>
<th>Contract</th>
<th>Current Year</th>
<th>Prior Year</th>
<th>Trend</th>
<th>% Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aetna</td>
<td>$464.42</td>
<td>$482.42</td>
<td>-4.7%</td>
<td>5%</td>
</tr>
<tr>
<td>BCBS</td>
<td>$78.73</td>
<td>$67.02</td>
<td>18.1%</td>
<td>9%</td>
</tr>
<tr>
<td>Cigna</td>
<td>$62.81</td>
<td>$53.06</td>
<td>17.4%</td>
<td>9%</td>
</tr>
<tr>
<td>CMS</td>
<td>$68.22</td>
<td>$51.99</td>
<td>31.2%</td>
<td>9%</td>
</tr>
<tr>
<td>United</td>
<td>$59.77</td>
<td>$61.22</td>
<td>-2.4%</td>
<td>7%</td>
</tr>
</tbody>
</table>

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Features
Executive Dashboards feature trends and performance against targets for the following:

- Per-member-per-month payments
- Leakage
- Utilization
- Quality (if the user also has the ACO Measures dashboard, then summary quality results are also available)

Anticipated Improvements

- Quickly and easily assess the state of ACO health by monitoring and comparing performance across all at-risk contracts.
- Eliminate the burden of manually scrubbing and analyzing claims-based files. On-going files refreshed as quickly as 24 hours after receipt.
- Review PMPM, utilization and quality measure trends to identify potential problem areas and focus further evaluation and improvement work.

Success Measures

Opportunity Identification:

- Quickly identify trends across all payer contracts
- Identify the top contributors to PMPM performance, positive and negative
- Monitor key utilization metrics and trends

Background
To succeed, ACO executives need to successfully manage costs and ensure that they meet key performance metrics. ACO Explorer provides a single, unified view of ACO performance on these financial and quality metrics so that leadership can quickly assess performance and identify problem areas across all at-risk contracts.
Problem Summary
ACOs gain access to claims data to monitor their ACO performance, but may find it difficult to interpret and analyze it. Using ACO Explorer, users can quickly and easily analyze this claims data, gaining a window into current ACO health.

Measures

PMPM
- Trend of PMPM payments over time, across all at-risk contracts
- Top 10 PMPM contribution, by specialty and principal diagnosis
- Top 10 PMPM variance, by provider and principal diagnosis

Leakage
- Trend of leakage over time, across all at-risk contracts
- Leakage PMPM for the current and prior year
- % of total dollars leaked, per contract

Utilization
- Admits per 1000
- ER Visits per 1000
- Inpatient Days per 1000
- Average Inpatient LOS
- Rehab LOS
- 30-Day Readmission Rate

Quality (if client also has ACO Measures)
- Current percentile/measure
- Current score and target/measure
- Previous score
- Monthly trend

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Use Cases

- A health system enters a shared-savings agreement with a local payer, and wants to understand how it is performing against its per-member-per-month targets; using ACO Explorer, the executive team can quickly see that for the past three months PMPM payments trended below the target, but that there has been a worrisome rise in spend in the last month.
- The leadership team wants to quickly identify potential sources of rising PMPM rates; using ACO Explorer, the CFO notices that septicemia is the greatest contributor to overall PMPM rates, and organizes a team to identify potential improvement opportunities.

Data Sources

Required: Paid claims for in-patients and out-patients plus the associated membership and provider files.

Optional: If the client also has ACO Metrics, the summary level information will be displayed.

Screen Shots

This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
**ACO Explorer Measures tab requires purchase of ACO Measures application**

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
ACO Measures

Description
ACO Measures tool supports accountable care organizations (ACO’s) participating in the Medicare Shared Savings Program (MSSP). This tool supports monitoring and managing actual performance against CMS required measures for ACO’s throughout the year. The ability to measure performance and drill into each measure anytime, not only after a required reporting period, provides the ability to identify inefficiencies and opportunities for improvement in a timelier manner.

Type: Process Improvement  Status: In-Development  Updated: 2015-03-25

MSSP ACO Performance Monitoring

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Ability to look at measures and see how many patients need to be seen to move to the next percentile so process improvements around measures can be identified.
- Ability to look at a provider’s patient population.
- A provider can look at the patient before being seen and take preventative care steps as appropriate while the patient is in the office.

Benefits

- This tool gives accountable care organizations the opportunity to assess and improve performance prior to reporting to CMS, which represents a critical advantage given the dollars tied to an ACO’s performance against the CMS measures.
- Quickly view performance on measures using the measure summary. Performance indicators direct your attention to underperforming measures.
- Measures can be analyzed individually to support finding problem areas and providing details leading to better understanding of what aspect of the patient interaction might be lacking.
- This tool provides details to view provider measure performance and individual patient details either of which could lead to improved measure performance, providing potential for specific actionable details about how to improve scores.

Anticipated Improvements

This tool gives accountable care organizations the opportunity to assess and improve performance prior to reporting to CMS, which represents a critical advantage given the dollars tied to an ACO’s performance against the CMS measures.

Success Measures

Opportunity Identification:

- Identify patients that are near or out of compliance in specific care processes
- Identify providers and clinics that have the largest areas of opportunity for improvement
- Identify financial impact of current performance

Process Improvement:

- Increase data distribution of performance 50% by providing monthly snapshot of performance to clinicians and ACO administrators
- Increase compliance for preventive care measures by 20% using the patient detail list as a key informative work list

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Background
Accountable Care Organizations were authorized in 2011 through the Affordable Care Act. The goal of an ACO is to deliver seamless, high-quality care for Medicare beneficiaries, instead of the fragmented care that often results from a Fee-For-Service payment system in which different providers receive different, disconnected payments.

ACO’s will be responsible for maintaining a patient-centered focus and developing processes to promote evidence-based medicine, promote patient engagement, internally and publicly report on quality and cost, and coordinate care.

Problem Summary
Accountable care organizations lack the capability of assessing their patient’s data to improve performance on measures throughout the year prior to reporting. This inhibits their ability to improve performance on those measures.

Use Cases
ACO Metrics is intended for those responsible for tracking, reporting, and analyzing the CMS specified metrics required for participation in the MSSP. This generally includes ACO administrators, clinicians, and practice managers.

Measures / Metrics
Measure categories:

- Patient/caregiver experience
- Care coordination/patient safety
- At-risk population
- Preventive Care

Data Sources
- Electronic Medical Records (EMR)
- CMS Claims
- HCAHPS – Patient Experience

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Measure Documentation

Select a Measure...

<table>
<thead>
<tr>
<th>Domain</th>
<th>CMS eMeasure</th>
<th>NQFID</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS165v3</td>
<td>0018</td>
<td>ACO 28 - Hypertension (HTN): Controlling High Blood Pressure</td>
</tr>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS164v3</td>
<td>0006</td>
<td>ACO 30 - Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antithrombotic</td>
</tr>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS159v3</td>
<td>0710</td>
<td>ACO 40 - Depression Remission at Twelve Months</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS147v4</td>
<td>0041</td>
<td>ACO 14 - Preventive Care and Screening; Influenza Immunization</td>
</tr>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS144v3</td>
<td>0083</td>
<td>ACO 31 - Heart Failure (HF): Beta-Blocker Therapy for Left Ventricular Systolic Dysfunction (LVSD)</td>
</tr>
<tr>
<td>Care Coordination/Safety</td>
<td>CMS139v3</td>
<td>0101</td>
<td>ACO 13 - Falls: Screening for Future Fall Risk</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS138v3</td>
<td>0028</td>
<td>ACO 17 - Preventive Care and Screening; Tobacco Use; Screening and Cessation Intervention</td>
</tr>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS135v3</td>
<td>0066</td>
<td>ACO 33 - Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy – for patients with CAD and Diabetes...</td>
</tr>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS131v3</td>
<td>0055</td>
<td>ACO 41 - Diabetes: Eye Exam</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS130v3</td>
<td>0034</td>
<td>ACO 19 - Colorectal Cancer Screening</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS127v3</td>
<td>0043</td>
<td>ACO 15 - Pneumonia Vaccination Status for Older Adults</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS125v3</td>
<td>0043</td>
<td>ACO 20 - Breast Cancer Screening</td>
</tr>
<tr>
<td>Clinical Care for At Risk Populations</td>
<td>CMS122v3</td>
<td>0059</td>
<td>ACO 27 - Diabetes Mellitus: Hemoglobin A1c Poor Control</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS69v3</td>
<td>0421</td>
<td>ACO 16 - Preventive Care and Screening; Body Mass Index (BMI) Screening and Follow Up</td>
</tr>
<tr>
<td>Care Coordination/Safety</td>
<td>CMS69v4</td>
<td>0419</td>
<td>ACO 39 - Documentation of Current Medications in the Medical Record</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS22v3</td>
<td>0418</td>
<td>ACO 21 - Preventive Care and Screening; Screening for High Blood Pressure and Follow-up Documented</td>
</tr>
<tr>
<td>Preventive Health</td>
<td>CMS22v3</td>
<td>0418</td>
<td>ACO 18 - Preventive Care and Screening; Screening for Clinical Depression and Follow-up Plan</td>
</tr>
<tr>
<td>Patient/Caregiver Experience</td>
<td>CMS2v4</td>
<td>0418</td>
<td>ACO 4 - CAHPS: Access to Specialists</td>
</tr>
</tbody>
</table>

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
**Bundled Payments**

**Description**

The Bundled Payments analytics tool evaluates cost and variation associated with care delivery for patients, and is intended to prioritize areas of focus and provide a baseline for exploratory analysis. The application is modeled on the Centers for Medicare and Medicaid Services (CMS) Bundled Payment for Care Improvement (BPCI) Initiative. (Previously known as Episodes of Care)

---

**Pareto Summary**

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

---

August 4, 2015
Features

- **Summary**: The summary dashboard is based on the Pareto Principle, also known as the 80/20 rule. The charts are used to identify which of the episodes of care types are consuming the most resources, and may represent the greatest opportunities for cost reduction.

- **Variation**: This dashboard graphs episode of care types on two axes: financial metrics on the x-axis vs. variation on the y-axis. Those episodes of care types that are highly variable and high resource-consuming processes – found in the upper right quadrant of the chart – reflect the greatest quality improvement opportunities that may lead to cost reduction. Selecting a single episode of care type will allow users to drill a layer deeper on the variation chart to gain insights into the variation of resource consumption at the level of DRG and care institution.

- **Bundled Analysis**: This dashboard graphs the average spend per bundled across service providers stratified by the service categories inpatient, outpatient, professional, additional and other. Selecting two or more service providers will allow users to compare average spend across service providers.

- **Detail**: Users approved for patient-level detail will have access to this dashboard. The dashboard provides both summary and patient-level detail of the account and claim underlying the analytic application, thus providing additional insights into financial metrics and variation.

Anticipated Improvements

- Reductions in cost and variation, improvements in care coordination

Success Measures

**Opportunity Identification:**

- Identify potential $ saved from reductions in variation on select bundles
- Identify X bundles to go at risk for by evaluating cost and variation in each of the 48 CMS defined episodes of care
- Reduce costs in a selected bundle by X%

Background

Bundled payment initiatives attempt to reduce care fragmentation and improve overall quality of care by aligning incentives between all providers—including hospitals, physicians, and post-acute care providers— that touch a single episode of care. Instead of issuing separate payments to each of the participating providers, the payer issues a single payment for the episode of care. Participating providers need to work closely with any provider that provides services to the patient as a part of that episode to manage costs and overall quality. CMS is currently piloting a bundled payment program, called the Bundled Payment for Care Improvement Initiative. This tool is built to support the most popular model in the pilot, Model 2, which provides a retrospective

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
bundled payment after actual expenditures are reconciled against a target price for the episode of care in question.

Problem
To secure incentive dollars for participating in the bundled payment program, participants must work to control costs and manage quality with all providers that participate in the patient’s episode of care. Understanding sources of cost and variation in cost across settings and the providers that are participating in the episode is critical.

Use Cases
- Health system leadership are considering the possibility of entering into a bundled payment initiative, and want to better understand which of the 48 episodes of care to choose; using the Bundled Payment analytic tool, leadership quickly identifies five bundles with the greatest variation in care, revealing significant opportunity for improvement
- A health system has entered CMS’s Bundled Payment Initiative and is participating in all 48 episodes of care. An improvement team uses the Bundled Payment tool to identify the bundles with the highest costs and sources of variation. Specifically, the team evaluates payments across participating sites of care, and identifies its emergency room as a place to focus improvement efforts.

Measures
- Variation in total payment, by bundle
- Mean paid amount by service provider, by bundle (includes severity)
- Average spend per episode by institution and provider
- Bundles ranked by total payment amount
- Total spend by place of service, per bundle

Data Sources
Required: Paid claims for in-patients and out-patients, for full tool functionality (to look at both in and out of network care) plus the associated membership and provider files.

We can provide an in-network view using patient financial data, but this is much less ideal.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Leakage & Referrals Explorer

Description
Leakage and Referrals is an analytic tool to support more effective network management. The tool is designed to help health care organizations evaluate referral patterns and out-of-network service utilization to identify opportunities for more effectively managing their networks.

Features
- **Summary**: Summary level view highlights key trends in network performance, including leakage PMPM and referral trends
- **Leakage**: Evaluate out-of-network service utilization, considering the total dollars going out of network by provider, facility, procedure, and geography
- **Referrals**: Evaluate in and out of network referrals by specialty, procedure, and facility over time; in addition to primary referral patterns, consider chain leakage to identify additional opportunities for improvement

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Anticipated Improvements
- Reduce costs, reduce leakage, improve referral patterns

Success Measures
Examples of success measures associated with this app include:

**Opportunity Identification:**
- Identify potential savings from improving in-network referral rates
- Targeted education efforts result in 25 percent more referrals to in-network providers
- Leakage and referral improvement efforts lead to an overall reduction in PMPM of 5 percent %

Background
To succeed under at-risk contracts, ACOs need to successfully manage care across the continuum, including services that attributed patients receive in and out of the network. In addition to building an adequate physician network, health care organizations must effectively manage the network that they have in place by reducing out-of-network service utilization and ensuring appropriate referral patterns.

Problem Summary
ACOs lack actionable information about how to better manage their physician networks, a critical competency to succeed under at-risk contracts. Even when ACOs gain access to claims data, they may lack the expertise or resources to conduct regular analyses and identify opportunities for improvement.

Measures
**Leakage**
- Total dollars leaked and % of dollars leaked
- Leakage from PCPs, by zip code
- Leakage by facility type, procedure, and geography

**Referrals**
- Total referrals
- In and out-of-network referrals
- Network referrals by specialty
- Referrals over time by specialty

Data Sources
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Required: Paid claims for in-patients and out-patients (leakage) plus the associated membership and provider files.

Required: EMR data (specifically referrals information)

**Screen Shots**

**Network Referrals (prototype)**
Patient Risk Stratification

Patient Risk Stratification for Care Management

Description
Patient Risk Stratification supports ACOs in managing cost and utilization for high-cost/risk patients. With the easy-to-use interface, users can analyze what drives the spending for these patients, stratify them by varying claim-based risk models, view metrics by multiple demographic, clinical, and claim-related filters and ultimately determine the most important candidates for intervention through care management.

Type: Process Improvement  Status: Available  Updated: 2015-07-22
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features
- Multiple patient risk models: APRDRG Severity of Illness, Charlson/Deyo, HHS-HCC (can be configured for custom client defined models as well)
- Compare various risk contracts, patient populations, providers, clinical groupings, etc.
- Identify patients of interest based on risk score, claim payments, clinical conditions, etc.

Anticipated Improvements / Benefits
- Reduce hospitalizations and ED encounters
- Improve the health of comorbid condition patients
- Understand and improve the health of highest risk patients

Success Measures
- Reduce overall patient care costs for the at-risk organization(s)
- Identify high-risk, high-cost patients
- Prioritize care management efforts to those patients in most need

Background
Successful ACOs understand that often around 5% of patients can drive more than 50% of spending. With that disproportion, first identifying and then effectively allocating care management resources to proactively care for that population can help avoid the higher likelihood of hospitalization, ED encounters or other high cost care.

Problem Summary
ACOs too often lack visibility into the key data that will help them manage their at-risk populations. Some of the key but often missing elements include: identification of patients with the highest risk of requiring high cost care using multiple models, comparing in and out-of-network claims, grouping or analyzing by: care processes, encounter details, diagnosis codes, providers, age cohorts, and zip codes.

Use Case
A health system wants to understand the details of their spending on their at-risk population. Using Patient Risk Stratification the executive team can quickly see that patients in a certain age cohort and clinical grouping are driving a disproportionate amount of their costs. To address the situation the team implements an aggressive care management strategy targeting the key processes that support the particular group of patients.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Measures/Metrics

- Risk score by age group
- Patient count by risk group or model
- Patient count by when last seen
- Trends by risk model
- Payments by patient risk
- Risk scores over time
- Historical variables contributing to patient risk score

Data Sources

- Acute & Ambulatory EMR systems
- Inpatient & outpatient claims

Screen Shots

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
PMPM Analyzer

Description
PMPM Analyzer supports a holistic evaluation of the drivers of per member per month payment performance. This claims-based tool gives an in- and out-of-network view of payment trends, and gives users the ability to understand how an ACO’s procedures, providers, patients, and specialty areas are contributing to overall PMPM payment performance.

Type: Identify Opportunities  Status: Available  Updated: 2015-07-22

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Features

- Summary-level statistics highlighting PMPM payment trends over time and against target rates
- Opportunity: review payment variation by provider, specialty, procedure, and diagnosis to explore potential opportunities for standardization
- Payments: Analyze the providers, patients, specialties, and diagnoses that are the greatest contributors to PMPM performance
- Providers: Explore variation in payment at the provider level; evaluate payments at the provider-level, considering the patients, diagnoses, procedures and care processes that are contributing to the trend
- Details (patient): Explore variation in payments at the patient level; consider the drivers of payments at the patient level

Benefits / Anticipated Improvements

Quickly identify top contributors to PMPM performance

- Claims-based dashboard provides a view across the continuum of care
- Visualize top contributors to PMPM payment trends at the specialty, provider, and patient levels

Conduct detailed analyses of PMPM performance to identify opportunities for improvement

- Drill into PMPM payment trends within each contract to identify major cost drivers
- In addition to highlighting the top overall contributors to PMPM performance, the tool supports very detailed and comprehensive analyses to identify a wide range of drivers of PMPM payment trends

Faster time to value

- Eliminate the burden of manually scrubbing and analyzing claims-based files
- Ongoing claims-based files refreshed as quickly as 24 hours upon receipt

Success Measures

Opportunity Identification:

- Identify potential $ saved from reductions in leakage
- Identify the opportunity to reduce PMPM payment rates by improving outreach to high-risk, high cost patients
Background
To succeed under at-risk contracts, ACO executives need to successfully manage costs. They must perform better than a PMPM target in order to realize savings and avoid losses. Where ACO Explorer provides an executive-level dashboard that allows the health care organizations to monitor high-level PMPM payment trends, PMPM Analyzer is designed to support analysts doing comprehensive, deep-dive analyses to understand how to improve PMPM performance.

Problem
ACOs gain access to claims data to monitor their ACO performance, but may find it difficult to interpret and analyze it. Specifically, it is critical for ACOs to leverage this claims data to monitor their performance on PMPM payment targets. Absent the ability to monitor PMPM trends and identify opportunities to improve, ACOs will lack the ability to strategically improve their financial performance against contractual targets.

Use Case
A health system enters a shared-savings agreement with a local payer, and wants to understand how it is performing against its per-member-per-month targets. Using ACO Explorer, the executive team can quickly see that for the past three months PMPM payments trended below the target, but that there has been a worrisome rise in spend in the last month. The CFO asks her analyst to explore this trend and identify opportunities for improvement. Using PMPM analyzer, the analyst determines that out-of-network service leakage for cardiology is one of the major drivers of rising costs. In response, leadership starts to consider options for better aligning with these specialists.

Measures/Metrics
- Total payments by care process, diagnosis, procedure, claim type, specialty, provider, and patient
- Variation in total payments per encounter by care process
- Variation in total payments at the patient level, stratified by the patient’s risk score

Data Sources
Required: Paid claims for in-patients and out-patients, plus associated membership and provider files.

Screen Shots

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Financial Analytics

Description
Financial applications from Health Catalyst address the basic measurement needs of the finance department in a health care setting. By combining finance data sources with other information such as billing, claims, clinical, costing and patient satisfaction, it is easy to understand the cause and effect of historical changes in revenue with prospective changes in payer mix or the impact of a new procedure. The Financial Management Components listed below are currently available or in active development. New component modules are being developed, so check back to see the newest additions to the Health Catalyst Financial Components.

Applications

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Financial Management Explorer

Description

Financial Management Explorer is aimed at senior and service line leadership as well as clinical and financial analysts. It provides single source of truth for clinical program financial performance and nicely ties together clinical, operational, and financial measures. Rich data exploration can occur through embedded drill through and slicing & dicing.

Type: Outcomes Improvement Status: Available Updated: 2015-03-12

Summary data provides a starting point for guided navigation

Features

- Application is automatically refreshed as new data is available.
- High-level clinical, operational, and financial performance measures are combined in a predictable and consistent manner.
- Guided navigation and drill down provides answers to the next series of questions typically asked by the user.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
• Embedded logic provides for quick and easy identification of clinical process variation and quantifies the potential opportunity for cost reduction. The application then provides guided navigation into the causes of variation, including provider, cost center, activity code.

Benefits
• Reducing the time to compile monthly or quarterly performance reports definitely frees up analyst time to focus on finding opportunities to standardize care and reduce cost, but more importantly, creating guided navigation reduces the time to focus in on the areas of highest opportunity.
• Single source of truth for key clinical, operational, and financial measures
• Guided navigation to quickly identify potential opportunities for reduced variation and cost reduction
• Deep drill down into causes of variation.

Anticipated Improvements
• Reducing the time to compile monthly or quarterly performance reports definitely frees up analyst time to focus on finding opportunities to standardize care and reduce cost, but more importantly, creating guided navigation reduces the time to focus in on the areas of highest opportunity.
• Single source of truth for key clinical, operational, and financial measures

Success Measures
Opportunity Identification:
• Uncover cost reduction opportunities related to standardizing care across a patient cohort.

Process Improvement:
• Reduce the effort it takes the Finance team to generate standard reporting as well as the effort to generate ad-hoc analysis. Finance team saves one day per month. Broadens the reach of reporting that has traditionally been limited

Outcomes Improvement:
• Reduce 2% in cost per case by December 2015 due to standardized practice(e.g. 5% reduction in length of stay, 12% reduction in lab costs)

Overview
Financial Management Explorer integrates data from billing and costing and creates snapshots of traditional financial metrics—snapshots that are as current as the underlying data. The app’s infrastructure facilitates flexible ad-hoc analysis and can serve as a single source of truth for clinical program financial performance.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
• Financial Management Explorer provides a strong foundation to inform business and clinical decisions by linking operational, financial, and clinical data across the healthcare enterprise.
• The app provides robust views of high-level financial performance as well as the capability to drill into clinical cost reduction opportunity and drivers of variation.
• Guided navigation and drill-down provide answers to the next series of questions typically asked by the user.
• Embedded logic helps users quickly identify clinical process variation and quantify the potential opportunity for cost reduction. The application then provides guided navigation into the causes of variation, including provider, cost center, and activity code.

Background
Most healthcare organizations operate on thin margins and need to have a trusted place to go for updated numbers and trends. Not only are the static and trended dollars and statistics important, but so too is the need to identify process variation and cost reduction opportunities. Financial Management Explorer provides a strong foundation to inform business and clinical decisions by linking operational, financial and clinical data across the healthcare enterprise. The application provides robust views of high level financial performance as well as the capability to drill into clinical cost reduction opportunity and drivers of variation.

Problem Summary
In many organizations, the Finance department is tasked with collecting and combining data from numerous sources to present a unified picture of current performance. This labor intensive monthly (or possibly quarterly) effort typically results in a static report that not only lacks visualization, but also focuses only on “what” is happening rather than “why”. Each additional question requires a new “one-off” data request that will undoubtedly need to be triaged and queued up for the next available analyst. The tool enables deep drilling from Clinical program down to the Diagnosis and from the Department group all the way down to the chargeable activity code. This allows the organization to focus in on strategic opportunities to reduce variability and improve bottom line performance.

Users
This application is aimed at senior and service-line leadership as well as clinical and financial analysts.

Measures
Traditional financial performance measures include:

• Charges
• Reimbursement
• Length of Stay
• Contribution & Total Margin
• Variable & Total Cost
• Case Mix Index

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Measures are augmented through the introduction of “opportunity” measures calculated at various dimensions of the data (provider, cost center, and detailed activity level). This creates actionable insight to help guide the user to areas of highest opportunity for reducing variation and reducing cost.

Data Sources
- General Financial systems

Screen Shots
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Financial Management Explorer

Financial Management Explorer utilizes patient billing and cost accounting systems to provide a snapshot of financial performance by clinical program, payor and location, with the ability to drill into cost metrics and assess variability of practice.

Financial Summary and Trending Tab
View financial metrics while navigating a hierarchy of Clinical Programs down to the diagnosis codes, Financial Classes down to payors and plans, and Locations to individual providers.

For each hierarchy, compare trends of any financial metric.

Opportunity Tab
View opportunity based on variability of patient cohorts, and refine based on outliers and minimum case counts.

Rank variable direct cost opportunity should utilization patterns be standardized around the mean and drill into specific patient cohorts to analyze metric trends.

Variability Tab
Drill down into major contributors of variation across Provider/Specialty, and view detailed activity and cost center utilization

Visit Detail Tab
View specific financial and visit details of a patient list, and then into the utilization details of a single patient.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
General Ledger Explorer

Description
General Ledger Explorer allows you to quickly organize, summarize, and investigate traditional general-ledger data (actual and budget) so that you can see and understand variances and take action as needed to improve your organization’s financial performance. Major benefits of using this app include:

- A “single source of truth” for key financial measures — and the ability to share actionable visualizations of these measures.
- Less time required to compile financial reports.
- More consistent and reliable results.
- Guided navigation for quick identification of variances to budget or prior year figures.

Type: Identify Opportunities Status: Available Updated: 2015-03-12

Summary View with Trends

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Features

- Application is automatically refreshed as new data is available.
- High-level financial and operational performance measures are combined in a predictable and consistent manner.
- Guided navigation and drill down provides answers to the next series of questions typically asked by the user.
- Embedded variance analysis decreases the time it takes to zoom in our major contributors to variance.

Benefits

- Reducing the time to compile monthly or quarterly performance reports definitely frees up analyst time to focus on finding opportunities to standardize care and reduce cost, but more importantly, creating guided navigation reduces the time to focus in on the areas of highest opportunity.
- Single source of truth for key clinical, operational, and financial measures
- Guided navigation to quickly identify potential opportunities for reduced variation and cost reduction
- Deep drill down into causes of variation.

Anticipated Improvements

- A “single source of truth” for key financial measures — and the ability to share actionable visualizations of these measures.
- Less time required to compile financial reports.

Success Measures

Opportunity Identification:

- Both the accounting office and cost center managers will benefit through rapid identification of monthly variances.

Process Improvement:

- Automate currently manual analysis and distribution of monthly financial statements. Reduction in time spent by accounting staff of one day per month.

Outcomes Improvement:

- Enable organization to meet budget expense target for quarter 3 of 2015.

Background

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
General Ledger Explorer provides a robust analytic front-end to organize, summarize, and provide actionable visualization of traditional general ledger data (actual and budget). An interactive variance analysis allows for rapid identification of major variances within the cost center hierarchy and account hierarchy.

**Problem Summary**
Many Finance Departments are challenged with simply getting the books closed each month. Providing them with a more timely view of financial performance (from the overall organization all the way down to the cost center) will decrease the time it takes to discover potential issues with the close process and analytics to drill into monthly variances to budget or prior year. Additionally, many organizations lack the ability to publish financial reports that represent financial performance using trending, drilling, and visualization. This application will drastically improve this process so that cost center leadership can dig into the monthly details to quickly identify variances and begin to develop their variance explanations.

**Users**
This app is intended for **financial and accounting office staff** and **cost center managers** — anyone who needs to maximize insights from general ledger data.

**Measures / Metrics**
The application is organized around the standard financial statement, including Income Statement and Balance Sheet measures calculated at various dimensions of the data (time, cost center hierarchy, and account hierarchy).

**Data Sources**
Data comes from your organization’s general ledger or budget tool. The app is organized around the standard financial statements, including the Income Statement and Balance Sheet measures calculated at various dimensions of the data (time, cost center hierarchy, and account hierarchy). Actual performance is compared to prior year and budget.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Revenue Cycle Explorer: Hospital

Description
Reporting tool that allows revenue cycle decision makers and analysts to quickly and easily identify trends and variances, pull ad hoc reports and address root causes of performance issues. Metrics include: denials management, accounts receivable, charge and cash trends, write offs, gross and net collection rates.

Type: Outcomes Improvement  Status: Available  Updated: 2014-05-31

Revenue Cycle KPIs

Executive Dashboard with high level KPIs and trending comparisons

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Drill down capabilities to the payer, provider, location and CPT level allow for true root cause analysis
- Built in comparisons and variances give instant insight to performance
- Application is automatically refreshed as new data is available.
- Guided navigation and drill down provides answers to the next series of questions typically asked by the user. Drill down typically extends as far as patient or transaction level which results in an actionable dataset that can be worked or validated.

Benefits

- The application is automatically refreshed as new data becomes available allowing for a paradigm shift in AR management from a reactive approach to one where potential issues and processes are corrected before they have a chance to affect cash flow or become a compliance risk.
- Frees up analyst/decision support time by providing timely and accurate reports and empowering users to find answers on their own through deep drill down analysis
- Single source of truth for key revenue cycle metrics

Anticipated Improvements

- Drill down capabilities to the payer, provider, location and CPT level allow for true root cause analysis
- Built in comparisons and variances give instant insight to performance

Success Measures

Opportunity Identification:

- Ability to show net collection rate variance of up to 7% between facilities of a healthcare system.

Process Improvement:

- By year end, reduce workload of centralized BI team by 20% by providing timely, accurate and actionable data to end users.

Outcomes Improvement:

- Lowered timely filing write offs for Medicaid payer by $1 million in six months.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Background & Problem Summary

Health care providers work in a challenging environment with rising costs of care, decreasing patient volumes and an evolving reimbursement model. One controllable aspect of the business is collecting every dollar that they are entitled to. However, complex billing rules from dozens of payers, convoluted regulations, and greater reliance on patients for payment combined with antiquated financial reporting has led to millions of dollars of lost revenue. Revenue Cycle Explorer gives decision makers timely access and visibility to the data that matters most - allowing them to drive change and succeed in this complex reimbursement environment.

Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charges, Payments, Adjustments</td>
<td>Location, Financial Class, Provider, Post Period</td>
</tr>
<tr>
<td></td>
<td>MTD or YTD</td>
</tr>
<tr>
<td></td>
<td>Compare to prior period, workday adjusted prior period or budget</td>
</tr>
<tr>
<td>Payer Mix</td>
<td>Location, Post Period/AR Report Date</td>
</tr>
<tr>
<td></td>
<td>View by Charges posted or Accounts Receivable</td>
</tr>
<tr>
<td>Write Offs (Bad Debt, Charity,</td>
<td>Location, Financial Class, Payer and post date</td>
</tr>
<tr>
<td>Operational Write Offs)</td>
<td></td>
</tr>
<tr>
<td>Total Accounts Receivable</td>
<td>Location, Financial Class, Provider, AR Report Date, Discharge Period</td>
</tr>
<tr>
<td></td>
<td>View as Dollars or # of Accounts</td>
</tr>
<tr>
<td></td>
<td>Aging Category: (0-30, 120+, etc.)</td>
</tr>
<tr>
<td></td>
<td>Account Balance Category: &lt;$0, $1k-$9k, $10k+, etc.)</td>
</tr>
<tr>
<td></td>
<td>Time Frame: Rolling 12 or compare to prior year</td>
</tr>
<tr>
<td>Days in AR</td>
<td>Location, Financial Class, Provider, AR Report Date</td>
</tr>
<tr>
<td></td>
<td>Time Frame: Rolling 12 or compare to prior year</td>
</tr>
<tr>
<td>Net Collection Rate</td>
<td>Financial Class, Payer, Discharge Period</td>
</tr>
<tr>
<td></td>
<td>Months from Discharge (trend how well you recover payments)</td>
</tr>
<tr>
<td>Gross Collection Rate</td>
<td>Financial Class, Payer, Discharge Period</td>
</tr>
<tr>
<td></td>
<td>Months from Discharge (trend how well you recover payments)</td>
</tr>
<tr>
<td>Denials</td>
<td>Count of denials and $ denied by Denial Category, Denial Code, Payer,</td>
</tr>
<tr>
<td></td>
<td>Location, Provider, CPT Code (for professional only)</td>
</tr>
</tbody>
</table>

Data Sources

- General Financial
- Billing and Accounting

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
### Gross and Net Collection Rates

#### Revenue Cycle Explorer

**Denials Category MTD**

<table>
<thead>
<tr>
<th>Category</th>
<th>MTD Denied</th>
<th>% of Total</th>
<th>Var to Prior</th>
<th>% Var</th>
<th>% Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Access</td>
<td>$392,290</td>
<td>20.0%</td>
<td>($220,424)</td>
<td>19.4%</td>
<td></td>
</tr>
<tr>
<td>Billing</td>
<td>$906,462</td>
<td>36.8%</td>
<td>($155,285)</td>
<td>16.3%</td>
<td></td>
</tr>
<tr>
<td>Non-Covered</td>
<td>$265,938</td>
<td>9.7%</td>
<td>($228,280)</td>
<td>80.8%</td>
<td></td>
</tr>
<tr>
<td>Non-Central</td>
<td>$229,850</td>
<td>9.3%</td>
<td>($228,434)</td>
<td>89.9%</td>
<td></td>
</tr>
<tr>
<td>Coding</td>
<td>$84,449</td>
<td>3.4%</td>
<td>($32,192)</td>
<td>27.6%</td>
<td></td>
</tr>
<tr>
<td>Provider</td>
<td>$85,915</td>
<td>3.5%</td>
<td>($21,605)</td>
<td>20.8%</td>
<td></td>
</tr>
<tr>
<td>Authorization</td>
<td>$29,456</td>
<td>1.2%</td>
<td>($65,147)</td>
<td>144.8%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>$1,106</td>
<td>0.0%</td>
<td>($720)</td>
<td>20.4%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,471,225</strong></td>
<td><strong>100.0%</strong></td>
<td>(<strong>$640,876</strong></td>
<td><strong>26.8%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Payer MTD**

<table>
<thead>
<tr>
<th>Payor/NI</th>
<th>MTD Denied</th>
<th>% of Total</th>
<th>Var to Prior</th>
<th>% Var</th>
<th>% Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicare</td>
<td>$101,432</td>
<td>31.0%</td>
<td>($31,025)</td>
<td>23.8%</td>
<td></td>
</tr>
<tr>
<td>Blue Cross</td>
<td>$261,697</td>
<td>81.4%</td>
<td>($100,196)</td>
<td>33.8%</td>
<td></td>
</tr>
<tr>
<td>CDPOTWASH</td>
<td>$26,524</td>
<td>11.7%</td>
<td>($44,402)</td>
<td>213.8%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,471,225</strong></td>
<td><strong>100.0%</strong></td>
<td>(<strong>$640,876</strong></td>
<td><strong>26.8%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Provider MTD**

<table>
<thead>
<tr>
<th>Provider MTD</th>
<th>MTD Denied</th>
<th>% of Total</th>
<th>Var to Prior</th>
<th>% Var</th>
<th>% Var</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,471,225</strong></td>
<td><strong>100.0%</strong></td>
<td>(<strong>$640,876</strong></td>
<td><strong>26.8%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Remit Code MTD**

<table>
<thead>
<tr>
<th>Remit Code</th>
<th>Description</th>
<th>MTD Denied</th>
<th>% of Total</th>
<th>Var to Prior</th>
<th>% Var</th>
<th>% Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>DENIED/REDUCED</td>
<td>$972,395</td>
<td>27.3%</td>
<td>($1,177,144)</td>
<td>14.9%</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>LHOS INFO NEED</td>
<td>$435,759</td>
<td>17.6%</td>
<td>($2,14,304)</td>
<td>46.9%</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>DUPLICATE CLAIM</td>
<td>$241,626</td>
<td>9.8%</td>
<td>($285,774)</td>
<td>23.2%</td>
<td></td>
</tr>
<tr>
<td>97</td>
<td>THE BENEFIT FOR</td>
<td>$13,391</td>
<td>0.5%</td>
<td>($65,763)</td>
<td>25.4%</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CLAIM DENIED</td>
<td>$89,386</td>
<td>4.0%</td>
<td>($70,864)</td>
<td>14.5%</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>DENIED/REDUCED</td>
<td>$94,930</td>
<td>3.4%</td>
<td>($2,10,311)</td>
<td>71.3%</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>NON-COVERED</td>
<td>$84,390</td>
<td>3.4%</td>
<td>($2,12,408)</td>
<td>160.2%</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>EXPENSES AFTER</td>
<td>$75,691</td>
<td>2.7%</td>
<td>($2,06,016)</td>
<td>28.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,471,225</strong></td>
<td><strong>100.0%</strong></td>
<td>(<strong>$640,876</strong></td>
<td><strong>26.8%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Location MTD**

<table>
<thead>
<tr>
<th>Location</th>
<th>MTD Denied</th>
<th>% of Total</th>
<th>Var to Prior</th>
<th>% Var</th>
<th>% Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milton Health Care</td>
<td>$198,821</td>
<td>7.0%</td>
<td>($32,236)</td>
<td>16.2%</td>
<td></td>
</tr>
<tr>
<td>Southwood Health Inc</td>
<td>$235,579</td>
<td>8.5%</td>
<td>($2,95,922)</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>Tahoma Clinic</td>
<td>$187,615</td>
<td>6.9%</td>
<td>($37,237)</td>
<td>20.2%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,471,225</strong></td>
<td><strong>100.0%</strong></td>
<td>(<strong>$640,876</strong></td>
<td><strong>26.8%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**CPT Code MTD**

<table>
<thead>
<tr>
<th>CPT Code</th>
<th>Description</th>
<th>MTD Denied</th>
<th>% of Total</th>
<th>Var to Prior</th>
<th>% Var</th>
<th>% Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>83041</td>
<td>SURG. BLEED. T. AUTO</td>
<td>$23,612</td>
<td>8.7%</td>
<td>($1,98,922)</td>
<td>10.0%</td>
<td></td>
</tr>
</tbody>
</table>

**Denials – in actionable categories by operational area**

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Operational Efficiency & Performance Monitoring

Description
Operational Efficiency and Performance Monitoring applications from Health Catalyst enable operations leaders and improvement teams within your organization to focus attention on specific goals of increased operational and workflow efficiencies, standardization, and waste reduction. Advanced Applications have been developed in these commonly requested clinical areas. The Workflow/Operational Components listed below have been developed or are in active development in these areas that are commonly requested by our clients. New module development is prioritized based on client demand. New Components are constantly being developed, so check back to see the newest additions to the Health Catalyst Workflow/Operational Components.

Workflow is a great place to start
Workflow and operational efficiency improvements are a logical place to start because the benefits of these improvements accrue to the health provider organization regardless of payment model. Unlike improvements which reduce referrals or procedural interventions, which based on the payment model, may benefit the health plan and not the provider.

Operational efficiency projects establish permanent improvement teams which leverage starter set AIMs, metrics, analytic models based on standard work and operational guidelines to achieve and sustain efficiency improvement for hospital and clinic departments.
Workflow Knowledge Assets

<table>
<thead>
<tr>
<th>Knowledge Asset Type</th>
<th>Discounted FFS</th>
<th>Per Diem</th>
<th>Per Case</th>
<th>Bundled Per Case</th>
<th>Condition Capitation</th>
<th>Full Capitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CMS</td>
<td>Commercial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workflow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnostic Variation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing Orders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substance Selection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triage Criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment and Monitoring Algorithms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indications for Referral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indications for Intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Red = Negative Impact
- Yellow = Positive or Negative
- Green = Positive Impact

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Applications

### Operational Efficiency & Performance Monitoring

<table>
<thead>
<tr>
<th>Application</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice Management Explorer – Patient Access</td>
<td>Available</td>
</tr>
<tr>
<td>Practice Management Explorer- Professional Billing</td>
<td>In-Development</td>
</tr>
<tr>
<td>Patient Experience Explorer</td>
<td>Roadmap</td>
</tr>
<tr>
<td>Labor Management Explorer</td>
<td></td>
</tr>
<tr>
<td>Patient Flow Explorer</td>
<td></td>
</tr>
<tr>
<td>Pediatric Reporting – Patient Safety</td>
<td></td>
</tr>
<tr>
<td>ACO Measures (see Accountable Care)</td>
<td></td>
</tr>
</tbody>
</table>

*This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.*

August 4, 2015
Labor Management Explorer

Description

**Labor Management Explorer** is an analytics tool that allows managers to understand basic operational and staffing indicators to facilitate more efficient labor force utilization. Users access and dynamically interact with EMR, HR, and Timecard data from multiple sources systems to discover meaningful opportunities for improvement.

For example, users can:

- Attain actionable information about key metrics such as work hours per unit of service (WHPUOS), overtime hours per unit, and contract staff.
- Review temp hours, scheduled and unscheduled PTO.
- Trend various measures over time (compare this year to last year.)

**Type:** Process Improvement  
**Status:** Available  
**Updated:** 2015-02-24

---

*Labor Productivity overview*

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Enables manager to understand basic operational and staffing indicators.
- Facilitates more efficient labor force utilization.
- Access and dynamic interaction with data from EMR, HR and Time card systems.

Benefits / Anticipated Improvements

Increase near-real-time and retrospective data to analyze staffing levels and ratios to align staffing goals with actual volumes.

Success Measures

Opportunity Identification:

- Identify potential $ saved in units with high utilization of premium pay
- Identify correlation discrepancies between utilization of premium pay and volumes
- Identify potential savings through reduction of third party vendor solutions

Process Improvements:

- Data availability increased from monthly to daily
- Multiple data sources integrated and consumable for leadership in a consolidated format

Background

In U.S. healthcare,

- More than $225 billion in spending goes to the salaries and benefits of hospital employees.
- Labor costs, as a percentage of total hospital spending, are approximately 60% 

Users

Labor Management Explorer is intended for those responsible for tracking, reporting, and analyzing staffing metrics enabling efficient, evidence-based coordination of existing and needed labor resources. This usually includes hospital administrators, clinical and operations directors, and unit managers.

- Leadership responsible for managing labor resources.
- Any leaders who may want to delve deeper than static reports to identify trends and potential improvement areas.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Metrics / Measures
- Work hours per unit of service (WHPUOS)
- Departmental volumes
- Overtime hours
- Temp hours
- Scheduled and unscheduled PTO

Data Sources
All of the data used within Labor Management Explorer are gathered from human resources (HR), time tracking, episode of care, and/or billing data. HR and time tracking data will enable the application to report hours based on an employee’s home department or cost center and to classify the types of hours, such as regular, overtime, or temporary. Episode of care and billing data enable patient volume calculations to give further insight into labor variations.

<table>
<thead>
<tr>
<th>Content</th>
<th>Possible Sources</th>
</tr>
</thead>
</table>
| Patient statistics/volumes by department for Actual and Budget by time period, including: | • Billing financials for ‘actual’ volumes, typically calculated from procedures or cost centers, but will vary by department. (Epic, Soarian, Cerner, EPSI)  
- Visits  
- Patient days  
- Discharges  
- Cases  
- Procedures  
- Budgeting or imported spreadsheet for ‘budget’ volumes |
| Mapping of earnings codes to worked/paid hours                           | • Payroll or Time Tracking system (such as Kronos, PeopleSoft, SAP)               |
| Cost center rollup hierarchy for reporting structure                     | • Budgeting or Costing system, general ledger (such as EPSI, TSI, PeopleSoft)   |
| Mapping of job code hierarchy (Job Family, Group, Code - such as administrative, clinical, nursing) | • Human Resources or Time Tracking system (such as Kronos, PeopleSoft or SAP) |
| Human Resource’s Hours — actual and budget by time period, including:    | • Payroll or Time Tracking system (such as Kronos, PeopleSoft, SAP)  
- Cost center  
- Job code  
- Earning type codes (Regular, Nonproductive, Contract labor, Over Time (OT), Float, Float OT)  
- Budgeting system or imported spreadsheet for ‘budget’ hours |
| Target work hours per volume                                            | • Budgeting or imported spreadsheet for ‘Target’ hours                           |

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Patient Experience Explorer

Description
Patient Experience delivers multiple, robust views into the data your patients are providing about their healthcare experience. Whether it is summary performance scores for executive leaders, survey results with goals and percentiles for unit managers or survey details for individual providers, this application delivers the information your organization will need in order to understand and improve on the safety, physical comfort, education and other aspects of care being provided to your patients.

Type: Process Improvement  Status: Available  Updated: 2015-03-13

Summary page showing system-wide metrics for patient satisfaction question

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- **Collect and display data from multiple patient survey types.** Users are given an overview of the surveys used, scores generated, and trends detected. This allows exploration of patient responses per survey sections and questions, by hospital unit, clinical program, location and provider. Filtering for questions related to CMS HCAHPS scores, review results based on priority questions identified for your system and gauge performance against organization goals.

- **Connect survey data to other operational or clinical indicators.** The essentials layer delivers providers the opportunity to add other key indicators to the survey data in support of a more complete understanding of the issues impacting a patient’s care experience: LOS, comorbidity count, admit diagnosis, discharge department etc.

- **Bookmarks provide quick access to user’s preferred view.** Customers are often looking for solutions that meet the informational needs of multiple audiences. This application allows users to bookmark their preferred view(s) of the patient survey data for easy access, minimizing the need for custom reporting.

Benefits

- Collect, aggregate, and display data from multiple patient survey types in one application
- Connect survey data to other operational or clinical indicators such as LOS, comorbidity count,

- Bookmark preferred views that correspond to the informational needs of different audiences.
- Easily see trends, goals and percentiles,, and access detailed responses
- Filter by date, questionnaire, patient demographic (age, gender, ethnicity), location and provider, etc. to target answers to questions about the patient experience in your system.

Anticipated Improvements

- Collect, aggregate and display survey data in a format that is easy to consume, analyze and is actionable.
- Further enhance the power of the survey data by linking to other operational, clinical indicators and patient demographics data.
Success Measures

Opportunity Identification:
- Identify trends, goals and percentiles in areas of strategic importance according to organizations priority matrix
- Identify departmental and service line opportunities
- Identify targets for improvements based on patient demographics, clinical indicators, locations, volumes or case mixes.

Process Improvements:
- Improved integration of data into clinical and operational improvement initiatives by 25%
- 25% improvement in utilization of analytic application
- 100% transparency of performance across organization
- 90% decrease in use of vendor portals

Outcomes Improvement:
- 15% reduction in report generation and distribution

Background
Patient experience surveys are an integral part of the healthcare industry’s transition to value-based care. Surveys are being deployed in more care environments and included in more regulatory programs, making it increasingly important that healthcare providers use robust analytic tools in order to gain clear insights from their patient survey data. Patient Experience Explorer supports informed care improvement decisions by exposing summary and detailed patient survey data and linking this information to other key clinical indicators, helping providers identify and address the effect of process change on the patient experience

Problem Summary
The basic, static performance reports survey vendors make available to their customers do not address the desires of most healthcare providers for detailed, dynamic views into their patient experience survey data. Addressing this reporting gap requires the provider to shoulder an additional analytics burden (or additional reporting module costs) that usually results in labor-intensive processes to produce the custom – but still static - reports. Adding other clinical indicators - length of stay, payer type, intervention actions, etc. - to patient experience reports requires still further effort (or costs). These obstacles limit the ability of many healthcare organizations to fully explore and understand patient experience survey data, thereby limiting the improvement efforts.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Users
This app is intended for hospital and health system administrators, unit managers, clinical and operations directors, clinical program guidance teams, and operational guidance teams.

Measures
Questions and categories from these patient experience surveys are handled by the typical deployment:

- Hospital In-Patient
- Out-Patient
- Emergency Department

Data Sources
Data comes from the EMR and experience survey tools (e.g., Press Ganey, NRC Picker, etc.).

Screen Shots
Details on answers to a specific question

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Patient Flow Explorer

Description:
Patient Flow Explorer provides hospital leadership, department level managers and clinical operational teams multiple views of data around the patient movement in and out of various locations during a visit. The application uses the admission, discharge and transfer (ADT) logs of the electronic medical record to establish patterns, trends and cycle times of common workflows.

Type: Process Improvement Status: Available Updated: 2015-03-17

Patient Flow Summary View

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features
- Delays in highest utilized workflows
- Most common workflows across the hospital
- Biggest delays in patient flows
- Stratified by:
  - Time: Of day (shift), week, year (seasonal)
  - Current capacity of hospital, department
  - Provider (Nurse/Attending) by specialty or service line
  - Chief Complaint/Primary Procedure
  - Patient (demographics/type)

Benefits
- Highest utilized workflows and capacity metrics
- Most common workflows in acute care setting
- Delays associated with patient flows
- Faster time to value – comparative data for analysis based on time of day, day, unit, patient type etc.
- Review information about trends and inconsistencies within workflow processes to start asking “why.”
- Daily monitoring strategy to meet the Joint Commission standards related to patient flow

Anticipated Improvements
Assist organization in gathering baseline data on patient flow to help improve the quality and safety of care provided to patients. Increase utilization of the data to provide informative visualization to the systemic issues across all patient care and support services areas as it relates to patient flow.

Success Measures
Opportunity Identification:
- Identify potential inefficiencies for patient placement in acute care setting
- Identify areas of the organization where boarders have the greatest impact on delays in patient flow generally Emergency Department and Surgical Services
- Identify variation in standard processes across units as related to efficiency and cycle times such as admission, discharges and transfer processes
- Identify demand and capacity trends related to seasonal and time parameters

Process Improvements:
- 10% improvement in admit disposition to patient occupying inpatient room

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
- 10% improvement in overall discharge cycle time discharge order received to room clean and ready for use
- 10% reduction in cycle time for patients waiting greater than 4 hours for an inpatient bed

**Background**
Healthcare organizations have struggled with processes related to patient flow for decades. Challenges arise with changes to measure reporting, capacity, and finding a balance between activities adding value to the patient’s healthcare experience and those contributing to waste. Organizations strive to provide high quality and cost efficient care, however the data required to evaluate the impact of workflow changes can be difficult to expose. Patient Flow Explorer supports collaborative and coordinated data to help analyze variation and discrepancies in efficiency, impact on patient safety, satisfaction and clinical outcomes.

**Problem Summary**
Organizations understand the impact of patient flow variation, waits, delays and the seemingly constant mismatch between demand and capacity. Efforts are made to improve workflow processes but the data needed to truly evaluate the impact and trends has been largely unavailable or difficult to integrate in an automated fashion.

**Use Cases**
The summary tab indicates that over 50% of admits come from the ED. Looking at the Emergency Dept tab, for the same date range, for the ED Board +4 hours metric, we see that there is a large variation in the number of boarders over the weeks of the month. You could also toggle the Volumes over Time graph to see the volumes by WeekDay or Hour. Since a high number of boarders is not desired, use the Inpatient tab for the same month to analyze the distribution of average admits/transfers in to discharges/transfers out by hour. The summary data indicates admits/discharges follow the same basic flow through the day, with the peak of both from about 12-2 pm. This does not allow for room turn-over, so might be contributing to inefficiencies around admissions and ED boarders. Use the Average Discharge Time by Discharge Dept table, and drill into the different departments, to analyze the admits/transfers/discharges per dept, along with the time of day graphs, which provide insight into potential bottlenecks or workflow inefficiencies might be occurring.

**Measures / Metrics**
- Emergency Department
- Surgical Services
- Women’s and Newborn
- Nursing Units
- Diagnostic Areas

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
- Support Services
- Hospital capacity

Data Sources
- Electronic Medical Record (EMR)
- Admit, Discharge and Transfer logs (ADT)
- Departmental software solutions – if different solution than EMR
- Bed management system - optional

Screen Shots

Patient Flow Explorer: Emergency Department

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Practice Management: Patient Access

Description
Practice Management – Patient Access helps provide big-picture insight about the patient-access element of a medical practice. What are the monthly and yearly trends for completed appointments? What about no shows or the numbers of patients who left without being seen? What about cancelations and a break-down of the reasons for all cancelations? How is the practice doing overall on physician availability? By location? By unit? By specialty? These are some of the strategically-important questions AE can help answer.

Type: Identify Opportunity  Status: Available  Updated: 2015-03-13

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Analyze appointment volumes by location, specialty and provider.
- Monitor monthly and annual volumes relative to budget or goal.
- Perform root cause analysis on unusual variation.
- Measure patient access by third next available appointment.

Benefits / Anticipated Improvements

Aggregated data comparing multiple measures across a common time frame reduces time needed to compile reports. Drill down capabilities within various tabs provide immediate insight and provide the opportunity for exploration and analysis with deeper detail. The data is automatically updated upon availability, making short term day to day metric management possible. This application links clinical, financial and operational data for key measures which improves accuracy and consistency across the enterprise. The diversity of metrics allows for easy identification of variation related drivers and opportunities for improvement.

Success Measures

Opportunity Identification:

- Identify bottlenecks in provider availability for patient appointments

Background

Most healthcare organizations operate on thin margins and need to have a trusted place to go for updated with shrinking insurance reimbursements, new and changing regulatory requirements, and increasing business costs, managing a medical practice is a growing challenge. There are several tools available to help make day-to-day operations easier, tools that incorporate features like automated appointment reminders and resource-scheduling-conflict warnings. But how can a service-line director or a practice manager tell if such operational tools or other measures are effectively improving things in the long run? How can she understand the health of her overall operations?

Problem Summary

In many organizations, the Finance department is tasked with collecting and combining data from numerous sources to present a unified picture of current performance.

Users

Analysts, service-line directors, practice managers

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Measures / Metrics
- Completed appointments
- Canceled appointments
- No-show appointments
- LWBS (left without being seen) appointments
- Average third-next-available days
- Average visits per provider
- Copay collection rate
- Copay per visit

Filters
- Year, quarter, month
- Location, department, department ID, specialty, provider
- Operating hours (e.g., 7:00 AM to 10:59 AM, 11:00 AM to 12:59 PM, etc.)
- Encounter closed (Y or N)

Data-presentation filters for volumes
- As volumes and rate or as distributions
- Over time or year-over-year

Data Sources
Ambulatory Practice Management System and clinical EMR
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Practice Management: Professional Billing

Description
Practice Management Explorer: Professional Billing application provides business and clinical leaders with insights into overall organizational health, effectiveness and productivity. The application provides views into visit volumes, trends and E&M billing including variances. Users can compare current performance of these metrics to prior year performance. The application also offers data related to productivity, basic charges, and revenue.

Type: Process Improvement
Status: Available
Updated: 2015-03-13

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Provides leaders and analysts with insights into overall organizational health, effectiveness and productivity.
- Views into visit billing, distinct patient volumes and wRVU trends and patterns.
- Compare current performance to benchmarks or prior years.
- Charge and revenue analysis.

Benefits / Anticipated Improvements
Aggregated data comparing multiple measures across a common time frame reduces time needed to compile reports. Drill down capabilities within various tabs provide immediate insight and provide the opportunity for exploration and analysis with deeper detail. The data is automatically updated upon availability, making short term day to day metric management possible. This application links clinical, financial and operational data for key measures which improves accuracy and consistency across the enterprise. The diversity of metrics allows for easy identification of variation related drivers and opportunities for improvement.

Success Measures

Opportunity Identification:

- Identify inconsistencies in E&M coding within services
- Identify potential increases in revenue by addressing service utilization
- Identify potential $ saved by addressing gaps in billable hours to avg. billing rates

Process Improvements:

- 15% improvement in appropriate E&M coding
- 10% improvement in utilization by provider type volumes

Data Sources

- Professional Billing, Patient Encounter, Budget Data, E&M Benchmarks

Background
Most healthcare organizations are feeling the effects of changing insurance reimbursements, new regulatory requirements, and increasing business costs. How does a clinical director or a practice manager tell what measures are effectively improving things in the long run? How can they better understand the overall health of the practice operations?

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Problem Summary
In many organizations, the Finance department is tasked with collecting and combining data from numerous sources to present a unified picture of current performance.

Users
Analysts, clinical directors, practice managers, business managers.

Metrics / Measures
Basic measures in various areas can be viewed with trends over different time parameters.

- Visits
- Distinct Patients
- Work RVUs
- Charges
- Payments
- Budget Data

Screen Shots

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Population Health & Patient Injury Prevention

Description
Population Health applications from Health Catalyst enable clinical improvement teams to go beyond basic indicators of health outcomes like readmissions and length of stay to focus attention on specific clinical measures needed to manage baseline population health processes and outcomes. More importantly, Health Catalyst advanced applications support active measurement of the effectiveness and outcome of Aim based care improvement interventions for specific patient populations as measured by clinical, financial and patient satisfaction measures. Health Catalyst advanced applications include robust, referenced started sets to enable improvement teams to focus their efforts and accelerate data driven care transformation aligned with literature supported best practices.

Patient Injury Prevention applications from Health Catalyst enable clinical improvement teams to go beyond the simple measurement of indicators of patient injury like infection rates and never events to focus attention upstream on the underlying care process that fail to prevent or actually enable patient harm. Health Catalyst knows that measurement of patient harm is a gateway to care improvement. By using analytics to measure harm efficiently, resources can be redirected to support care improvement teams focused on preventive interventions. Health Catalyst advanced applications support active measurement of potential and actual harm events and support patient safety improvement teams implementation of Aim based care improvements to increase the safety and outcome for at risk populations as measured by clinical, financial and patient satisfaction measures. Health Catalyst advanced applications include robust, referenced started sets to enable improvement teams to focus their efforts and accelerate data driven care transformation aligned with literature supported best practices resulting in enhanced care outcomes and improved culture of safety.

Clinical Integration Hierarchy
In order to prioritize and implement healthcare delivery improvement initiatives, Health Catalyst has developed a four-level Clinical Integration Hierarchy whose elements are:

- Clinical Programs
- Care Process Families
- Care Processes
- Sub-Care Processes

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Cardiovascular Program Example

Population Health Application Definition

1. At least one outcome goal (clinical or cost) and the 2-3 most important Aim Statements (process goals) that lead to the outcome
2. At least one Anatomy of Healthcare Delivery Knowledge Asset
3. All applicable regulatory metrics

This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Breast Milk Feeding

Description
The **Exclusive Breast Milk Feeding Advanced Application** is aimed at Women and Newborn clinical directors, operational directors, clinical program guidance teams, and operational guidance teams. The application focuses on providing data for a hospital system’s newborn cohort. It aids in tracking and reporting The Joint Commission Perinatal Core Measure PC-05 (exclusive breast milk feeding) and helps identify opportunities for promoting exclusive breast milk feeding within the newborn population.

**Type:** Outcomes Improvement  **Status:** Available  **Updated:** 2015-03-12

![Graph and data visualization showing trends in exclusive breast milk feeding and associated outcomes.](image)
Features

- Executive Dashboard Screen: Provides high-level metrics that quickly reveal the general status of the newborn patient population and associated measures.
- General Metrics Screen: Provides information on general metrics such as length of stay, mortality rate, readmission, and neonate complications—with the ability to drill deeper into the data tied to these metrics.
- Exclusive Breastfeed Rate Screen: Provides metrics and associated details for exclusive breastfeeding rates; also provides information related to other feeding type categories and The Joint Commission exclusions for not breast feeding.
- Breastfeeding Metrics Screen: Provides additional metrics related to exclusive breastfeeding rates.
- Patient Level Detail Screen: Provides a list of filtered individual patient records.

Benefits

- Provides data to help meet the PC-05 regulatory requirements.
- Identifies opportunities to increase exclusive breast milk feeding during the hospital stay.

Anticipated Improvements

- Improved documentation of breastfeeding practices.
- Improved rates of hospitalized newborn exclusive breast milk feeding.
- Improved rates of breastfeeding after discharge.

Success Measures

Opportunity Identification:

- Identify hospitals within the system who have lowest rates of exclusive breast milk feeding.

Process Improvements:

- Improve documentation processes by X%.

Outcomes Improvement:

- Improve rates of exclusive breast milk feeding by X%. Lower rates of otitis media, URI, asthma, and gastroenteritis within the first year of life for infants who are exclusively breast milk and formula fed.
Background
Exclusive breast milk feeding has become increasingly important not only as regulatory measure but as a significant way to improve population health. Breastfeeding is associated with a decrease in many pediatric diseases (otitis media, respiratory tract infections, asthma, atopic dermatitis, gastroenteritis, type 2 diabetes, sudden infant death syndrome and pediatric obesity). Women who have breastfed also benefit; they have lower rates of postpartum hemorrhage, type 2 diabetes, ovarian cancer, and breast cancer. Unfortunately the rate of breastfeeding is only 38% at three months and drops to 16% by six months. Hospitals must recognize their role in affecting breastfeeding practice over time: the most significant predictor of breastfeeding duration is whether the infant received formula supplementation while in the hospital.

Problem Statement
To increase exclusive breast milk feeding of newborns, it’s helpful to have a birds-eye view of metrics associated with exclusive breast milk feeding (skin-to-skin time, time of first feeding, use of a lactation consultant, medications given during labor, C-section or vaginal delivery, mother’s ethnicity, language preference, etc.). These metrics guide the focus of improvement activities aimed at increasing exclusive breast milk feeding.

Use Cases
- To improve population health, a hospital wants to use data to help increase breastfeeding rates in their Women’s and Newborn population.
- A hospital’s executive team identifies the need to improve exclusive breast milk feeding rates to meet Joint Commission PC-05 requirements.

Measures
- Proportion of newborns whose mothers initiate breastfeeding during the delivery inpatient stay.
- Proportion of newborns whose mothers exclusively breastfed during the delivery inpatient stay.
- Proportion of newborns who receive exclusive breast milk supplementation during the delivery inpatient stay if mothers are unable to directly breastfeed their newborn.
- The Lactation Standards Team wants to create a breastfeeding preparation class targeting women who are historically least likely to breastfeed.

Data Sources
- EMR
- Patient Satisfaction

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Catheter Associated Urinary Tract Infection (CAUTI) Prevention

Description

The Catheter Associated Urinary Tract Infection (CAUTI) Prevention Advanced Application is aimed at hospital infection prevention teams, clinical and operational directors, hospital leadership and members of quality improvement teams. The CAUTII application enables users to efficiently find, review, and document CAUTI cases to support NHSN (National Healthcare Safety Network) reporting and to review outcomes and trends of CAUTI across institutions and health systems. It also provides near real-time analysis of internal processes related to CAUTI to support care process improvement for CAUTI prevention.

Type: Outcomes Improvement  Status: Available  Updated: 2015-03-13

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- The Performance dashboard helps users measure outcome metrics (CAUTI rate, urinary catheter utilization, excess cost, etc.) in relation to intervention metrics (hand hygiene and urinary catheter maintenance bundle compliance).
- The Urinary Catheter Risk dashboard enables users to identify the hospital care location where patients are at increased risk of developing CAUTI.
- Workflow dashboard(s) provide infection prevention surveillance teams with automated work lists. These dashboards are interactive and give the surveillance team the ability to evaluate auto-flagged cases, along with supporting clinical details, to make the final determination of the CAUTI cases prior NHSN submission.

Benefits

Specific capabilities powered by the app include the ability for users to:

- Rapidly find, assess and document CAUTI cases according to NHSN definitions.
- Efficiently review NHSN submission data and CAUTI rates.
- Understand CAUTI risk based on device utilization and bundle compliance based on care location to identify and prioritize improvement interventions.
- Drill down to the facility, unit, service, or patient level to analyze performance, provide feedback, and support measurement of performance improvement interventions.

Anticipated Improvements

- Increased compliance with practices shown to decrease CAUTI: best practice device utilization, urinary catheter insertion practices, and maintenance bundle use.
- Lower CAUTI rate and fewer urinary catheter utilization days.
- Revelation of system-wide variation in CAUTI rates and variation in internal processes related to CAUTI (e.g., compliance with urinary catheter maintenance bundles).
- More efficient and reliable NHSN reporting.
- Ability for Infection Prevention resources to be redirected to analysis, feedback, and intervention to improve CAUTI prevention process and outcomes.
- Increased insight into trends, populations, practice and performance—increased ability to uncover the “why” behind CAUTI and the “where” to focus improvement efforts.
Success Measures
Reduce Risk of HAC Reduction Program Penalties:

- CAUTI is one of the HACs measured for the 1% reimbursement penalty form CMS in 2015.

Opportunity Identification:

- Measure and broadly share CAUTI rates and CAUTI prevention bundle compliance measures across the enterprise to help make visible the opportunities for improvement.

Process Improvements:

- XX% improvement in reduction of utilization in urinary catheter utilization days.

Outcomes Improvement

- Decrease CAUTI rate or CAUTI-specific readmission rate by XX%.

Background
Infectious complications from urinary catheter placement, known as CAUTI, are alarmingly frequent, second only to surgical site infection (SSI) (CDC, 2015), based on recent reports by acute care hospitals to the CDC National Healthcare Safety Network (NHSN). CAUTI cases are largely preventable by proper application of best practices such as removing un-needed urinary catheters and properly inserting and maintaining urinary catheters. Effective implementation of these best practices has been shown to reduce CAUTI infection rates.

Problem Summary
In FY 2015, the CMS-administered Hospital-Acquired Conditions (HAC) Reduction Program will penalize the lowest performing hospitals by 1% based on CAUTI and CLABSI rates reported to the NHSN (National Healthcare Safety Network) as well as PSI- scores. Identifying and reporting CAUTI cases has become essential to health systems. However, doing so often requires extensive manual chart review according to complex NHSN rules. This inefficient surveillance process results in ‘measurement waste’—one consequence of which is a lack of infection prevention resources available to support upstream clinical process improvement to actually decrease the risk and incidence of reported CAUTI cases.

Use Cases

- An executive is interested is understanding the hospital CAUTI rate as well as understanding how compliant the doctors and nurses are at following best practices for hand hygiene. The CAUTI advanced application allows this user to find these outcome and intervention metrics.
An infection preventionist (IP) would like to easily identify and review all positive urine cultures to determine if additional CAUTI cases need to be reported to the CDC (Centers for Disease Control) via NHSN. The CAUTI advanced application enables the IP to filter down a list of positive blood cultures to those most recently.

Data Sources
EMR, nurse charting, orders, hospital billing records, professional billing system(s), Costing
Central Line Associated Blood Stream Infections (CLABSI) Prevention

Description
The Central Line Associated Bloodstream Infection (CLABSI) Prevention Advanced Application is aimed at hospital infection prevention teams, clinical and operational directors, hospital leadership and members of quality improvement teams. The CLABSI application enables users to efficiently find, review, and document CLABSI cases to support NHSN (National Healthcare Safety Network) reporting and to review outcomes and trends of CLABSI across institutions and health systems. It also provides near real-time analysis of internal processes related to CLABSI to support care process improvement for CLABSI prevention.

Type: Outcomes Improvement  Status: Available  Updated: 2015-03-13

Key Performance Indicators

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- The Performance dashboard helps users measure the outcome metrics (CLABSI rate, central line utilization, excess cost, etc.) in relation to the intervention metrics (hand hygiene and central line maintenance bundle compliance).
- The Central Line Risk dashboard enables users to identify the hospital care location where patients are at increased risk of developing CLABSI.
- The Workflow dashboard(s) provide infection prevention surveillance teams with automated work lists. These dashboards are interactive and give the surveillance team the ability to evaluate cases flagged as at-risk, along with supporting clinical details, to make the final determination of the CLABSI case prior NHSN submission.

Benefits

Specific capabilities powered by the app include the ability for users to:

- Rapidly find, assess, and document CLABSI cases according to NHSN definitions.
- Efficiently review NHSN submission data and CLABSI rates.
- Understand CLABSI risk based on device utilization and bundle compliance a care location to identify and prioritize improvement interventions.
- Drill down to the facility, unit, service, or patient level to analyze performance, provide feedback, and support measurement of performance improvement interventions.

Anticipated Improvements

- Increased compliance with practices shown to decrease CLABSI: best practice device utilization, central line insertion practices, and maintenance bundle use.
- Decrease CLABSI rate and decrease central line days.
- Revelation of system-wide variation in CLABSI rates and variation in internal processes related to CLABSI (e.g., compliance with best practice central line insertion and maintenance bundles).
- More efficient and reliable NHSN reporting.
- Ability for Infection Prevention resources to be redirected to analysis, feedback, and intervention to improve CLABSI prevention process and outcomes.
- Increased insight into trends, populations, practice and performance—increased ability to uncover the “why” behind CLABSI and the “where” to focus improvement efforts.

Success Measures

There are 3 types of success measures:

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
• **Reduce Risk of HAC Reduction Program Penalties**: CLABSI is one of the HACs measured for the 1% reimbursement penalty form CMS in 2015.

• **Opportunity Identification**: Measure and broadly share CLABSI rates and CLABSI prevention bundle compliance measures across the enterprise to help make visible the opportunities for improvement.

• **Process Improvements**: XX% improvement in reduction of utilization in central line days.

• **Outcomes Improvement**: Decrease CLABSI rate or CLABSI-specific readmission rate by XX%.

**Background**

Infectious complications from central line placement, known as CLABSI (central line-associated bloodstream infections), are alarmingly frequent with over 30,000 cases annually reported by acute care hospitals. CLABSI cases are largely preventable by proper application of best practices for central line insertion and maintenance bundles.

**Problem**

In FY 2015, the CMS-administered Hospital-Acquired Conditions (HAC) Reduction Program will penalize the lowest performing hospitals by 1% based on CLABSI rates, CAUTI rates reported to the NHSN (National Healthcare Safety Network), and PSI-scores. This has made identifying and reporting CLABSI cases even more important for health systems. However, doing so often requires extensive manual chart review according to complex NHSN rules. This inefficient surveillance process results in ‘measurement waste’--one consequence of which is a lack of infection prevention resources available to support upstream clinical process improvement to actually decrease the risk and incidence of reported CLABSI cases.

**Use Cases**

• An executive is interested in understanding the hospital CLABSI rate as well as understanding how compliant the doctors and nurses are at following best practices for hand hygiene. The CLABSI advanced application allows this user to find these outcome and intervention metrics.

• An infection preventionist (IP) would like to easily identify and review all positive blood cultures to determine if additional CLABSI cases need to be reported to the CDC via NHSN. The CLABSI advanced application allows the IP to filter down a list of positive blood cultures to those most recently collected and flagged as “pending review.” The IP can then quickly evaluate and confirm or rule out potential CLABSI cases.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Measures / Metrics

Process Metrics

- Infection present on arrival
- Attribution department
- Central Line and line type
- Infection found in blood (organism)
- Vitals (Temperature, MAP)
- Infection found in non-blood site

Outcome Metrics

- CLABSI rate
- Central Line Days
- Patient Days

Intervention Metrics

- Hand Hygiene Compliance
- Central Line maintenance bundle compliance
- CLIP insertion bundle compliance (in progress) Clinician

Data Sources

- EMR: nurse charting & orders
- hospital billing records
- professional billing system(s)
- Costing
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Cohort Builder

Description

The Cohort Builder application is designed for clinicians, clinical analysts, and leaders of outcome improvement projects—people who aren’t necessarily data analysts or database experts but need to conduct complex queries of data stored in the EDW. The app allows users to identify specific populations of patients based on demographic and many clinical criteria (diagnosis, medication, lab, and orders details; and download information about these populations. Users can specify the level of detail (“grain”) they need for a cohort (patient-, episode- or encounter-centric data) and may deploy the tool in a patient de-identified configuration to facilitate study design and pre-IRB analysis.

Type: Identify Opportunity  Status: Available  Updated: 2015-03-12

Diagnosis Filters

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Population data available at three fundamental levels of granularity: patient-centric data such as demographics, problem lists, medication, labs, and orders (e.g., asthma, beta 2 agonists, and PFT orders); episode-centric data gathered from facility billing and specific to a facility account (e.g., pregnancy); and encounter-centric data derived from a patient encounter (e.g., appendectomy).
- Populations stratified by diagnosis, place in the clinical hierarchy (clinical program, care process family, and care process), orders, medications, labs, and demographics.
- Exportable patient lists for all levels of granularity
- Support for de-identified version to support research needs.
- Future (2016) support for sharing of defined registries across Health Catalyst Analytics Platform for your health system.

Benefits

- Decreased time and resources required to create more precise patient registries for improvement projects and clinical studies.
- Increased physician and leadership engagement with EDW data due to the ease and speed of “self-service” analytics.
- Greater ease in planning resource needs and duration for studies, due to the ability to quickly determine number of members likely to qualify for research study within a given time period.

Anticipated Improvements

- Decreased time and resources required to create more precise patient registries for improvement projects and clinical studies.
- Increased physician and leadership engagement with EDW data due to the ease and speed of “self-service” analytics.
- Greater ease in planning resource needs and duration for studies, due to the ability to quickly determine number of members likely to qualify for research study within a given time period.

Success Measures

- Registry identification: Identify potential $ saved from more efficient definition of patient cohorts.
- Accelerated improvement: Lower time and resources spent on iterative population registry definitions for improvement work teams.
- Better Information: Deliver rapid, clear insight into study recruitment potential, inclusion criteria, associated resources, and potential study timelines.
Background
Clinical quality improvement initiatives and clinical studies require precisely defined patient populations. Having a clinician-friendly way to dynamically and simply interact with the data in the EDW can make this patient cohort definition process more efficient.

Problem Summary
The task of defining patient cohorts for quality improvement projects or clinical studies is often shared by several people working in various clinical and technical roles. Typically, the complex questions of the clinician experts must be transmitted to technical team members, who then conduct the queries and produce a custom-built report—one that will likely require several iterative reviews before it meets the needs of the clinicians. This process of iteratively defining patient cohorts can be time-consuming—and it delays progress on meaningful clinical improvement and research.

Users
Cohort Builder allows users to conduct complex queries, but it uses a simple interface. Typical users include clinicians, clinical analysts, and leaders of quality/performance improvement initiatives—anyone who wants to do activities such as:

- “Self-service” exploration—including exploring inclusion and exclusion criteria for patient populations—to define cohorts and share the definitions with others.
- Evaluation of patient cohorts for clinical studies: see how study recruitment and duration relate to inclusion and exclusion criteria.

Use Cases
- A team leading the hospital’s pediatric improvement team needs to validate a hunch that head CT scans are being overused for pediatric patients with head injuries.
- A case manager wants to generate a list of asthma patients who smoke to invite them to participate in a tobacco cessation program.
- An improvement team needs to identify the patients that have received naloxone and are also mechanically ventilated to screen for potential in-hospital iatrogenic respiratory failure.
- A researcher is planning a study to investigate the use of ACE inhibitors in elderly patients with diabetes to determine the need for potassium supplementation. The researcher would like to know how many patients in the last year have diabetes, are older than age 65, have at least one order for an ACE inhibitor, and at least one serum potassium measurement.
Metrics/Measures
- Patients
- Facility Accounts
- Encounters
- Clinical Programs
- Care Process Families
- Care Processes
- APRDRGs
- Medications: Generic, Therapeutic Class, Pharmaceutical Class
- Laboratory Orders
- Demographics

Data Sources
Data comes from the EMR and may include patient problems, medications administered, laboratory orders and results, orders, APRDRGs (billing data), and ICD diagnoses and procedures.

Screen Shots

This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Community Care

Description
The Community Care Advanced Application is aimed at Primary Care Clinical Program leaders, primary care providers and care coordinators working in ambulatory settings, quality improvement teams, and staff responsible for reports related to the organization’s status as an Accountable Care Organization (ACO). The application focuses on providing data to help organizations review population health; compare their performance to national benchmarking standards for specific measures; identify opportunities for costs savings, and help practices track, monitor, and meet the needs of high-risk patients.

Type: Outcomes Improvement Status: Available Updated: 2015-03-12

Summary Performance Metrics across the Enterprise/Community

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Features
- Preventive and chronic care interventions and control measures for primary care physicians
- Measurements are compared to external benchmarks and internal goals
- Scores are calculated for the organization as a whole, clinic, department, provider and by patient
- Patient panels by provider for use by care managers and others in proactive patient engagement

Benefits / Anticipated Improvements
- Improved reporting on and compliance with best practice preventive and primary care measures (e.g., HEDIS, PQRS, etc.).
- Improved screening and primary care for specific populations of high-risk patients, especially those with diabetes, heart failure, hypertension, hypercholesterolemia, and other chronic conditions.
- Improved patient satisfaction related to the health system’s proactive outreach services.
- Increased capacity for care providers to identify care gaps for specific patients and take action during the current office visit.

Success Measures
Opportunity Identification:
- Identify gaps in preventive and primary care within your patient population.

Process Improvements:
- Support delivery of a list of patients with care gaps for generating outreach letters encouraging patients to schedule an appointment or connect with a care manager. Improve compliance with best practices for delivery of preventive and primary care during the current or future follow-up care.

Outcomes Improvement:
- Increase by XX% the percent of diabetes patients with HbA1c lower than 6.5%
- Improve by XX% the percent of patients age 50 or older whose care is compliant with colonoscopy screening guidelines.
- Increase percent of patients over 50 years of age who have received recommended pneumococcal and influenza vaccines.
Background
The healthcare industry is intensely focused on improving the quality of patient care while simultaneously lowering cost. It’s increasingly clear that a system built upon a foundation of strong preventive and primary care is critical to achieving these goals. Delivering high-quality, efficient, patient-centered care begins with a primary care system that can effectively manage the health of patient populations.

Problem Statement
AHRQ reports that 5 percent of the population accounts for 50 percent of healthcare costs; this fact is a primary driver of the need to effectively manage the health of populations. Many of the drivers of overall cost are chronic conditions. Being able to easily identify patients with preventive or primary care gaps is the first step in improving care and outcomes. Yet currently, most organizations lack the ability to track and monitor needed primary and preventive care metrics. They also lack the actionable analytics that support outreach to specific patients for care follow up and help providers easily see what screening, monitoring, and therapies are needed for patients during primary care visits.

Use Cases
- A care coordinator wants to identify patients with cardiovascular disease who have hypertension and high LDL—these patients will be the focus of new outreach efforts aimed at preventing MI.
- A primary care provider and diabetes educator want to gauge the impact of several new initiatives aimed at improving diabetes self-management.
- An obstetrical provider wants to see how many of her patients have been screened for chlamydia.
- After a particularly brutal influenza season, an organization wants to review immunization rates and patterns to help them design a community health campaign for the following year.

Metrics
Multiple metrics have been identified and a full list can be found in the Technical Document; however, the key metrics are listed below. It should be further noted that the Qlikview reporting tool allows for further comparisons that may not be listed here.

- **Lab results with control indicators**: LDL and HbA1c blood test results and a field that indicates LDL over 100 will be out of control, and HbA1c levels over 8% are out of control.
- **Vitals with control indicators**: currently only systolic blood pressure and diastolic blood pressure results and an indicator of out of control if either are high (systolic over 139 or diastolic over 89).
- **Diabetes in control indicator**: patients are only in control if all 5 measures (D5) are in control. They need to have in control 1) LDL, 2) HbA1c, 3) blood pressure, 4) aspirin prescribed (if comorbidity of cardiovascular disease), or 5) documentation patient is a non-tobacco user.
- **Preventative in control indicator**: patients are in control if they fall within age buckets for preventative screenings and have received them (results not important). They need to have a screen for 1) cervical cancer (female), 2) mammograms (female), 3) colonoscopy over 50 years old, 4) Chlamydia test (female is sexually active), 5) influenza vaccination, 6) pneumococcal vaccination if 65 years old.

**Data Sources**
- EMR
- Patient Satisfaction
The Provider tab shows provider-specific overall performance metrics and identifies specific care gaps for specific patients. Monitoring tests and preventive health intervention gaps can be closed during the current or next patient visit.
The Patient Tab provides additional detail for care providers on specific patients – reflecting upcoming measures and needed care that is overdue or currently due.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Heart Failure

Description
The Heart Failure Advanced Application is aimed at Cardiovascular Clinical Program directors, operational directors, clinical program guidance teams, operational guidance teams and care management teams. The application focuses on providing data for a health care system’s heart failure cohort. It aids in tracking and reporting CMS Core Measures (LOS, readmissions, administration of appropriate medications, etc.), risk stratifies patients requiring the most resources, and tracks care transitions to the outpatient arena. The data surfaced in this application helps identify opportunities for improving care and outcomes in all these areas.

Type: Outcomes Improvement  Status: Available  Updated: 2015-03-12

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Executive Dashboard: Surveys high-level metrics such as LOS, mortality rate, readmissions rates, cost/case, etc. and shows how results are tracking toward system goals.
- Risk Stratification Dashboard: Repeatedly (every 24 hours) stratifies hospitalized heart failure patients into groups of risk for readmission.
- Outcome Metrics Dashboard: Tracks LOS, mortality rates, readmission rates and cost per case.
- Process Metrics Dashboard: Tracks identification and treatment modalities of heart failure patients; allows users to filter on ejection fraction, NYHA classifications, ICD counseling, or medications prescribed.
- Transitions Dashboard: Tracks medication reconciliation, follow-up appointment scheduling, follow-up telephone calls, referrals to heart failure clinics, and other activities related to transitions in care.

Benefits / Anticipated Improvements

- Increased ability to identify high-risk heart failure patients (those most likely to be readmitted within 30 days) and to provide appropriate interventions to prevent these readmissions.
- Decreased 30- and 60-day readmission rates due to better tracking and improved transitions of care (medication reconciliation, follow-up visits within 48 hours, follow-up telephone call, and primary care provider knowledge transfer).
- Increase compliance with CMS-recommended medications for treatment of the heart failure patients.

Success Measures

There are 3 types of success measures:

- **Opportunity Identification**: Potential $ saved from reduction in clinical variation and standardization of care.
- **Process Improvements**: Increase compliance with recommended practices for patient follow-up by X%.
- **Outcomes Improvement**: Reduce readmissions; reduce mortality; reduce LOS; reduce cost per case; improve patient satisfaction.

Background

Heart failure (HF) ranks as one of the most expensive inpatient diagnoses in the United States—and experts predict that costs will continue to rise in the decades to come. To help manage costs and patient health risk, CMS has elected to tie reimbursement to HF readmissions. Research shows that implementing numerous transitions of care will help lower readmission rates and promote increased satisfaction.
Problem Statement
To improve and manage care of patients with heart failure, it’s helpful to have a birds-eye view of key metrics associated with clinical best practice, high-level performance measures reportable to CMS, and transitions in patients’ care. It’s also valuable to be able to identify patients who would most benefit from the finite resources within a hospital system.

Use Cases
- A hospital wants to see how readmission rates relate to their risk-stratification of heart failure patients.
- A hospital’s executive team identifies the need to lower LOS of heart failure patients without increasing readmission rates.
- A cardiovascular clinical program wants to understand if sending NYHA Classification III and IV patients to a nurse practitioner-run heart failure clinic will lower readmissions and improve patient satisfaction.

Metrics
- Readmissions (30 or 90 day) – Percentage of patients with primary diagnosis of heart failure readmitted within 30/90 days of discharge. Readmission must be inpatient, non-elective.
- Readmission LOS (Length of Stay) – The days between the readmit date and readmit discharge date.
- ER Utilization – Primary HF discharged patients who came back to ER without any inpatient visits in-between. The days between the HF discharge and ER visits are calculated as well as ER LOS.
- Observation Stay – Primary HF discharge patients who came back as OB patients without any inpatient visits in-between. The days between the HF discharge and the OB visit are calculated as well as the OB LOS.

Data Sources
- EMR
- Patient Satisfaction
- Billing Data
This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Labor and Delivery

Description
The Labor and Delivery Advanced Application is aimed at Women and Newborn clinical directors, operational directors, clinical program guidance teams, and operational guidance teams. The application focuses on providing data for a hospital system’s pregnancy cohort. It aids in tracking and reporting The Joint Commission Perinatal Core Measures (administration of antenatal steroids, decreasing inappropriate cesarean sections and preventing early induction of labor) and helps identify opportunities for improving care in these areas. It also provides data about the antepartum care of C-section patients.

Type: Outcomes Improvement  Status: Available  Updated: 2015-03-05

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- All Deliveries Dashboard: Provides an overview of all deliveries in a health system with emphasis on number of deliveries, specifically the number of C-sections, current C-section rate, average LOS, 30 day readmission rate and mortality.
- PC-01 Elective Deliveries Dashboard: Provides regulatory metrics and associated details for elective deliveries.
- PC-02 C-Section Dashboard: Provides regulatory metrics and associated details for NTSV patients.
- PC-03 Antenatal Steroids: Provides regulatory metrics and associated details for administration of corticosteroids to women at risk of preterm deliveries.
- Antepartum C-section Dashboard: Provides data about the antepartum course for C-section patients and allows user to track key interventions such as timing of antibiotic administration and skin prep completion.

Benefits / Anticipated Improvements

- Fewer NTSV C-sections.
- Fewer early inductions.
- Increased use of antenatal steroid administration to mothers in preterm labor.
- Lower rate of C-section complications.

Success Measures

Opportunity Identification:

- Potential $ saved from reduction in clinical variation and standardization of care.
- Evaluate and change documentation processes.

Outcomes Improvement:

- NTSV: Decrease risk of surgical complications for mothers and infants; decrease health care costs (an average C-section is almost twice as much as a vaginal delivery); acquire value-based contracts based on low C-section rates.
- Early Induction: Decrease infant complications such as NICU admissions, ventilator support, and hypothermia.
- Antenatal Steroids: Decrease infant complications such as NICU admissions and ventilator support.
- Antepartum C-section Care: Decrease surgical site infections and postsurgical complications.
Background
Each of the 4 million births in the United States each year involves some risk. To help manage this risk, The Joint Commission has elected to monitor several best perinatal care practices in all hospitals that perform more than 1000 deliveries per year; over time, hospitals will be required to demonstrate significant reductions in practices associated with increased risk to mothers and babies:

- Cesarean delivery—a major surgery that is generally riskier and more costly than vaginal delivery—has become one of the most common procedures performed in the United States, increasing from 22 to 33% of all deliveries.
- Elective labor induction before 39 weeks also has been shown to increase risk; it’s associated with more NICU admissions, respiratory distress, and difficulty maintaining neonate temperature.

Failure to appropriately administer a full course of corticosteroids to women at risk of preterm birth; antenatal steroids have been shown to reduce morbidity and mortality rates among newborns.

Metrics / Measures

- Delivery Type – how the baby was delivered: vaginal, C-section, other
- Nulliparous – first time delivery of a fetus that is older than 20 weeks
- Term – gestational age is 37.0 weeks or greater
- Singleton – one newborn for the delivery
- Vertex – presentation when the top of the baby’s head is the presenting part
- Provider

Problem Summary
To improve care of pregnant women, organizations benefit from a bird’s-eye view of the data on key metrics, particularly in areas related to accepted best practice: cesarean rates for deliveries assumed to be low risk, numbers of inappropriate elective inductions, and administration of antenatal corticosteroids to women at risk for delivering before term.

Use Cases

- A hospital wants to use data to help improve NTSV rates in their Women’s and Newborn population.
- A hospital’s executive team identifies the need to lower early induction rates to meet The Joint Commission PC-02 requirements.
- A hospital system wants to lower complication rates on preterm infants by using data to identify compliance to an antenatal steroid protocol.
Data Sources

- **EMR**: patients, providers, encounters, payers, service areas, departments, locations
- **Finance**: hospital accounts, diagnosis
- **Labor & Delivery**: induction, dating, status, patient presentation, patient history, obstetrics, summary
Pediatric Appendectomy

Description
The Pediatric Appendectomy Advanced Application is aimed at Pediatric and Surgical Services clinical directors, operational directors, clinical program guidance teams, and operational guidance teams. The application focuses on providing data for a hospital system’s pediatric cohort to track morbidity and LOS of pediatric appendectomy patients.

Type: Outcomes Improvement Status: Available Updated: 2015-03-12

<table>
<thead>
<tr>
<th>CP</th>
<th>1-Complex: Rolling 3 Months</th>
<th>2-Simple: Rolling 3 Months</th>
<th>3-Other: Rolling 3 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count: 65</td>
<td>Readmit Rate: 9.2%</td>
<td>LOS: 6.8</td>
<td>Count: 141</td>
</tr>
<tr>
<td>Avg Cost: $8,052</td>
<td>Avg Cost: $4,140</td>
<td>Avg Cost Per Readmit: $9,863</td>
<td>Avg Cost Per Readmit: $6,310</td>
</tr>
</tbody>
</table>

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- **Volume Dashboard**: Provides information about surgery time by hour, discharge time, patient age, severity and surgeon.
- **Readmission Dashboard**: Provides information about readmission to the hospital and ED visits post appendectomy.
- **Severity Dashboard**: Provides the ability to match severity of the appendicitis (simple or complex) related to the care provided by physicians.
- **LOS Dashboard**: Provides LOS metrics and the ability to review data by severity and surgeon.
- **Wound Classification Dashboard**: Provides information about wound class, time of admission, post-op severity, antibiotic prescribed and time of administration, and surgeon.
- **Executive Dashboard**: Provides information on actual volume, cost per case, readmissions, LOS, etc.

Benefits / Anticipated Improvements

- Fewer SSIs.
- Decreased LOS for pediatric appendectomy patients.
- Lower cost per case for pediatric appendectomy patients.

Success Measures

There are 3 types of success measures:

- **Opportunity Identification**: Identify how the severity of appendicitis (simple, complex) effects LOS.
- **Process Improvements**: Improve documentation processes by X%. Improve time from diagnosis to antibiotic by X%. Improve time from diagnosis to OR by X%.
- **Outcomes Improvement**: Decrease LOS by X%. Decrease morbidity by X%. Decrease SSI rate by X%.

Background

There are approximately 250,000 cases of appendicitis diagnosed in pediatric patients each year. These same cases account for an estimated one million hospital days. Research has shown that the mean length of stay for appendectomy procedures can vary significantly based on a number of factors. These factors can be associated with variations in care which may be accounting for an increase in morbidity and LOS. Evaluating the care of these patients provides ample opportunities to improve outcomes.
Problem Summary
To improve care of the pediatric patient with appendicitis, it’s helpful to have a birds-eye view of metrics associated with practices related to their hospital care. These metrics help organizations identify variations in care and guide the focus of improvement activities aimed at decreasing complications and LOS.

Use Cases
- A hospital wants to use data to help improve the time from a diagnosis of appendicitis to antibiotic administration and diagnosis to OR.
- A hospital’s executive team identifies the rate of surgical site infections has increased in pediatric appendectomy population and wish to decrease it.
- A Surgical Services Clinical Program wishes to track wound classifications to post-operative severity and surgeon.

Measures
- Proportion of patents diagnosed with the appropriate severity of appendicitis.
- Proportion of patients who were prescribed the correct antibiotic in the appropriate time frame.
- Proportion of patients who receive an accurate diagnosis in a timely manner.
- Proportion of physicians who are using the correct order set
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Pediatric Asthma

Description
The **Pediatric Asthma Advanced Application** is aimed at pediatric clinical directors, operational directors, clinical-program guidance teams, operational guidance teams and care management teams. The application focuses on providing data for a health care system’s pediatric asthma cohort. It provides the ability to analyze hospital care and processes to better manage pediatric asthma patients and identify areas of inefficiency and waste.

**Type:** Outcomes Improvement  **Status:** Available  **Updated:** 2015-03-12

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features
- Acute Measures: Shows ED delivery time of beta agonists, percentage of patients discharged from the ED and those admitted, patients who received an asthma action plan.
- Steroid Administration Dashboard: Shows the timeliness of steroid administration in the ED.
- Triage Beta-Agonist Administration: Shows triage times for administration of beta-agonists.
- Asthma CXR Dashboard: Shows number of admitted patients who had CXRs, cost per case, timing of CXR, and asthma protocol adherence.
- Readmission Dashboard: Provides data about ED and hospital readmissions.

Benefits / Anticipated Improvements
- Fewer unnecessary CXRs in pediatric asthma patients.
- Reduced cost for an ED asthma admission.
- Fewer ED and inpatient asthma admissions.
- Improved adoption of pediatric asthma order set
- Increased physician use of an EHR-based asthma action plan

Success Measures
Opportunity Identification:
- Potential $ saved from reduction in clinical variation and standardization of care.

Process Improvements:
- Evaluate and change documentation processes; define and implement a pediatric asthma order set; increased provision of asthma action plans to patients.

Outcomes Improvement:
- Reduce ED and inpatient admissions; decrease readmission; improve LOS; reduce cost per case; improve patient satisfaction; reduce number of CXRs performed on pediatric asthma patients.

Use Cases
- A hospital case management team notes the disparity of action plans being provided to pediatric asthma patients in the ED.
- A hospital’s executive team identifies the need to lower the rate of pediatric asthma inpatient admissions.
- A hospital system wants to improve the door to beta-agonist administration time in pediatric ED asthma patients.
- A pediatric hospital is interested in decreasing cost per case in their inpatient pediatric asthma population.
Metrics/Measures

- Volume (Complex, Simple, Other)
- Cost (Complex, Simple, Other)
- Readmission Rate (Complex, Simple, Other)
- Length of Stay (Complex, Simple, Other)
- Severity
- Post Op LOS Days by Severity
- Post Op LOS Days by Campus
- Surgery to Discharge
- Presentation to Diagnosis
- Presentation to Surgery Start
- Presentation to 1st level Antibiotic
- Diagnosis to First Medication
- Diagnosis to Surgery Start
- Time from ED triage to delivery of beta-agonist
- Proportion of patient discharged with asthma exacerbation/status asthmaticus with a CXR obtained
- Rate of Inpatient and Observation patient accounts who received an Asthma Action Plan

Data Sources

- EMR
- Patient Satisfaction
- Billing Data
Population Explorer

Description
The **Population Explorer** analytics tool is intended for healthcare personnel responsible for tracking, reporting, and analyzing population metrics to improve care. This group includes hospital administrators, clinical and operations directors, and members of quality improvement teams; it may also include data architects, data analysts, and knowledge managers. The app facilitates surveillance and reporting of key outcomes such as LOS, cost, and readmissions for selected populations; helps deliver insight into patient cohorts and improvement opportunities for clinical improvement projects; and supports leaders’ ability to identify, prioritize, and report on quality improvement efforts.

**Type:** Identify Opportunity  
**Status:** Available  
**Updated:** 2015-03-12

![Population Summary](image)

Summary view of Heart Failure population

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Hundreds of predefined patient registries—and the ability to define and save new ones.
- Starter set of 50 common metrics, each of which can be stratified by diverse types of patient data: demographics, payer information, diagnoses, location of treatment, discharge status, and so on.
- At-a-glance comparisons of readmissions, LOS, or costs between two subsections of a population or between two different populations.

Benefits / Anticipated Improvements

- Increased access to data (via self-service) and greater ability to analyze readmission, LOS, and cost metrics for many specific populations.
- Greater insight into variation as it relates to patient demographics, treatment locations, payers, or referral sources.
- More effective quality improvement projects: the organization can focus on the right population and refine the questions they want to answer for that population.
- Faster access to meaningful information and less frustration: simple, direct, dynamic, interaction with analytics applications replaces cumbersome, slow, report request process.

Success Measures

- **Increase Efficiency**: Decrease the number of report requests for simple metrics on various different population registries.
- **Increase Access**: Share data and make it available for data-driven decisions.
- **Identify Opportunity**: Identify length of stay for a specific patients within any of hundreds of registries.
- **Compare Performance**: Compare performance on readmission, LOS, and financial metrics between different registries, admit sources, visit details, financial class, payers, discharge location, or billing location.

Background

As healthcare teams identify opportunities to reduce variability in cost and quality in specific clinical and operational areas, they also need to understand the affected patient populations before they can move forward in designing effective quality improvement projects. Typically, the complex questions of improvement teams must be transmitted to a data analyst, who then conducts the queries and produce a custom-built report—one that will likely require several iterative reviews before it meets the needs of the team. This process of iteratively defining patient cohorts can be time-consuming—and it delays progress on meaningful clinical improvement and research.
Problem Summary
In most healthcare systems, analyzing population metrics to improve care is difficult and time-consuming, requiring analyst staff to collect and combine data from numerous sources to satisfy each request. Organizations can benefit from a tool that pulls together patient data from multiple sources to help teams understand population characteristics such as demographics, payer information, counts of current diagnoses, and other visit-related outcomes.

Users
Population Explorer is intended for those responsible for tracking, reporting, and analyzing population metrics to improve care. This usually includes hospital administrators, clinical and operations directors, and members of quality improvement teams. It may also include data architects, data analysts, and knowledge managers. When deciding who should be trained to use Population Explorer, consider choosing people who fit these general role profiles:

- Staff who are responsible for tracking and reporting LOS and readmission, or other similar reports.
- Staff who will help define the cohorts for clinical improvement projects.
- Clinical and administrative leaders responsible for identifying, prioritizing, and reporting on quality improvement efforts.
- Any staff or leaders who may want to delve deeper than static reports to identify trends and potential improvement areas.

Use Cases
- A Cardiovascular quality improvement team wants to identify the next opportunity they should focus effort on. Using Population Explorer, they determine that their 30-day readmission rate for heart failure patients is, at 28%, significantly higher than the national average. They determine their next improvement effort must focus on reducing readmission in their heart failure population registry.
- The quality improvement team wants to look more closely at their COPD patients, comparing costs and readmission rates for patients age 65 and older to those younger than 65.
- The Cardiovascular team wants to compare the 90-day readmission rate for Medicaid patients with heart failure to all other patients with heart failure; they also want to review the average charges and LOS for the two patient populations.
**Measures / Metrics**

**Demographics**
- Discharges by age
- Discharges by gender
- Discharges by comorbidity count
- Number and percentage of discharges per ethnic group

**Visit outcomes**
- Number discharges by patient type
- Number of discharges by diagnosis

**Two-population comparisons by**
- 7-, 14-, 30-, 60-, 90-, and 120-day readmissions
- Length of stay
- Charges, payments, variable cost, and total cost

**Associative measures**
- Patient count, percentage of patients, discharge count, or percentage of discounts per
  - Patient type, discharge unit, admit source, and discharge status
  - Financial class and primary payor
  - Admit ICD code and Primary ICD code

**Primary-care visits by**
- Patient
- Clinic, and how many per clinic
- Days since last encounter

**Data Sources**

The application uses claims and billing data from patient episodes or visits; it may include EMR reference data (master file facility, departments, payer, cost centers, providers, and APRDRGs), inpatient hospital billing data, discharge status, and so on.
Screen Shots

Demographics of the selected population

Comparative analytics between asthma and COPD populations

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Readmission Explorer

Description

**Readmission Explorer** is intended for hospital administrators, clinical and operations directors, and members of quality improvement teams. The application provides a broad spectrum of readmission metrics for all-cause, unplanned readmissions for inpatient stays and emergency department visits. For cohort selection, users can start with one of seven predefined, CMS-based cohorts, a hospital-wide specialty cohort, use the Health Catalyst Care Process Hierarchy, or define custom cohorts by ICD9 diagnosis and/or procedure codes. Regardless of the starting point for analysis in Readmission Explorer, each cohort and/or method can be further refined by patient demographics, discharge status, provider, and other metrics.

**Type:** Identify Opportunity  
**Status:** Available  
**Updated:** 2015-03-12

**Readmission Summary Tab**

- Overall Readmission (aka Numerator) Count & Rate
- Overall Index Admission (aka Denominator) Count
- Monthly / Quarterly Readmission Count, Index Admission Count, Readmission Rate
- Readmission Count by Readmit Primary Diagnosis

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
- Cumulative Readmission Percent by Readmit Primary Diagnosis
- Readmission Count by Readmit Clinical Program
- Cumulative Readmission Percent by Readmit Clinical Program

Features
- Highlight trends associated with readmissions and identify areas where readmissions could be reduced.
- Users can filter on index admissions (LACE score) and/or readmission conditions
- Supports CMS specific readmission conditions: AMI, Heart Failure, Pneumonia, Total Hip/Total Knee, CABG and COPD.

Benefits / Anticipated Improvements
- More efficient and accurate reporting of readmission data.
- Increased ability to perform meaningful investigation on factors related to readmission and their implications for specific groups of patients, across the health system.
- Avoidance of CMS penalties, due to increased ability to recognize and address trends that may trigger penalties.

Success Measures
- Opportunity Identification: Potential $ saved from more efficient querying and reporting.
- Outcomes Improvement: Reduce or eliminate CMS penalties related to readmissions.

Background
Hospital readmission rates represent an important, if imperfect, proxy measure for poor-quality inpatient and outpatient care and poor care transitions (Axon 2011). Furthermore, as mandated by the Patient Protection and Affordable Care Act and related legislation, CMS reduces payments to hospitals with excess readmissions (42 CFR part 412). For these reasons, hospital systems do significant work to report and analyze readmissions within their system.

Problem Summary
To meet the demand for data and insight related to readmissions, hospitals need analytic tools that can provide both breadth and depth for investigating a facility’s historical readmission performance. Clinicians and administrators alike benefit from an array of measures and filters to ask and answer significant questions regarding historical performance. It’s also helpful to have a tool that provides a foundation for further investigation into factors that contribute to readmissions and for other analysis focused on specific cohorts of patients.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Users
Typical users of the Readmission Explorer app include department heads and leaders of quality and performance improvement initiatives.

Use Cases
- A Cardiovascular clinical improvement team wants to explore readmissions among different stratifications of their heart failure patient population and gauge the impact of recent efforts to lower heart failure readmissions.
- A pediatric team wants to explore asthma care and asthma education. How many children hospitalized for asthma were seen again for asthma exacerbations in the ED?

Measures / Metrics
Cohorts and readmission analysis can be refined through the use of Readmission Explorer’s filters. Generally, cohorts are modified through the use of “Index Filters” and readmission analysis is refined through the use of “Readmission Filters”. Index and Readmission filters are available on each tab of the application.

Index (Denominator) Filters:
- Clinical Program, Care Process Family, Care Process
- Primary ICD9 Diagnosis Code & Description
- Primary ICD9 Procedure Code & Description
- Primary Service
- Attending Provider Name & Specialty
- Discharge Location & Department
- Discharge Status
- Financial Class
- Patient Age Group
- Discharge Year, Quarter, Month

Readmission (Numerator) Filters:
- Clinical Program, Care Process Family, Care Process
- Primary ICD9 Diagnosis Code & Description
- Primary ICD9 Procedure Code & Description
- Primary Service
- Attending Provider Name & Specialty
- Financial Class
- Discharge Status

Data Sources
- EMR
- Billing

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Screen Shots

Readmission Analysis Tab

- Readmission Count by Index Clinical Program
- Cumulative Readmission Percent by Index Clinical Program
- Readmission Rate by Index Clinical Program
- Index Admission Count by Index Clinical Program
- Readmission Count by Index Care Process Family
- Cumulative Readmission Percent by Index Care Process Family
- Readmission Rate by Index Care Process Family
- Index Admission Count by Index Care Process Family
- Readmission Count by Index Care Process
- Cumulative Readmission Percent by Index Care Process
- Readmission Rate by Index Care Process
- Index Admission Count by Index Care Process
- Readmission Count by Index Provider Specialty
- Cumulative Readmission Count by Index Provider Specialty

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Index Analysis Tab

- Readmission Count by Index Primary Diagnosis
- Cumulative Readmission Percent by Index Primary Diagnosis
- Index Admission Count by Index LACE Score
- Cumulative Index Admission Percent by Index LACE Score
- Readmission Count by Index Discharge Status
- Index Admission Count by Index Discharge Status
- Readmission Rate by Index Discharge Status

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Readmission Detail Tab

The Readmission Detail tab does not display any new metrics but provides a list of patients meeting the Index and Readmission filter criteria.
Sepsis Improvement

Description

The **Sepsis Advanced Application** is aimed at clinical and medical directors, operational directors, clinical program guidance teams in emergency, intensive care, and inpatient units. The application focuses on providing data to help improve early recognition of sepsis, early intervention for severe sepsis, and early therapy for septic shock to reduce mortality, morbidity, and cost.

**Type:** Outcomes Improvement  
**Status:** Available  
**Updated:** 2015-03-04

---

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- Performance dashboard to visualize outcome and process metrics in an easy-to-consume, one-page performance summary.
- Outcome metrics include mortality, 30-day readmission, LOS, ICU LOS, and cost per case.
- Performance metrics include 3-hour bundle (lactate measurement, fluid resuscitation, blood culture, broad spectrum antimicrobial administration, all within 3 hours of time zero) and 6-hour bundle (vasopressor for initial fluid bolus resistant hypotension and for ongoing shock, measurement of CVP/ScvO2, measure of serum lactate within 6 hours of time zero) for compliance measurement.
- In addition to compliance metrics (% of patient lactate measured with 180 min.), includes improvement metrics (% of patients with lactate measured within 1 hour of triage) so that clinical improvement feedback is available to understand specific performance gaps and what actions or interventions will be most effective.
- Detailed analytics for each bundle domain provide dynamic data exploration, real-time filtering, and drill-down to patient level detail.
- Includes visualizations to support understanding of how performance can be improved in bundle compliance to lower sepsis mortality rates.
- Provides export or print capability for patient list, metric performance, etc.

Anticipated Improvements

- Improved processes and timeliness of early recognition and treatment of sepsis.
- Increased compliance to components of early intervention and early therapy guidelines.
- Decreased mortality rate and length of stay.

Success Measures

Opportunity Identification:

- Increase percent of patients eventually diagnosed with sepsis who were accurately diagnosed in the ED.

Process Improvements:

- Lower time from ED triage to sepsis recognition and alert.
- Increase percent of patients with severe sepsis for whom all components of the 3-hour early intervention bundle are met.
- Increase percent of patients with septic shock for whom all components of the 6-hour early therapy bundle are met.

Outcomes Improvement:

- Lower mortality rate for sepsis patients.
- Reduce length of stay.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Definition
Sepsis is defined as at least two of the following signs and symptoms (SIRS) that are both present and new to the patient and suspicion of new infection:

- Hyperthermia >38.3 degree C or Hypothermia < 36 degrees C
- Tachycardia >90 bpm
- Leukocytosis (>12,000 uL-1) or Leukopenia (<4,000 uL-1) or >10% bands
- Acutely Altered Mental Status
- Tachypnea >20 bpm
- Hyperglycemia (>120 mg/dl) in the absence of diabetes

Background
Sepsis has the highest mortality rate and cost of any condition treated in U.S. hospitals, and causes significant morbidity. One in four patients with severe sepsis or septic shock will die from the condition, and many of these deaths will occur in the hospital.\(^1\) The hospital mortality rate for sepsis is more than 8 times higher than for any other diagnosis. Sepsis also poses a huge economic burden to the US health system, accounting for over 5% of the total aggregate cost of all hospitalizations.\(^4\) Patients who survive sepsis are more likely to require long-term care and to have long-term cognitive and physical function impairments.

Problem Summary
Health Catalyst ranks the sepsis care process in the top one-third of its list of clinical quality improvement opportunities based on volume, variation, and financial metrics. The substantial evidence base to guide care also makes sepsis a promising area for quality improvement. To pursue opportunities to improve sepsis care and outcomes, organizations benefit from analytics that provide views of key metrics associated with clinical best practice, high-level performance measures, and transitions in patients’ care.

Use Cases
- Quality improvement leaders in a large hospital system observe that their sepsis mortality rate has been creeping upward over the previous three quarters---and seems to correspond to declining compliance with the ED screening protocol. Is declining compliance a problem at every facility’s ED, for all shifts?
- The ED manager notes that compliance with the 3-hour bundle remains low, despite focused efforts to improve. Which aspect of the bundle is proving most problematic for front-line staff?
Measures / Metrics
- Mortality
- Two Blood Cultures Collected
- Two Blood Cultures before Antibiotics
- Hospital Length of Stay (LOS)
- ED Length of Stay (ED LOS)
- ICU Length of Stay (ICU LOS)
- Antibiotics in ED < 180 minutes of time zero
- Lactate within 60 minutes of time zero
- Fluid Resuscitation
- Orderset Compliance

Data Sources
EMR: Orders, Procedures, Finance Account and Transactions, Medications and Therapeutic Class, Flowsheet values, Fluid Intake and Output

Screen Shots
Surgical Site Infections

Description
The Surgical Site Infections (SSI) Prevention Advanced Application is aimed at hospital infection prevention teams, clinical and operational directors, hospital leadership and members of quality improvement teams. The SSI application enables users to efficiently find, review, and document SSI cases to support NHSN (National Healthcare Safety Network) reporting and to review outcomes and trends of SSI across institutions and health systems. It also provides near real-time analysis of internal processes related to SSI to support care process improvement.

Type: Outcomes Improvement  Status: Available  Updated: 2015-03-06
Features

- Performance dashboard to visualize SSI rates and case counts for NHSN by OR location, surgeon, ASA score, etc.
- Surveillance worklist and workflow tools speed SSI surveillance.
- Patient detail tab: Gives a one-page summary of the patient demographics, surgery scheduling, and surgical case data, along with key data for case participants, diagnosis, preoperative labs, preoperative antimicrobials, surgical risk factors, and bundle compliance measures.
- Intervention measurements: Track surgical bundle compliance and other interventions.
- Trending views: Track performance on outcome and process metrics.
- Comparison analytics: Compare performance across different patient groups by surgeon, OR room, procedure, etc.
- Export or print capability: For patient lists, metric performance, etc.

Benefits

Specific capabilities powered by the app include the ability for users to:

- Rapidly find, assess and document SSI according to NHSN definitions
- Efficiently review NHSN submission data and SSI rates
- Easily identify trends in performance and SSI prevention bundles compliance
- Discover differences in outcomes based on various stratifications (OR location, Surgical service, department, provider, date, comorbidity, e.g.)
- Drill down to the facility, unit, service, or patient level to analyze performance, provide feedback, and support measurement of performance improvement interventions

Anticipated Improvements

- Increased compliance with practices shown to decrease SSI: pre-op antimicrobials, glucose management, CHG skin prep, thermoregulation, etc.
- Lower SSI rate.
- Revelation of system-wide variation in SSI rates and variation in internal processes related to SSI (e.g., compliance with infection control bundles).
- More efficient and reliable NHSN reporting.
- Infection Prevention resources redirected to analysis, feedback, and intervention to improve SSI prevention process and outcomes.
- Increased insight into trends, populations, practice and performance—increased ability to uncover the “why” behind SSIs and the “where” to focus improvement efforts.

Success Measures

There are 3 types of success measures:

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
• **Opportunity Identification**: Measure and broadly share SSI rates and SSI PREVENTION BUNDLES compliance measures across the enterprise to help make visible the opportunities for improvement.
• **Process Improvements**: XX% improvement in compliance with selection and timing of preoperative antimicrobials (part of SSI prevention bundles).
• **Outcomes Improvement** Decrease SSI rate or SSI specific readmission rate by XX%.

**Background**
According to the CDC (2015), SSI is the leading hospital-acquired infection. Despite advances in infection control practices, SSIs remain a substantial cause of mortality, morbidity, prolonged hospitalization, and excess cost. To reduce SSI risk, the CDC promotes surveillance of SSI with feedback of appropriate data to surgeons. In addition to SSI rate data, feedback should also be provided on compliance with pre-surgical processes known to decrease SSI risk. The SSI app streamlines this surveillance and feedback, while also providing the opportunity to dive more deeply into the data to discover possible reasons and opportunities to inform outcome improvement efforts.

**Problem Summary**
Hospitals are required to track and report SSI rates to CMS via the CDC NHSN reporting system. Due to CMS payment penalties and high excess costs, health systems are eager to improve outcomes for their patients. However, organizations are frequently so focused on the task of finding, validating, and reporting SSI data externally—that they struggle to resource efforts to analyze data, identify root cause, and provide effective intervention to actively decrease SSI rates and improve outcomes.

**Users**
The SSI Advanced Dashboard is intended for those responsible for influencing the SSI outcomes. This usually includes hospital administrators, clinical and operations directors, and members of quality improvement teams. It may also include data architects, data analysts, and knowledge managers. When deciding who should be trained to use the SSI Advanced Dashboard, consider choosing people who fit these general role profiles:

• Staff who are responsible for tracking and reporting SSI rates to external entities.
• Staff who will help define monitor the Surgical Bundles for the system.
• Clinical and administrative leaders responsible for identifying, prioritizing, and reporting on quality improvement efforts.
• Any staff or leaders who may want to delve deeper than static reports to identify trends and potential improvement areas.
Use Cases

- A hospital executive reviews the SSI report from the Infection Prevention Committee and wants to know what is being done to decrease SSI rates to avoid payment penalties.
- An infection prevention team member discovers an increasing trend of higher-than-system-average SSI rate in a particular group of patients. They want to engage with a surgical care improvement team to improve processes to decrease SSI rates; however, they are so busy conducting surveillance for SSI rates, they don’t have time to focus on improvement.
- The surgical care process improvement team wants to measure the impact of a new colorectal surgery bundle on SSI rates. The team uses the app to look at compliance with the new process and the trend in SSI rates since implementation of the new process.
- An infection prevention team member is assigned to conduct surveillance and documentation of SSI cases in preparation for submitting to NHSN for a specific hospital. She uses the SSI Prevention advanced app to quickly identify SSI cases and finds it dramatically more efficient than her usual manual surveillance methods. In addition, she’s able to identify an apparent trend of increased infection rates in bowel surgeries. The application helps her investigate preoperative care processes and develop a hypothesis, based on actual compliance date. Within a short time, she has data to share with the medical director for GI surgery demonstrating the trend in SSI and supporting data on SSI prevention bundles.

Metrics/Measures

- SSI Rate
- SSI Count
- Case Count
- Encounter Count
- Patient Count
- Intervention Counts and Composite Score

Data Sources

- EMR: hospital billing records, professional billing system(s), surgery scheduling and surgery case data.
- Costing
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This roadmap does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Translational Research

Description
Applications for translational research are focused on supporting the needs of academic research as well as the tools needed to translate that research into actual clinical practice. Capabilities include de-identification of data, data discovery of cohorts, trends, inliers and outliers, study recruitment and research workflow.

Applications

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
De-Identified Cohort Builder

Description
De-identified Cohort Builder – Due to regulatory concerns and lack of available tools, researchers are often challenged obtaining even basic information about patient cohorts that are defined with complex rule sets. De-identified Cohort Builder allows non-technical users to input clinical and demographic criteria to identify specific populations of patients and obtain basic analytic data on those populations. The tool is ideal for researchers preparing a grant submission or IRB proposal. Access to the tool can be streamlined since there is no protected health information (PHI).

Type: Identify Opportunity  Status: Available  Updated: 2015-04-08
Features

- Population data available at three fundamental levels of granularity: patient-centric data such as demographics, problem lists, medication, labs, and orders (e.g., asthma, beta 2 agonists, and PFT orders); episode-centric data gathered from facility billing and specific to a facility account (e.g., pregnancy); and encounter-centric data derived from a patient encounter (e.g., appendectomy).
- Populations stratified by diagnosis, place in the clinical hierarchy (clinical program, care process family, and care process), orders, medications, labs, and demographics.
- Support for de-identified version to support research needs.

Anticipated Improvements

- Decreased time and resources required to create more precise patient registries for improvement projects and clinical studies.
- Greater ease in planning resource needs and duration for studies, due to the ability to quickly determine number of members likely to qualify for research study within a given time period.

Success Measures

- **Registry identification**: Identify potential $ saved from more efficient definition of patient cohorts.
- **Accelerated improvement**: Lower time and resources spent on iterative population registry definitions for improvement work teams.
- **Better Information**: Deliver rapid, clear insight into study recruitment potential, inclusion criteria, associated resources, and potential study timelines.

Background

Clinical quality improvement initiatives and clinical studies require precisely defined patient populations. Having a clinician-friendly way to dynamically and simply interact with the data in the EDW can make this patient cohort definition process more efficient.

Problem Summary

The task of defining patient cohorts for quality improvement projects or clinical studies is often shared by several people working in various clinical and technical roles. Typically, the complex questions of the clinician experts must be transmitted to technical team members, who then conduct the queries and produce a custom-built report—one that will likely require several iterative reviews before it meets the needs of the clinicians. This process of iteratively defining patient cohorts can be time-consuming—and it delays progress on meaningful clinical improvement and research.
Use Cases

- A researcher is planning a study to investigate the use of ACE inhibitors in elderly patients with diabetes to determine the need for potassium supplementation. The researcher would like to know how many patients in the last year have diabetes, are older than age 65, have at least one order for an ACE inhibitor, and at least one serum potassium measurement.

Metrics/Measures

- Patients
- Facility Accounts
- Encounters
- Clinical Programs
- Care Process Families
- Care Processes
- APRDRGs
- Medications: Generic, Therapeutic Class, Pharmaceutical Class
- Laboratory Orders
- Demographics

Data Sources

Data comes from the EMR and may include patient problems, medications administered, laboratory orders and results, orders, APRDRGs (billing data), and ICD diagnoses and procedures.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
De-identified Population Explorer

Description
De-identified Population Explorer – Due to regulatory concerns and lack of available tools, researchers often have difficulty in accessing data that allows them to understand and compare clinical measures across different populations. This kind of analysis is a critical component in the hypothesis generation process. De-identified Population Explorer provides an easy-to-use interface that lets users explore a wide variety of metrics across 800+ registries and a starter set of 50 common metrics. Users can view metrics about individual patient populations, including case counts, readmission rates, charges, revenue, and length of stay, among many other metrics. Each of these metrics can be stratified by demographic information and other clinical and financial information. The tool makes it very easy to switch between different populations as well as providing comparative views between multiple populations. Access to the tool can be streamlined since there is no protected health information (PHI).

Type: Process Improvement  Status: Available  Updated: 2015-04-08

Population Explorer Summary Tab showing 90 day readmission rates, average length of stay, and financial data on a selected population. Users can select any clinical cohort and can filter by demographic, visit detail, and financial data. This example shows visit details for Female Heart Failure Patients.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features
- 1,000+ Population Registries
- 50+ Population Health Analytical Measurements within each registry
- Customizable Drill-down Data Visualization
- Comparison across multiple populations

Benefits
Get a broad overview of the populations being treated and basic information about each.
- Integration of clinical, financial and administrative data
- 1000+ bundled population registries
- Adaptive framework provides the ability to easily add new cohorts

Faster time to value
- Pre-defined population registry cohorts
- 50+ population health built-in analytical measurements

Review information about trends and inconsistencies within treated populations to start asking “why.”
- Ability to stratify and filter across 50 analytic measurements (ex: comorbidities)
- Ability to change views between populations as well as across multiple populations
- Ability to drill-down to specific patient level

Anticipated Improvements
Reduce time and resources to evaluate patient populations for new grants and studies

Success Measures
Opportunity Identification:
- Identify potential patient cohorts for new studies without HIPAA or expensive chart review.

Process Improvements:
- 50% improvement in reduction of time and resources for new grant applications
Problem Summary
Researchers are often frustrated with the lack of insight into the patient populations at their clinical affiliates. This clinical data represents potential study recruitment targets as well as a rich information source for formulating population-based hypotheses. In order to get access to this data, researchers must embark on a lengthy process to fulfill HIPAA regulatory requirements,

Measures
Demographics
- Discharges by age, gender, comorbidity count
- Number and percentage of discharges per ethnic group

Visit outcomes
- Number discharges by patient type and diagnosis

Two-population comparisons by
- 7-, 14-, 30-, 60-, 90-, and 120-day readmissions
- Length of stay
- Charges, payments, variable cost, and total cost

Associative measures
- Patient count, percentage of patients, discharge count, or percentage of discounts per
  o Patient type, discharge unit, admit source, and discharge status
  o Financial class and primary payor
  o Admit ICD code and Primary ICD code

Primary-care visits by
- Patient
- Clinic, and how many per clinic
- Days since last encounter

Data Sources
- EMR
- Costing
Screen Shots

Population Visit Detail tab. This tab stratifies visit detail data on a selected population. Users can select any clinical cohort and can filter by demographic, visit detail, and financial data. This example shows visit details for Female Heart Failure Patients.

Demographic Summary Tab. This tab shows demographic and comorbidity data on a selected population. Users can select any clinical cohort and can filter by demographic, visit detail, and financial data. This example shows visit details for Female Heart Failure Patients.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
The Cross Cohort tab allows comparison between two different populations. In this screenshot, readmission rates are being compared for a male and female populations of heart failure patients. Users can compare any two populations that can be defined with clinical, demographic, visit detail, and financial data.
IDEA for Research

Description
Researchers often collect data for their studies in spreadsheets and consumer database products such as Microsoft Access. In addition to security risks, this introduces data quality issues and the ability to merge this data with existing clinical repositories creates data integration challenges. Instant Data Entry Application (IDEA)

Type: Process Improvement        Status: Available        Updated: 2015-04-09

Form fields in a custom-made IDEA app

Background
Sometimes a source system doesn't collect a subset of data you need. IDEA, or the Instant Data Entry Application, lets users of all levels of technical expertise create, publish, and use a web-based data-entry form. As data is collected, it flows right into the EDW.
Late Binding™ Data Warehouse

It all starts with a data warehouse

Most large healthcare organizations have hundreds of analytics vendors. Without bringing all of their data into an enterprise data warehouse (EDW), reliable and repeatable reporting and analysis is impossible.

Health Catalyst’s Late-Binding™ Data Warehouse is a revolutionary architectural model for healthcare analytics. When an organization combines an EDW with the power of Late-Binding™, they quickly progress to registries and reporting, population health, and clinical and financial risk modeling.

Late-Binding™ architecture
Data must undergo massive transformations to fit into an enterprise data model.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
The pitfalls of early binding
Early binding architectures – like those espoused by Bill Inmon, Ralph Kimball, and others – force early data bindings into proprietary enterprise data models. Time has proven early binding architectures to be inflexible, one-size-fits-all solutions, enforcing a compromised, and least-common-denominator warehouse.

The power of Late-Binding™
Health Catalyst’s Late-Binding™ architecture avoids those inherent limitations. By delaying data binding until the proper time and context, data retains its original, undiluted value.

Health Catalyst’s Late-Binding™ principles
Data warehouses in the military, manufacturing, and healthcare that have operated by these principles for more than 20 years continue to deliver an unparalleled track record for proven results.

1. Minimize remodeling data in the data warehouse until the analytic use case requires it. Leverage the natural data models of the source systems by reflecting much of the same data modeling in the data warehouse.
2. Delay binding to rules and vocabulary as long as possible until a clear use case requires it.
3. Earlier binding is appropriate for business rules or vocabularies that change infrequently or that the organization wants to lock down for consistent analytics.
4. Late binding in the visualization layer is appropriate for what-if scenario analysis.
5. Retain a record of the changes to vocabulary and rule bindings in the data models of the data warehouse. This will provide a self-contained configuration control history that can be invaluable for conducting retrospective analysis that feeds forecasting and predictive analytics.
Catalyst Analytics Platform

The Catalyst Analytics Platform is the breakthrough technology at the foundation of Health Catalyst’s Late-Binding™ Data Warehouse.

It isn’t a lack of data that makes it challenging for healthcare organizations to uncover opportunities to lower costs and improve care. Just one patient encounter can generate hundreds of rows of data in source systems spanning nearly every area.

Without a way to organize that data into an enterprise data warehouse, volumes of clinical, financial, patient satisfaction, and administrative data sit trapped in silos. Leaders risk making critical business and clinical decisions based on only fragments of the big picture.
Turning data into outcomes

Powered by a unique, metadata-driven ETL engine, the Catalyst Analytics Platform extracts data from a healthcare organization's many source systems and gathers them into Health Catalyst’s Late-Binding™ Data Warehouse, where it binds the right data, at the right time, and at the right place.

When surfaced later in interactive visualizations, decision makers can bring that quality, cross-organizational data into focus and deliver specific, actionable interventions in quality, outcomes, patient safety, and waste reduction.

Benefits

Insights in weeks and months, not years

- Fastest implementation in the industry
- Rapid time to value
- Near-real-time data

Cross-organizational discovery

The platform:

- Integrates disparate data across the organization into a single source of truth
- Links data (like patient information) between silos
- Shows opportunities for actionable interventions
- Quickly adapts to changing needs and market conditions

Powerful, intuitive software and tools

Users will:

- Extract, transform, and load data from commonly available source systems from well-known healthcare vendors - including clinical, financial, and ancillary sources
- Create, maintain, and customize data marts
- Manage ETL processes
- Provide self-service tools to the front lines
Metadata-Driven ETL Engine

In Health Catalyst’s view, metadata is king.
Many enterprise data warehousing ETL models contain no metadata, relying mostly on manual processes to bring data into their EDW. Over many years of updates and code changes – without structure and standards in place – maintenance costs become burdensome and reports are bottlenecked by the time-consuming work required to massage data into new formats.

Automated, metadata-driven ETL
Rather than a data analyst maintaining hundreds of ETL scripts and performing each extraction, the Catalyst Analytics Platform deploys Source Mart Designer (link to SMD page) to map source system tables and columns to their Source Mart counterparts entirely with metadata.

Mappings are then used to create one or more ETL tasks for each source system table, automating extractions of data from the source systems. Users define how often they want the underlying data to refresh – up to as often as every 10–15 minutes. This gives users:

Near-real-time data
- The ability to execute potentially hundreds of ETL processes each night
- Reports that rebuild each time metadata is updated

Agile, flexible, and scalable
Initially, the ETL process does little or no transformation of the source data beyond mapping source system data types to destination system data types. That means that rather than developing the entire data model up front before knowing what all the use cases for the data will be, data is bound late in the process — just in time to solve an actual clinical or business problem.

The flexibility of late binding is a benefit James Dixon also promotes in his concept of a data lake architecture (link to https://www.healthcatalyst.com/data-lake-vs-data-warehouse-right-for-healthcare), which preserves data in its unstructured form so it can answer new questions that arise down the road.
Source Mart Data Flow

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Agile Data Models

Flexible data models – paired with drag-and-drop ETL management tools – keep data agile, adaptable, and always up to date.

What does it take other vendors up to two years to implement their EDW and start delivering actionable insights? They spend too much time mapping portions of the metadata, relying mostly on manual processes and hand-customized ETL scripting. Manual mapping is not only time consuming but also must be redone again and again as data models shift.

Pre-built data models
Health Catalyst arrives with a box of preconfigured loading scripts for based on commonly available source systems, including clinical, financial, and ancillary sources from well-known healthcare software vendors.

This extensive, ever-growing library - developed by Health Catalyst team members who have mapped hundreds, maybe thousands, of Source Mart tables using traditional, manual methods - expedites extraction and automatically transforms metadata to load scripts. That means the platform can be installed and configured in as few as three months with a real ROI in as few as six.

Data mapping made easy
Developing, testing, and deploying custom Source Marts is painless with the Source Mart Designer tool, which captures source system metadata to automatically map tables and columns in a source system to tables and columns in a Source Mart.

Demystifying table and column names
The Health Catalyst team uses its extensive knowledge of a source system, supplemented by the knowledge base in Source Mart Designer, to change cryptic source system names into ones that reflect the way humans think.

For example, a column in an EHR source system labeled Pat_ID may make sense to someone who's worked with healthcare IT software a long time – and it’s only one of many names that could be used. But it's not the way a person unfamiliar with that code would search for that information. The Health Catalyst team changes that column heading to the more intuitive PatientID so that when users search the metadata repository, they’re far more likely to find what they're looking for.
Optimized for late binding
Data loaded from the source system to a Source Mart undergoes minimal transformation in the process — just enough to link it to core naming standards like patient ID, provider ID, encounter date and time, facility ID, etc.

Data stays in its raw, undiluted form and isn't bound until a use case requires it, which saves healthcare systems from hammering out their entire data model up front.
Linking and standardization

Just-in-time binding gives healthcare providers most meaningful, up-to-date data the moment they need it.

Traditional data warehouses try to model the perfect database from the outset, determining in advance every possible business rule and vocabulary set needed to bring together data for analysis. This practice, called early binding, is a time-consuming, expensive undertaking. In healthcare, business rules and vocabularies change rapidly – and so do the use the cases that data linked across different source systems can serve.

The wisdom of late binding

Health Catalyst's Late-Binding™ Data Warehouse architecture avoids the consequences of linking data with volatile business rules or vocabularies too early. By waiting to bind data until it’s time to solve an actual clinical or business problem, analysts:

- Don’t have to make lasting decisions about a data model up front when they can’t see what’s coming down the road in two, three, or five years
- Quickly adapt to new questions and use cases
- Have the data they need to perform timely, relevant advanced analytics (link to Advanced Analytics page)

Etl with a lowercase t

When data is extracted from source systems and loaded into the EDW, it undergoes almost no transformation. Aside from some minimal data conformance (for example, making sure the “patient name” field in one Source Mart is structured the same as the “patient name” field in another), the data is kept as raw as possible in a source system’s natural data models.

Minimal transformation also helps analysts easily track and catalog data lineage through a single enterprise metadata dictionary.

Just-in-time answers

When it’s time to analyze a specific use case, source mart data is bound more tightly in a Subject Area Mart (link to Advanced Analytics page). At this point, we perform some transformation of the data, but only when necessary. Subject Area Mart Designer (SAMD) (link to SAMD page)

Essentials layer

Some common linkable identifiers are fundamental to almost all analytic use cases, like standard metrics for populations, finance, and operations. Because these data elements don’t change often, we bind to them early. More volatile rules and vocabularies are bound as late as possible.
The six binding points
Data in Health Catalyst's Late-Binding™ Data Warehouse can be bound at six points:

Six Points to Bind Data

Binding defined
Binding is the process of mapping the data in the data warehouse from source systems to standardized vocabularies (e.g., SNOMED and RxNorm) and business rules (e.g., length-of-stay definitions, ADT rules) so it can be used together for analysis.

Health Catalyst’s late-binding architecture avoids wasted time and effort by waiting to bind data until a business case drives it.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Page 191
Master Data Management

Link identifiers and medical vocabularies across multiple source systems into a single, consistent point of reference.
In many health organizations, each source system maintains its own definition of common data identifiers, like a patient or provider identifier.

For data aggregating systems like an EDW, those identifiers must be linked or mapped to one another across the enterprise to accurately qualify identifiers in multiple source systems. Just as critical is managing code sets in controlled medical vocabularies.

The value of master data management
Master data management is, at its most basic, the process of linking identity data and reference data across multiple IT systems into a single, consistent point of reference. That single point of reference could be a patient ID, a procedure code, a controlled medical vocabulary, or any of a wide array of others.

Linking identifiers
The Health Catalyst EDW uses master data management to map identifiers across source systems. Supported shared, cross-system data objects include:

- Patient identifiers
- Provider identifiers
- Subsets of standard medical vocabularies

Managing common terminology
Another type of master data are controlled medical vocabularies like ICD-9, ICD-10, LOINC, and CPT codes. Healthcare organizations often use these codes to exchange data between systems, for billing, and for external reporting purposes.

Health Catalyst’s applications use these codes and their mappings to build patient cohorts and metrics definitions. Because these code sets are critical for applications to function, Health Catalyst manages them in its master data management subsystem.

Note
Health Catalyst's master data management subsystem is not a replacement for a full-featured eMPI or terminology management system.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Advanced Analytics

Less time
The key to outcomes-driven analytic insights is extracting the data needed (and only the data needed) to:

- Build custom Subject Area Marts that allow users to make calculations
- Feed business intelligence tools to create visualizations of trends

Health Catalyst’s late-binding architecture helps healthcare organizations rapidly achieve both for a broad scope of clinical and operational processes.

Rapid construction
The Subject Area Mart Designer (link to SAMD page) tool bypasses the laborious process of retrieving data from individual source systems to build custom Subject Area Marts.

Once the metadata-driven ETL engine (link to Metadata-driven ETL engine page) integrates source system data into the EDW, data architects create Subject Area Marts that measure specific cost and quality metrics.

Data visualization
After that late-bound data is fed into analytics applications (link to https://www.healthcatalyst.com/analytics-applications) targeting specific interventions, it isn't long before users delve into insights, create and analyze visualizations, and kick off improvement initiatives.

Instant deployment
The Health Catalyst architecture also includes out-of-the-box data applications ready for deployment to hundreds of users shortly after key data sources are loaded.
Platform Applications

Atlas Meta-Data Management

Self-service analytics for technical and nontechnical users alike
Users don't have to be technically advanced to contribute to data discovery.

Atlas is a web-based, user-friendly tool that opens a window to the EDW and enhances it with the subjective knowledge of those who know the data best.

A Google-like keyword search combs each data mart, table, and column in the metadata repository to see:

- The source and lineage of data
- How often it's updated
- Data examples, samples, and types
- Descriptions of the physical data tables and columns
- Any known data quality issues
- Contact information for data stewards (link to access management page)

Making data meaningful
When metadata is mapped in the EDW (link to SMD page), Health Catalyst’s experts use their extensive knowledge of the source system to change all the cryptic source system names into ones reflecting the way humans think (link to Linking and Standardization page). All of that data goes in the metadata repository so users can search and browse it in Atlas.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Wisdom of the crowd
Atlas’s wiki-style contribution model encourages users to:

- Add notes about data and data sources
- Review and refine metadata in the EDW
- Create and edit descriptions for objects in the data warehouse
- Make comments
- Create a self-sufficient community

Data stewardship through subject-matter expertise
System administrators designate a data steward (link to Access Management page) – a knowledge expert in a particular data mart – as its primary owner. Besides managing access rights, data stewards also evaluate and improve data quality and answer users’ questions about the data.

Always up to date
- Data in the EDW updates daily
- An RSS feed alerts users of changes

User Interface
EDW Console

An ETL management dashboard
While Atlas (link to Atlas page) – EDW Console's companion tool – is available to many users, EDW Console is accessible by only designated administrators, who typically perform functions similar to a system administrator.

The EDW Console dashboard clearly shows malfunctions and errors, pointing out where administrators need to take corrective actions.

Administrators easily and efficiently:

Configure batches
- See all sources brought into the EDW
- Create, view, modify, and remove the batch definitions of each source system
- Search and filter batch definitions
- Drill into various packages

Execute ETL tasks
- Create, schedule, run, and cancel batches
- Launch and relaunch ETL tasks
- Check the status of execution processes

Monitor the health of the EDW
- View batch and table load history
- Access detailed logging tables
- See error messages for failed loads to correct
- Correct error conditions

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Security: Access Management

Protect data responsibly while empowering your users.
Good data warehouse architecture delivers a single reporting platform and a single point of entry into an organized repository of the organization’s data. That architecture allows privileged system users to control and monitor access to pieces of the EDW on the individual data mart level.

Best practices made simple
Health Catalyst follows four guiding principles for security and access:

- Partner data owners and data architects to design and implement the appropriate level of security.
- Give as much read-only access as possible, but closely monitor the usage.
- Use views to limit end-user exposure to sensitive columns, like Social Security Numbers.
- Manage access through data stewardship

Data stewardship through knowledge experts
System administrators can designate data stewards - knowledge experts in a particular data mart - as the data mart's primary owner. Their authority allows them to:

- Approve, disapprove, or revoke access to a data mart or dashboard
- Evaluate and improve data quality
- Monitor how users navigate the data mart and generate reports

Privileges by group
EDW users typically fall under the following three levels of access. Privileges can be tied to Active Directory or other Windows authentication services.

Tier 1: Basic user
Basic users can browse data mart information in Atlas but cannot modify data marts or configurations.

Tier 2: Data steward
Data stewards control which users can access which data marts.

Tier 3: System administrator
According to local security policies, system administrators:

- Have full access to EDW configuration tables
- Manage user access to the EDW and its specific data marts

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Security: Auditing

Idera SQL Compliance Manager monitors EDW servers to protect data and minimize costly downtime.

Idera is a highly rated, third-party SQL server auditing appliance packaged with Health Catalyst's EDW solution that expeditiously monitors server activity and quickly alerts administrators of problems.

Agentless, real-time monitoring
- Captures and generates detailed access logs of server activity and user access
- Monitors the server's health and performance
- Sends instant alerts to a central console or mobile device

Fast diagnosis and remediation
- Provides diagnostics solution
- Identify performance bottlenecks

Easy trend spotting
- Stores historical performance data in a central repository for strategic analysis of long-term trends and capacity
- Diagnoses historical SQL Server performance problems

Secure data collection
- Provides simple, secure data collection from a background service
- Does not install agents or components of any kind on the monitored SQL Servers

Common users
- Database Administrators (DBAs)
- Data Warehouse Directors or Managers
- Data Warehouse Personnel (e.g., Data Architects)
- Compliance Departments (e.g., Audit Log inquiries)

Idera SQL Compliance Manager can be configured for a variety of database setups. Following is typical client setup in the Catalyst Analytics Platform:
Visit Idera on the web [link to https://www.idera.com/] to read more about Idera SQL Compliance Manager.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Source Mart Designer

Intelligent metadata mapping and standardization is the heart of the Health Catalyst solution.
Source Mart Designer answers one of the biggest challenges organizations face when implementing an EDW: the time it takes to manually extract data from source systems, bring it into the EDW, and map it to data marts for downstream use in advanced applications.

The problem with manual ETL maintenance
Many enterprise data warehousing ETL models contain no metadata – making it difficult, if not impossible, for a data analyst to know where tables and columns originated in the source system. Worse, when new data sources are added to the data warehouse or analytic use cases mature, source system data must be conformed and mapped again.

Metadata mapping at full speed
Source Mart Designer mobilizes Health Catalyst's metadata-driven ETL engine to automate that time-consuming, labor-intensive chore.

Metadata in memory
Metadata – captured for every field – creates mappings between the tables and columns in each source system with their destination Source Marts. Source Mart Designer captures that metadata in a single, comprehensive repository.

Metadata in movement
Source Mart Designer drives the ETL process entirely by metadata. Based on source system characteristics and supplemented with a few simple, Health Catalyst-supplied ETL scripts, a customized, configurable ETL process is created for each source system table.

Making metadata meaningful

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Once metadata is mapped, Health Catalyst experts use their extensive knowledge of the source system, supplemented by the knowledge base in Source Mart Designer, to change all the cryptic source system names into ones reflecting the way humans think.

All of that data goes in the metadata repository so users can search and browse it in Atlas (link to Atlas page), Health Catalyst's metadata management tool.

**Hands-off maintenance**

Rather than relying on a SQL import/export utility or an ETL tool to move data, data architects simply decide how to set up their columns. Data loads during the nightly ETL process.

Benefits include:

- Automated upload of common source system fields, schemas, data types, columns, and more
- Modifiable column name suggestions
- Ability to determine if a data load is full or incremental based on both the volume of data and speed requirements
- Consistent naming taxonomy guidelines for review and confirmation

**Licensing**

Source Mart Designer (SMD) can be licensed for use at two levels based on client needs. A “Standard” license enables clients to maintain source marts which have been purchased from Health Catalyst. A “Professional” license enables clients to design, create and deploy source marts for integration of IT systems which have not been purchased from Health Catalyst.

**User Interface**

Source Mart Designer's easy-to-use interface helps data analysts maintain enterprise-wide consistency.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Success story: From data managers to data analysts

Indiana University Health

IU Health tasked its Information Systems (IS) department to increase the value decision-makers get from the health system’s data — and to do it with fewer resources.

Using Source Mart Designer, the IS team automated a rapid integration of source system data into the EDW, empowering them to rapidly design, develop, and deploy Source Marts 75 percent faster.

The days of time-consuming manual ETL maintenance behind them, IS staff spend less time managing data and more time putting their analytical skills to drive clinical quality improvement.

Read more (link to: https://www.healthcatalyst.com/success_stories/integrating-source-marts-into-a-healthcare-data-warehouse)
Subject Area Mart (SAM) Designer

SAM Designer provides a simple, visual user experience for creating and deploying custom data marts in the EDW.

In the past, pulling information out of various source systems to perform calculations was a time-consuming, manual task that required specialized IT knowledge. It could take months to build an individual Subject Area Mart (link to Advanced Analytics page) in an EDW and start getting answers to questions.

Subject Area Mart (SAM) Designer simplifies that process. By relying on the metadata captured by Health Catalyst's metadata-driven ETL engine (link to Metadata-driven ETL engine page) when a source system is loaded into the EDW, SAM Designer pulls relevant data into a Subject Area Mart and filters out anything not needed. Analysts then run calculations on that data and create visualizations that reflect the results.

Definition management
Subject SAM Designer allows users to:

- Create or modify Subject Area Marts
- Manage the lifecycle of Subject Area Marts
- Create Subject Area Mart definitions
- Search the metadata of existing Subject Area Marts

Collaborative value
SAM Designer provides a simple, visual user experience for creating and deploying Subject Area Marts. Clinicians and data architects actively work together to build a Subject Area Mart, which can often be built in just one day, and the organization starts realizing value immediately.

Licensing
Subject Area Mart Designer (SAMD) can be licensed for use at two levels based on client needs. A “Standard” license enables clients to maintain subject area marts for applications which have been purchased from Health Catalyst. A “Professional” license enables clients to design, create and deploy subject area marts for applications which have not been purchased from Health Catalyst.
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Instant Data Entry Applications (IDEA)

Deploy a custom data-collection app in a matter of minutes.
Sometimes a source system doesn't collect a subset of data you need. IDEA, or the Instant Data Entry Application, lets users of all levels of technical expertise create, publish, and use a web-based data-entry form. As data is collected, it flows right into the EDW.

Potential use cases
- Data for quality improvement initiatives
- Research data
- Call center survey results
- Hierarchy (org chart) maintenance
- Hand hygiene recording application
- Stop gap for EMR workflow development
- Confirm or augment clinical definition around a condition
- Custom lists and hierarchies required for reporting

API connections
The IDEA API extends to other tools, including QlikView, BO, Cognos, etc., through a restful web service. API functionality allows users to update existing data based on what they see in the presentation layer.

Form fields in a custom-made IDEA app
Data Acquisition and Storage

Description
The Late-Binding™ Architecture of the Health Catalyst data warehouse streamlines and automates the process of bringing data into the warehouse from source systems.

A Source Mart contains the data that have been extracted, minimally transformed, and loaded into the data warehousing system. Metadata, created by Source Mart Designer during the mapping phase of the Source Mart integration process, is used to drive the nightly update (ETL) process of Source Mart data. Periodically, typically each night, the Source Mart data are refreshed to include new data or updated data from the source system. The data are then available for downstream use in Catalyst Foundational, Discovery, and Advanced Applications as well as reports and local applications.

- 11 EMRs now supported
- 84 source marts deployed in 2014
- 55 total source marts in library

Implemented 9 Source Systems in 9 weeks at Crystal Run (new world record)

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Source Mart Library
Health Catalyst has a proven record of successfully integrating data into its EDW platform, including:

Billing
- Allscripts Practice Management
- Cerner Millenium
- Epic
- GE Centricity Professional Billing
- Keane Hospital Billing
- McKesson STAR Billing
- Meditech
- NextGen
- Soarian Financials

Claims
- Aetna
- Blue Cross Blue Shield
- CMS Medicare
- QNXT

Electronic Medical Records
- Allscripts Enterprise
- Cerner Millennium
- Cerner PowerWorks (ambulatory)
- Epic
- McKesson Horizon
- Meditech Magic/Medisolv
- NextGen (QSI)
- Soarian Clinicals & Financials

Financial
- Lawson General Ledger
- Lawson Accounts Payable
- Lawson Materials Management
- Meditech
- Microsoft Great Plains
- PeopleSoft General Ledger
- PeopleSoft Accounts Payable
- PeopleSoft Supply Chain
- SmartStream General Ledger

Human Resources
- API Healthcare
- Empath HR
- Genesys HR
- Kronos
- PeopleSoft HR

Miscellaneous
- Cactus
- Digimas Material Management
- Echo
- FlightLink
- MSO
- MarketShare
- Safety Scoop
- TransChart
- University Health Consortium

Other Clinical Systems
- Apollo
- Aspire
- Cerner HomeWorks
- Cerner Lab
- GE Centricity Practice Management
- HST Pathways
- McKesson ORSOS
- MIDAS Risk Management
- PCIS Perioperative Suite
- Sunquest Lab
- VITAL Pharmacy

Patient Satisfaction
- NRC Picker
- PRC
- Press Ganey

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
- Sullivan Luallin

**Standard Costing**
- Allscripts EPSI

**Contracted Sources (Roadmap)**

**Claims**
- Children’s Community Health Plan (CCHP)
- CIT Claims
- Cone Health Employee Plan
- Hawaii Medial Service Association (HMSA)
- PWHP Claims
- SSI Claims
- Wisconsin Health Information Organization (WHIO)

**Electronic Medical Record (EMR)**
- Allscripts Enterprise/TouchWorks (ambulatory)
- eClinicalWorks (ambulatory)

**Financial**
- HealthQuest Patient Accounting

**Other Clinical Systems**
- Bed Ready
- CareStream RSI
- GE Centricity RIS (radiology)
- MAC Lab
- MD Associates
- MUSE (EKG)
- OBIX Perinatal
- PACS Health (radiology)
- Varian Aria (oncology)

**Patient Satisfaction**
- HealthStream

**Standard Costing**
- Allscripts TSI
- CostFlex
- IOS Envy
- McKesson Cost HPM
- PPM

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Shared Applications

Description
These applications are packaged as part of the Catalyst Analytics Platform which is installed and deployed at every client. These applications cover a broad scope of clinical and operational processes and are useful for in the creation and fingerprinting of all improvement applications.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Attribution Modeler

Description:
Attribution Modeler is aimed at clinical directors, operational directors, clinical-program guidance teams, and operational guidance teams through implementation in Health Catalyst applications. For patient populations of interest Attribution Modeler provides attribution based on configurable methods, weighting, scoring and ranking.

Type: Identify Opportunities
Status: Available
Updated: 2015-03-06

Event Notes
Single Encounter Event Pass in EncounterID pulls PatientID and EncounterDTs. For all patient types, single patient output.

Multiple Encounters/Provider Type “OP”, pulls Max EncounterDTs per Patient where provider primary specialty name in value sets specified. Output only patient list output.

Medicare Patient Where FinancialClassNM = “Medicare” and TotalChargAmt > 0 and DischargeDTs in 3yr range. Pulls max DischargeDTs per patient for input only patient list output.

Features
- Configurable patient populations, attribution methods, weighting, scoring and ranking.
- Summary table listing all providers for each patient, with rank and confidence percent.
- Override capability on attribution, to activate or inactivate attributed values as needed.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Benefits
- Ability to attribute patients to providers.
- Ability to attribute patients to locations.
- Ability to see all providers or locations associated with patient’s care.
- Ability to override attribution.

Anticipated Improvements
Develop more standard attribution methods over time for all patient settings, and National healthcare improvement initiatives.

Success Measures
- Standardize the methodology in which a provider’s patient panel is created across practices and units.
- A standards\transparent model generates greater buy-in with physician groups that are frustrated with limited or inadequate attribution models.
- Attribution may be applied across different types of caregivers. Nurses, physicians, and even behavioral health specialists can all share in the patient attribution this provides points of contact to coordinate care between providers

Background
In a healthcare system looking for potential areas of improvement, it often helps to start with the attribution of patients to providers for accountability of care and outcomes.

Problem Summary
Healthcare organizations are seeking to hold providers accountable for the care of the patients attributed to them, but most patients will see many providers in any given timeframe so identifying the provider with main responsibility for the patient’s care can be a difficult task.

Users
Teams whose improvement efforts require insight into the attribution of patient to provider or locations

Measures
Starting Populations of Patients (Configurable)
- Multiple Encounters: Pulls max encounter timestamp per patient where provider primary specialty name in value sets specified. Outpatient only, patient list output.
- Medicare Patients: Pulls max discharge timestamp per patient where financial class = ‘Medicare’ and total charge amount > 0. Inpatient only, patient list output.

**Attribution Methods (Configurable)**

- Weighted Physician Score: Highest Weighted Score based on a 12 month look back period. PCP provider gets 20 points per visit, Specialist Provider gets 15 points per visit, the most recent visit get 10 points, and every Order placed by an Ordering Provider gets 1 point.
- Dartmouth Method: Patients are assigned a provider based on the most visits in the highest priority specialty. Each provider is classified as (any visit to a higher priority specialty trumps the lower): 1-PCP providers 2-medical specialists 3-surgical specialists.
- Medicare Method: Patients assigned a provider based on charges of 1) PCP service (internal medicine, general practice, family practice, and geriatric medicine 2) Specialist Provider and certain non-physicians (nurse practitioner, clinical nurse, and physician assistant).
- Weighted Location Score: Highest Weighted Score based on a 12 month look back period. Each visit gets 1 point, with most recent visit getting extra 2 points.

**Data Sources**
Sources that feed the Essentials Layer, such as the EMR(s), as Attribution Modeler feeds from the Essentials Layer.
Executive Dashboard Integration Tool (EDIT)

Description
The Executive Dashboard Integration Tool (EDIT) delivers an executive dashboard that can be tailored to display the key operational, financial, quality, and patient satisfaction metrics that are most pressing to the organization. If an executive is interested beyond a summary level, EDIT can launch the specific application that contains all the additional detail.

Type: Identify Opportunities  Status: Available  Updated: 2015-03-05

Features
- Allows users to go to a single hub to view high level metrics without opening multiple departmental or clinical focus applications.
- Shows trending over time as well as variance to targets down to the location and unit level.
- Allows users to directly navigate to more detailed underlying application if more analysis is deemed necessary.

Benefits / Anticipated Improvements
- More cohesive partnership within systems by aiding in strategy and goal alignment in working towards common goals.
- Early identifications of problems and successes provide opportunities to elevate performance.
- Clear understand of drivers of value.
- Coordination and visibility across multi-site enterprises.

System-wide overview of key metrics
Success Measures

- Align all units and groups on key measures driving initiatives.
- Validate impact of transformation initiatives.
- Promote Quality Improvement measures to all executives and across entire enterprise.

Background

One of the fundamental ideas of quality improvement theory is to identify key work processes, then organize around them. A limited number processes (the “Golden Few”) make up the vast majority of services you provide to patients (80/20 rule). We want to prioritize this subset of key processes in quality improvement efforts.

Problem Summary

Medical group executives require tools to maintain tight integration with physicians and staff across expansive enterprises. System leadership needs a method to convey high level progress on strategic objectives directly to executives and promote progress on quality performance improvements.

Use Cases

Executive leadership puts forth a system wide initiative focusing on the system’s ability to better manage patient risk. System wide measures such as Overall 30 day Readmissions, Heart Failure Readmissions and Med Rec, CAUDI and CLABSI rates are harvested from individual dashboards, aggregated and displayed as system wide KPIs for all locations and units in the system to analyze to make targeted improvements across the organization.

Measures / Metrics

EDIT leverages metrics from any previously installed applications from any product line. These metrics are then rolled up into high level metrics such as location and unit for easier high level consumption.

Data Sources

Existing Health Catalyst applications
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Key Process Analysis (KPA)

Description
The Key Process Analysis (KPA) application uses the “80/20 rule” to identify cost-driving clinical areas and variation in care processes. The KPA combines clinical and financial data to highlight the best opportunities for improvement and cost reduction, and guides the development of applications to support improvement initiatives.

Type: Identify Opportunities    Status: Available    Updated: 2015-03-05

Pareto view of Variable Direct Costs

Features
- Apply risk adjustment using either APRDRG severity illness, HHS-HCC or Charlson/Deyo risk index scores
- Look at variation in different metrics of cost, charges and length of stay
- Drill into department and provider variation for a selected care process

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Benefits
Identify within a care process:

- Patients impacted
- Total time spent caring for patients
- Opportunity due to variation of care
- Resource consumption /risk to patient

Anticipated Improvements
Identify within a care process:

- Patients impacted
- Total time spent caring for patients
- Opportunity due to variation of care

Success Measures
Opportunity Identification:

- Identify cost-driving clinical areas and variation in care processes

Background
One of the fundamental ideas of quality improvement theory is to identify key work processes, then organize around them. A limited number processes (the “Golden Few”) make up the vast majority of services you provide to patients (80/20 rule). We want to prioritize this subset of key processes in quality improvement efforts.

Problem Summary
How do we define, identify and prioritize key clinical work processes when resources are not available to work on multiple initiatives simultaneously?

Users
KPA is intended for hospital and health system administrators, clinical and operations directors, and members of quality improvement teams. It may also include data architects, data analysts, and knowledge managers or others who help identify, prioritize, and monitor quality improvement efforts.

Use Cases
The KPA allows the analyst and clinician to group like activities into clinical work processes to determine which processes make up the majority of the care provided within any given Clinical Program. Once the data has been assembled, it will expose potential variation existing within each clinical work process.

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Care Process Model work group team members, through observation of the actual processes in the hospitals and clinics will need to determine if the variation is assignable to differences in how data is collected within the data system or if the variation is due to variation in clinical practices (MD strategy/thought process) or clinical workflow variation (Nursing/Operations tactics/logistics). Through collaborative discussion, research and experimentation a standardized care process model will be developed and implemented across the organization to promote the best clinical and operational practices in the delivery of care.

### Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charges, gross patient revenue</td>
<td>Charge to the patient for services rendered.</td>
</tr>
<tr>
<td>Revenue or net revenue or payment</td>
<td>The amount the hospital receives for services billed.</td>
</tr>
<tr>
<td>Total costs</td>
<td>The costs for the services the healthcare entity provides; this includes all costs such as equipment, labor, supplies and indirect costs. Variation in total cost and variable cost can reflect data issues and variation in care delivered.</td>
</tr>
<tr>
<td>Variable direct cost</td>
<td>Costs for salaries and supplies for the services provided. Each hospital assigns costs to these buckets. Direct refers to costs within the cost centers directly providing care. Generally these include nursing, ancillary areas. Indirect would refer to cost centers like administration and IT. Variable costs fluctuate with volume, more operating room cases require more supplies. Direct variable costs are the most controllable costs. The hospital can reduce the number of units or the cost per unit to lower the cost.</td>
</tr>
<tr>
<td>Severity adjusted coefficient of variation</td>
<td>The standard deviation divided by the mean calculated for each severity level. The Coefficient of Variation allows variation to be evaluated between data sets with different scales. In order to ensure that like patients are being compared, the weighted average coefficient of variation is calculated based on grouping the data by the severity index.</td>
</tr>
</tbody>
</table>

### Data Sources

Data comes from client’s costing or decision support system and the billing system. The app evaluates facility account and visit level data by assigning each record to a clinical hierarchy based on a primary ICD-9 diagnosis code or APDRG code. It uses the APRDRG schema to provide four levels of severity for each APRDRG (the APRDRG grouper is different from the MDSRG grouper used by Medicare).
Screen Shots

**KPA Pareto Analysis**

- Ranking analysis showing key metrics by clinical area

**KPA Bubble Chart**

- Bubble chart highlighting variation versus direct cost

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015
Severity-adjusted variation in septicemia costs
**Risk Model Analyzer**

**Description**

**Risk Model Analyzer** is aimed at clinical directors and operational directors. The application helps users visualize underlying risk models that calculate risk for a patient at a particular point in time. The risk models currently contained within the application include the Health and Human Services derivation of the HCC model (HHS-HCC), Charlson/Deyo, and APRDRG severity of illness. Risk models can be evaluated from a population or patient standpoint as well as comparatively to determine how high risk patients in one model correlate with high risk patients in another model.

**Type:** Identify Opportunities  
**Status:** Available  
**Updated:** 2015-03-05

This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.
Features

- 3 ‘Out of the Box’ Risk Models
- Architectural framework that accommodates implementing additional risk models
- Drill-down Data Visualization
- Comparison across multiple risk models
- Ability to view population risk and patient risk over time

Benefits

Get a broad overview of risk models

- Explore average risk scores for specific conditions
- View population risk over time
- Become familiar with various risk models

Dive deep into population and patient risk

- View patient risk variables over time
- View patient coverage within each risk model

Anticipated Improvements

In many or most cases these will be a focused, shorten version of the benefits above.

Success Measures

Opportunity Identification: identify risk within the population and specific patients

Background

In a healthcare system looking for potential areas of improvement such as lowering cost per case, it is important to have a method for determining cases that could merit a higher cost. The risk models contained within the application assign a risk score for a patient at a particular point in time and categorize that patient into one of five risk levels. These levels can be used as a way to view similar patients grouped within each risk level. The Risk Model Analyzer provides a window to explore the current risk models with the intent that risk can be evaluated in other advanced applications and process improvement initiatives. The underlying framework allows other risk models to be added by associating a score to a patient relative to a point in time. The current risk models are based heavily off of diagnosis codes from the previous encounters for the patient and identify comorbid conditions within the Charlson/Deyo model and Hierarchical Condition Categories in the HHS-HCC model.
Problem Summary
Many organizations need a methodical approach in evaluating patient risk as a means to improve the quality of care for that patient and evaluate risk for a specified population. Populations can be defined in a variety of ways such as a primary care physician’s panel of patients, patient registries, geographical area, or the physical location of a clinic or hospital. Once populations are defined, individual patient risk within the population can be explored. This application will provide a view of risk for a broad population displaying capabilities for future smaller, more targeted outcome improvement projects.

Measures
Population
- Mean score for population by risk model or specific conditions
- Patient coverage of score components. Ex. What portion of the total risk score is contributed by age or condition
- Average population risk over time

Risk Models
- Average score by model for each risk level
- Average total risk score and patient count for each risk model component
- Comparative risk scores by risk model

Patients
- Patient risk over time
- Historical conditions contributing to a patient risk score.
- Historical log of conditions contributing to a score.

Data Sources
- EMR (required)
- Professional Billing (Optional)
- Claims (Optional)
This road map does not represent a commitment to develop any of the included products and is subject to change at the sole discretion of Health Catalyst.

August 4, 2015

Page 226
Improvement Pathways

AIM statements are the fundamental building block of an Improvement. All three systems contribute to the transformation process which begins with Health Catalyst supplied content and ends with sustainable measurement.

Health Catalyst is focused on the successful outcomes improvement for our clients. We believe that an incremental approach is required to effectively transform into a data-driven improvement organization. By bringing all three systems together in each phase (Statement of Work) we can together prove the methodology and then expand the approach to other parts of the organization via new improvement teams.

Improvements (analytic applications, data sources and services) can be assembled into phases of work which are customizable to meet individual client needs. A client might start with Accountable Care and then find that additional improvement from Population Health or Patient Injury Prevention are required.
The diagram above shows how starting with a few data sources and one or two improvement teams focused on limited number of improvements can be expanded each year (SOW) until the client is capable of sustaining the improvement system on their own.

Contact any member of the Health Catalyst team to assemble your Improvement Pathway and begin your journey to sustainable performance improvement.