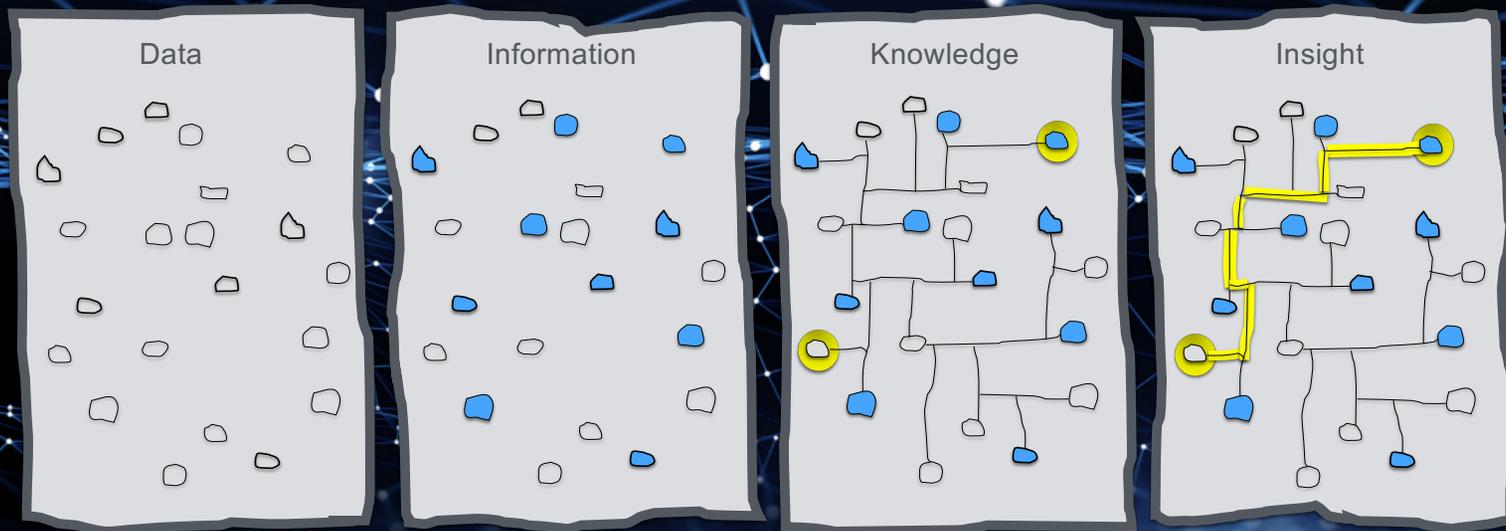


apervita

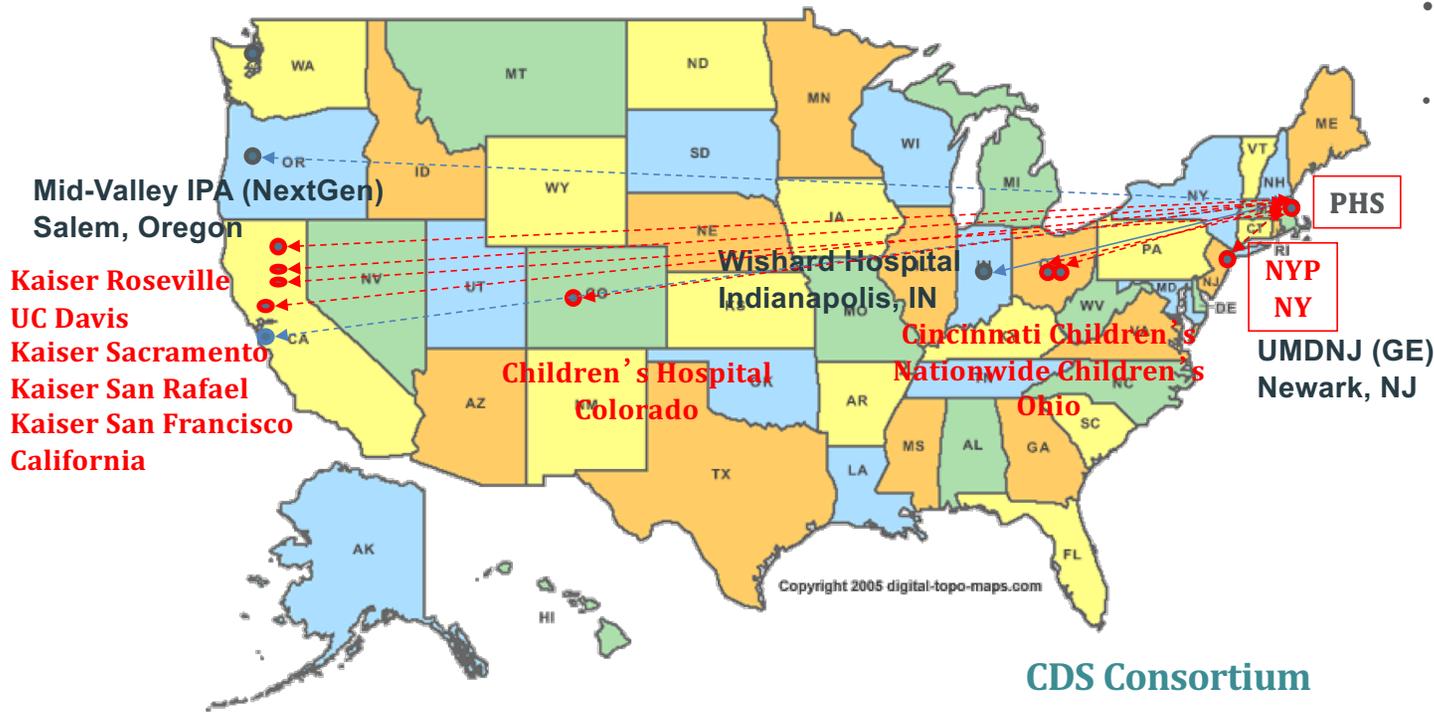
Powering the Era of *Insight Driven Care*



A Platform-as-a-Service to rapidly
Build, Deploy, and Scale Health Analytics
Blackford Middleton, MD, MPH, MSc
Blackford.Middleton@Apervita.com

CDS Consortium Demonstrations: 2008-13

Toward a National Knowledge Sharing Service



CDS Consortium

PECARN TBI CDS

- **Clinical Decision Support Consortium**

Middleton B, PI: 2008-13, AHRQ –funded:
HHS290200810010

- **Major accomplishments:**

- Knowledge artifacts published: 11 clinical rules, 50+ classification rules and 375 immunization schedule rules

- 8 clinical sites implemented using 5 different EHRs

- More than 240 users utilize CDS services

- Established legal framework for collaboration

- Since 2010 more than 1.7M CCD transactions were processed

- 31 entities (companies and academics) in a pre-competitive environment

- Contributed to ONC-sponsored Health-e-Decisions efforts: KAS 1 and KAS 2

Key principles for a national clinical decision support knowledge sharing framework: synthesis of insights from leading subject matter experts

Kensaku Kawamoto,¹ Tonya Hongsermeier,² Adam Wright,³ Janet Lewis,² Douglas S Bell,⁴ Blackford Middleton⁵

► Additional appendices are published online only. To view this files please visit the journal online (<http://dx.doi.org/10.1136/amiajnl-2012-000887>).

¹Department of Biomedical Informatics, University of Utah, Salt Lake City, Utah, USA

²Clinical Informatics Research and Development, Partners HealthCare, Boston, Massachusetts, USA

³Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, USA

⁴RAND Corporation and Department of Medicine, UCLA, Los Angeles, California, USA

⁵Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, and Health Policy and Management, Harvard School of Public Health, Boston, Massachusetts, USA

Correspondence to

ABSTRACT

Objective To identify key principles for establishing a national clinical decision support (CDS) knowledge sharing framework.

Materials and methods As part of an initiative by the US Office of the National Coordinator for Health IT (ONC) to establish a framework for national CDS knowledge sharing, key stakeholders were identified. Stakeholders' viewpoints were obtained through surveys and in-depth interviews, and findings and relevant insights were summarized. Based on these insights, key principles were formulated for establishing a national CDS knowledge sharing framework.

Results Nineteen key stakeholders were recruited, including six executives from electronic health record system vendors, seven executives from knowledge content producers, three executives from healthcare provider organizations, and three additional experts in clinical informatics. Based on these stakeholders' insights, five key principles were identified for effectively sharing CDS knowledge nationally. These principles are (1) prioritize and support the creation and maintenance of a national CDS knowledge sharing framework: (2)

available.⁵⁻⁶ There are many reasons for the limited deployment of CDS capabilities, but an important factor is the lack of a framework for sharing CDS resources and capabilities nationally.⁵⁻⁸ There have been several previous efforts to enable widespread CDS sharing.⁹⁻¹² For example, the Knowledge Bank initiative sought to share documentation templates and other knowledge resources across users of a commercial EHR system,⁹ the Institute for Medical Knowledge Implementation¹³ attempted to share Arden Syntax medical logic modules¹⁴ across EHR system vendors, and the Morningside initiative¹⁵ attempted to create a shared community repository of executable medical knowledge. However, there is still no widely accepted approach for sharing CDS nationally. Thus, to address this important need, the RAND Corporation and Partners HealthCare were commissioned by the United States (US) Office of the National Coordinator for Health IT (ONC) to develop a proposed national framework for CDS content sharing and to pilot an initial implementation of that framework. This effort under-

The Central Problem

Lack of shareable computable knowledge – quality measures and clinical decision support / ePathways

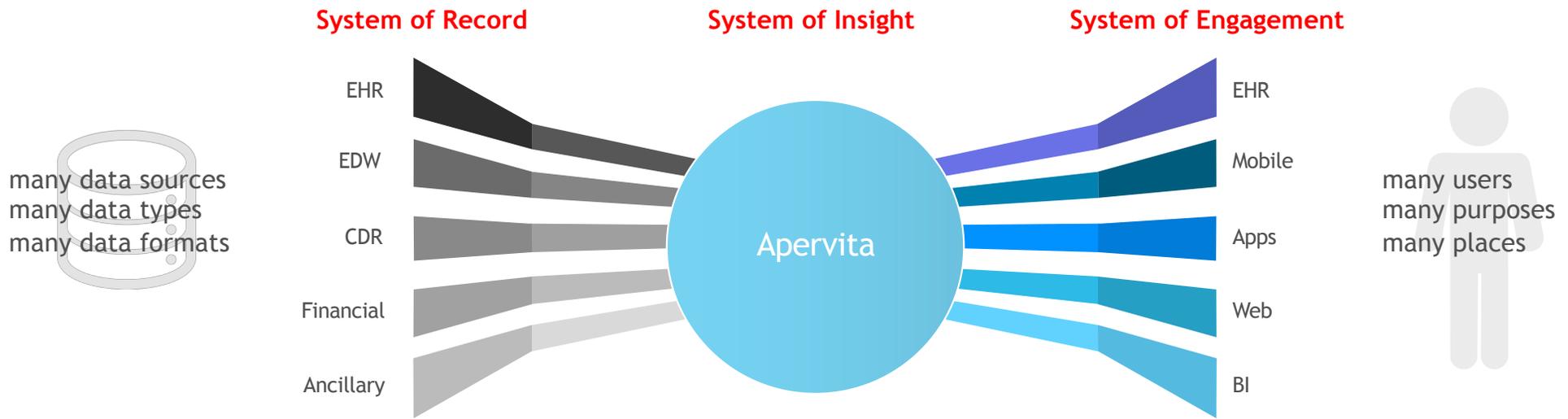
Why is it so hard to transform care with even the best health IT?

Simply put: the chasm which exists between published knowledge and clinical experience, and implemented knowledge in health IT, is too wide for the average clinician or healthcare delivery organization to manage.

This must be achieved at scale for all to benefit.

A System of Insight

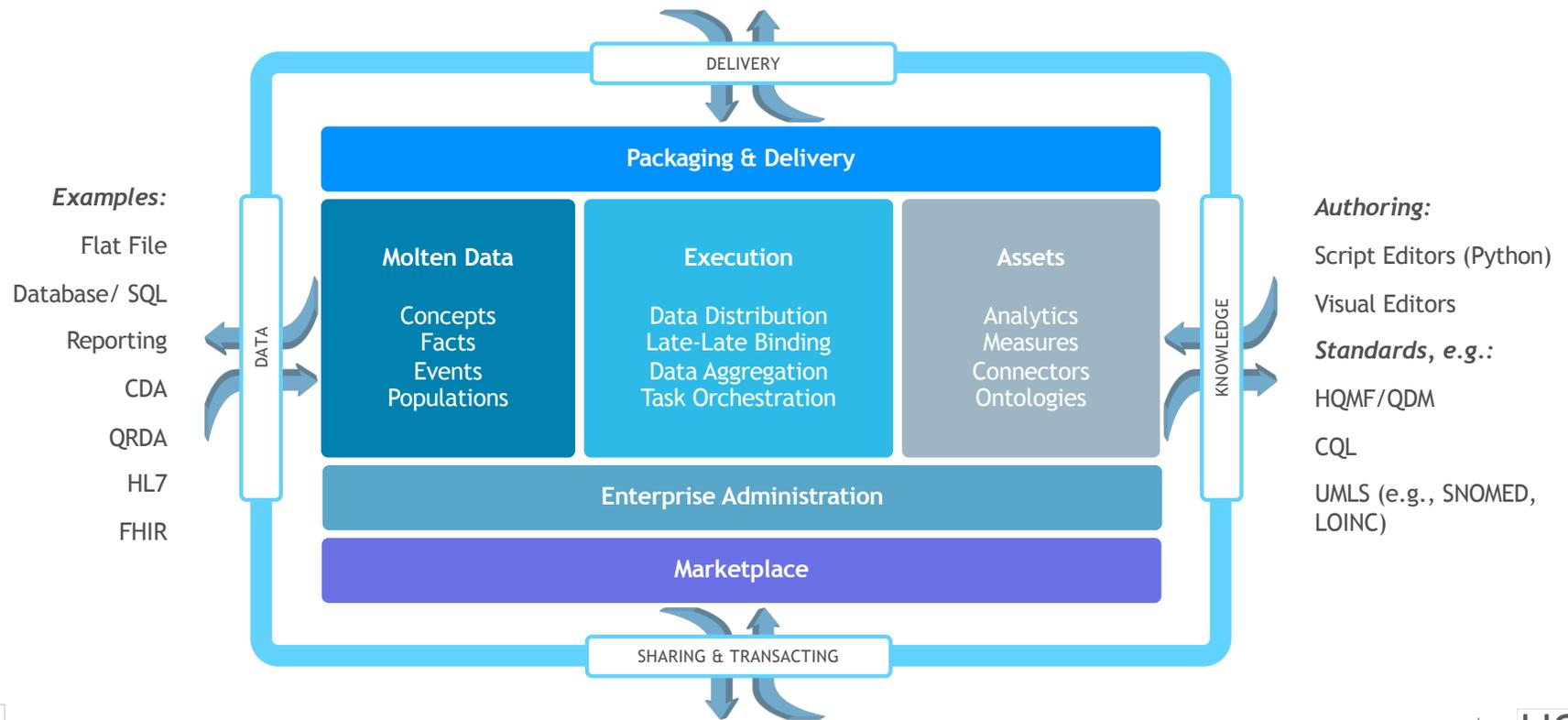
The platform to implement a next generation architecture



Apervita is positioned to support HCOs and business networks at scale: supporting and providing leadership in the vision, design, and deployment of advanced applications and analytics across the healthcare industry

Apervita PaaS Components

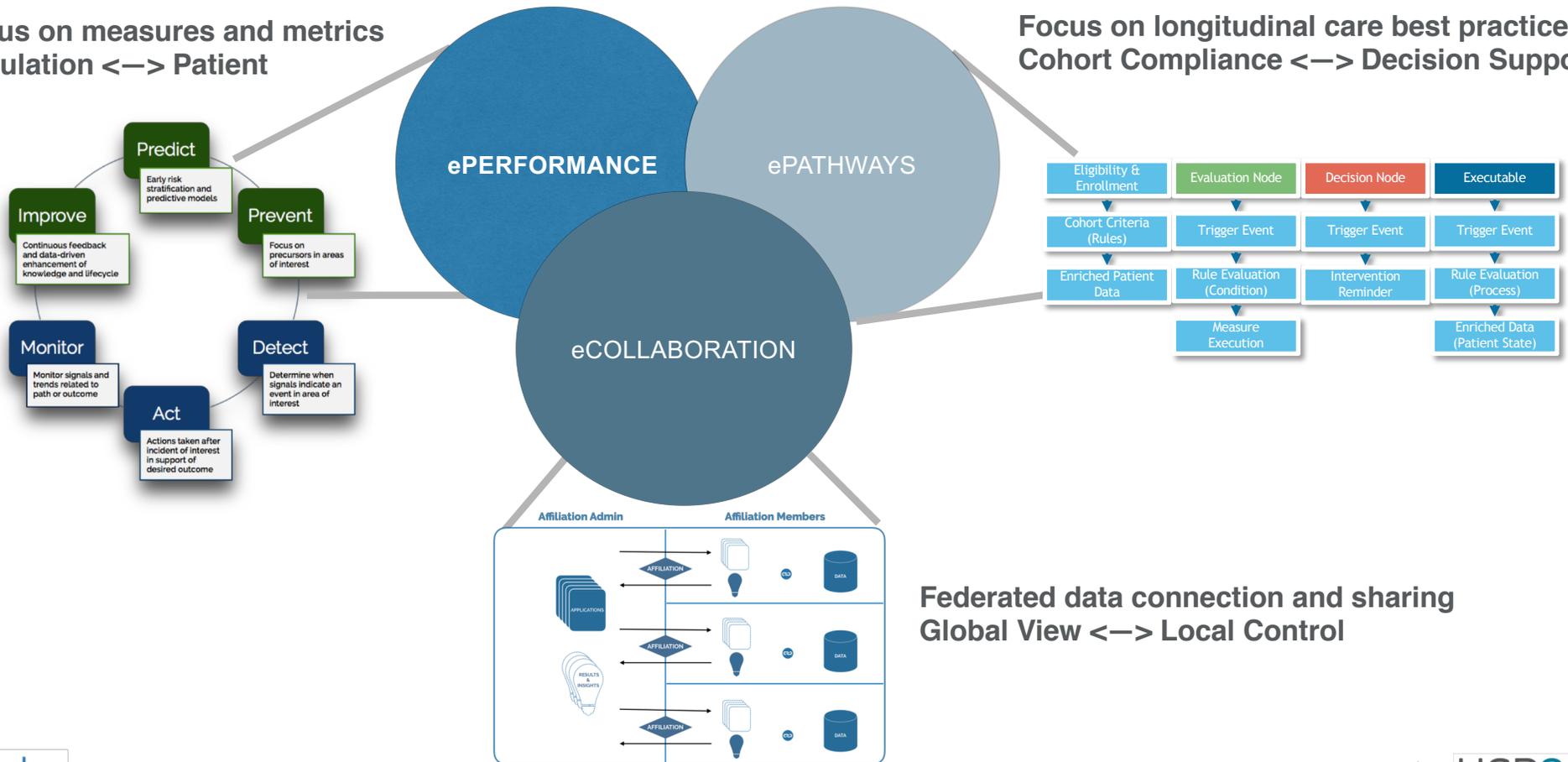
An industry-scale Platform-as-a-Service for computing, delivery, and interoperation



Apervita Platform Solutions

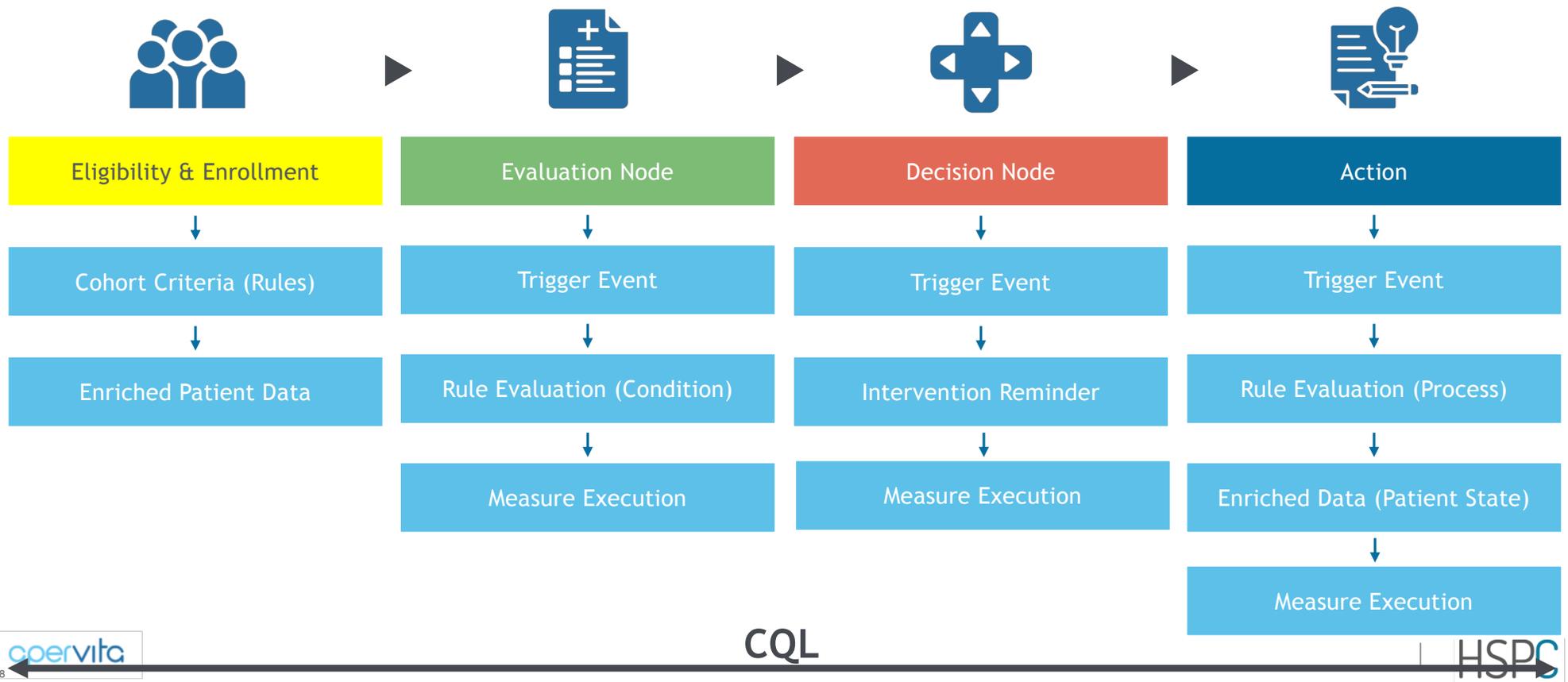
Focus on measures and metrics
Population <—> Patient

Focus on longitudinal care best practices
Cohort Compliance <—> Decision Support



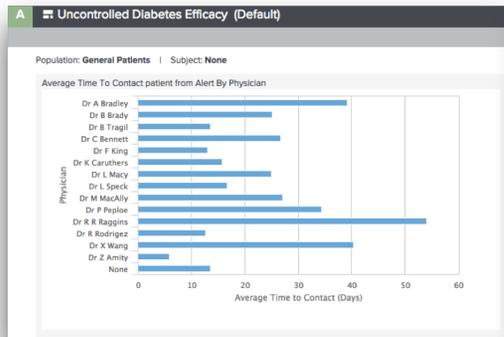
Federated data connection and sharing
Global View <—> Local Control

PLATFORM SUPPORT FOR EVERY COMPONENT OF ePATHWAYS

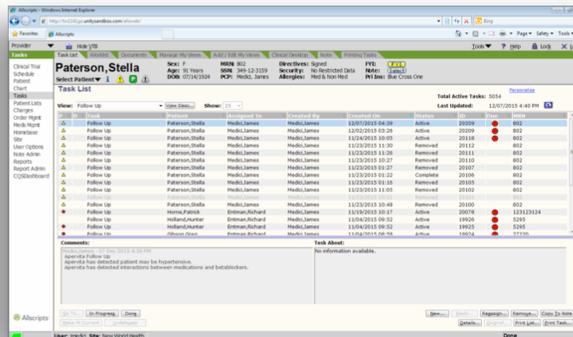


Delivery Framework

Re-usable adapters and endpoints for flexible workflow integration



Population Health Dashboards on Apervita



Patient Care in EHRs



Operational Dashboards in Tableau

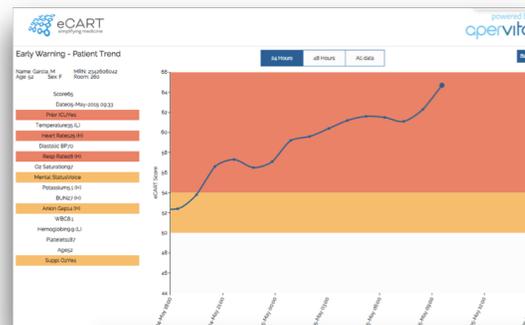
Breakdown of Costs by Risk Group

Uncontrolled Diabetes Risk	Number of Patients	Average Hospitalization (Days)	Average Cost (\$)	Std Dev Cost (\$)
High	825	7.54	\$ 32,252	\$ 27,570
Grand Total		7.54	\$ 32,252	\$ 27,570

Top 10 Procedures By Cost

Encounter Name	Number of Procedures	Average of Cost (\$)
Procedure67360	1	99,902
Procedure52107	1	99,989
Procedure77241	1	99,925
Procedure19656	1	99,856
Procedure67278	1	99,855
Procedure36650	1	99,856
Procedure69930	1	99,977
Procedure41118	1	99,798
Procedure15321	1	99,793
Procedure46693	1	99,938

Financial Analysis in Excel



In a custom web app



Clinician Alerts in Mobile



CDC Gonorrhea ePathway

Scalable, standards-based, ePathway

WHAT WAS DONE

Led an ambitious, first of its kind, undertaking with the CDC to implement a completely standards based ePathway from the 2015 CDC Gonorrhea guideline

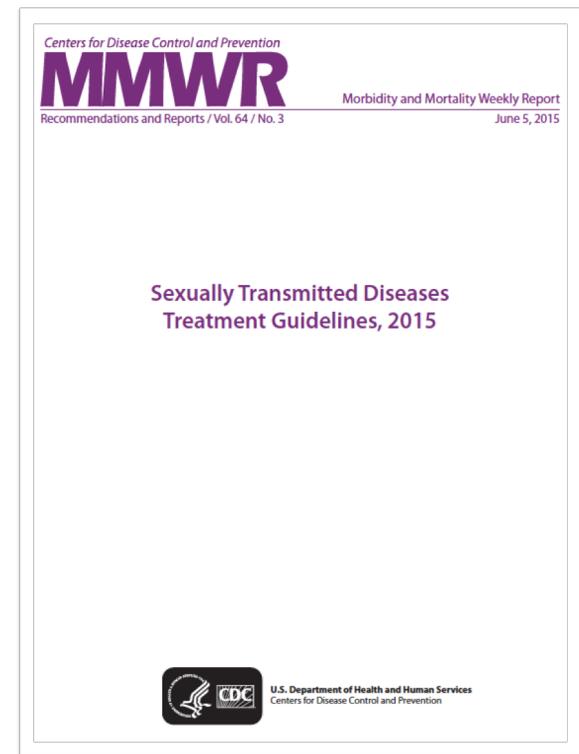
HOW IT WORKS

- Knowledge Engineering: conversion of paper guideline to logic flow diagrams and CQL with CDC SME input
- Build: translation of the CQL to computable form on the Apervita platform
- Delivery: deployment of results into demo integrations into workflows (Cerner and SMARTonFHIR application)

WHAT MAKES THE SOLUTION COMPELLING?

- Faster building, testing, deployment of analytics.
- Standards-based knowledge assets allow for portability and scalability across any site
- Work continues today with the CDC to integrate the Gonorrhea ePathway into the EHR with a clinical partner

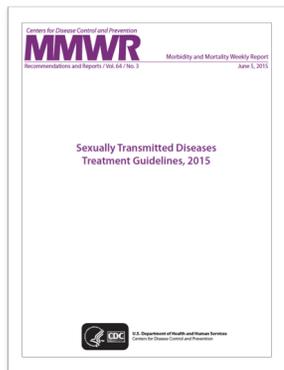
apervita



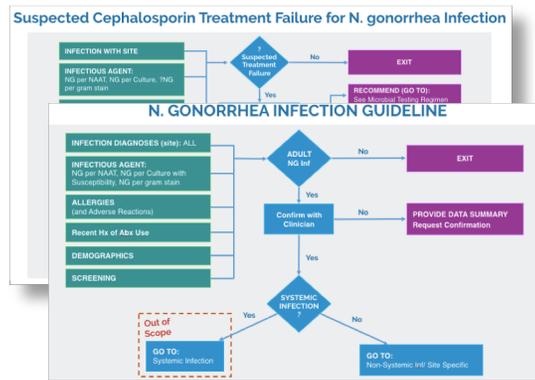
HSPC

WHERE DOES CQL FIT IN TO THE KNOWLEDGE ENGINEERING PROCESS?

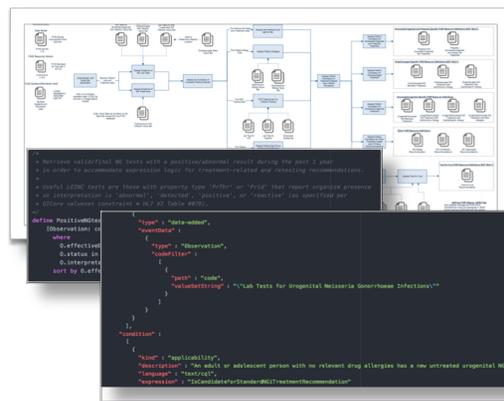
L1 Started with paper CDS STI Guideline



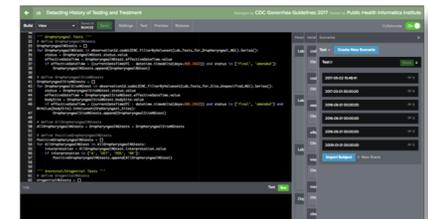
L2 Converted Guideline to a logic flow diagram



L3 Built standards-compliant CQL and FHIR Resources



L4 Implemented real-time CDS on Apervita



Boxwala AA, Rocha BH, Maviglia S, et al. A multi-layered framework for disseminating knowledge for computer-based decision support. *Journal of the American Medical Informatics Association : JAMIA*. 2011;18 Suppl 1:i132-i139.

Applying Current Informatics Standards to the Translation and Specification Process



<i>FHIR QICore Data Profile</i>	<i>CQL (Clinical Quality Language)</i>	<i>VSAC and custom Value Sets</i>	<i>FHIR STU3 PlanDefinition</i>
<ul style="list-style-type: none"> Based upon Quality Information and Clinical Knowledge (QUICK) data model Specializes in clinical decision support and quality measures Designed to be highly interoperable 	<ul style="list-style-type: none"> CQL is designed to harmonize eQMs and CDS Provides for specification of interoperable expression logic Both human-readable and machine-readable 	<ul style="list-style-type: none"> Define high-level concepts in terms of applicable codes from standard terminologies Share standard definitions with eCQM specifications and measure developers 	<ul style="list-style-type: none"> FHIR STU3 resources are focused around reusability, performance, and data fidelity PlanDefinition resource provides a template for recommendations and actions in treatment guidelines 

CDS HOOKS[®]

WORKFLOW TRIGGERED

- Clinical Decision Support is delivered to clinicians with no need to “click the button” or otherwise invoke the clinical reasoning module.

INFORMATION IN CONTEXT

- Provides information and suggestions for action to clinicians in the EHR user interface and in the patient context.

SMART ON FHIR

- Links to SMART-on-FHIR apps when more extensive interaction is required.

DATA INTEGRATION

- Returns data and decisions for integration with the patient record.

RESULTS TRACKING

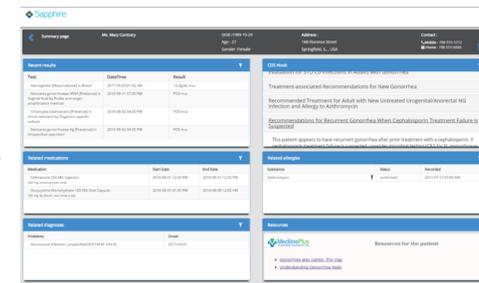
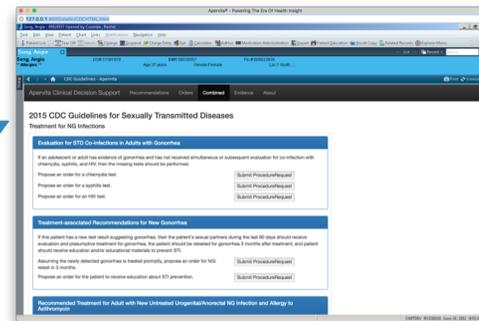
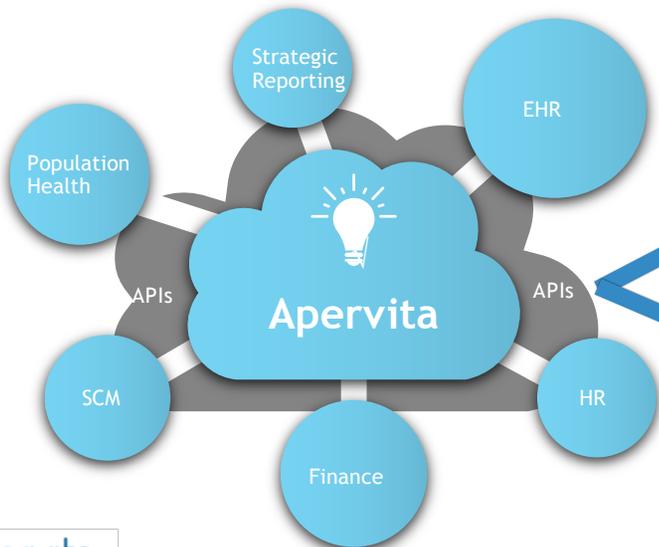
- Records and tracks accepted suggestions and decisions to support process improvement.

Implementation and Application Overview

Analytics Engine



EHR



EHRs

...

Smart on FHIR
elimu



VA Digital Health Platform (DHP)

Case Study: A system-wide approach to analytics



VA | U.S. Department of Veterans Affairs

WHAT WAS DONE

- Apervita acts as the core Real Time Analytics Platform for the VA DHP Proof of Concept
- Creation of a Traumatic Brain Injury (TBI) pathway and decision nodes
- Data ingestion from many sources and API integration into Salesforce, the patient engagement layer responsible for scheduling and patient follow-ups

HOW IT WORKS?

Goal is to deliver efficient and effective care through more flexible and intelligent workflow

It is an open, platform of platforms, powered at its core by real time analytics

WHAT MAKES THE DHP COMPELLING?

- Deliver insights for all patients, to all providers and sites, all the time, for the best care everywhere
- Build, deploy, and manage executable knowledge assets of all types - eligibility, rules and recommendations, pathways and compliance, predictive and preventative
- Continuously execute thousands of analytics on data from any sources at industry scale
- Centrally monitor, evaluate, and improve decision support effectiveness

