


A Common Open Source Clinical Decision Support Administration Tool for Public Health



2016 Public Health Informatics
Conference
Atlanta, GA
August 24, 2016



Noam H. Arzt, PhD, FHIMSS
Daryl Chertcoff
HLN Consulting, LLC



Background

- Clinical Decision Support (CDS) tools important to support surveillance
 - Use of clinical data to help make choices
- Software can be costly, hard to configure, test, and maintain
- Open source solutions becoming available
- Distinct advantages to Open Source



SWOT Analysis: Open Source

Strengths <ul style="list-style-type: none">• No license fee to use• No loss of access to source code if developer stops work• Freedom to make/share changes• Transparency in governance• Enables more modular deployment	Weaknesses <ul style="list-style-type: none">• Risk of <i>detrimental</i> source code “forking”• Burden of enhancements may fall to individual users/organizations• Software support may be harder to secure
Opportunities <ul style="list-style-type: none">• “Joint development” can reduce cost of enhancements & support• Commercial vendors often provide solid support• More modular systems might enable more Open Source component use	Threats <ul style="list-style-type: none">• Public health community will not financially support product development• Public health community expects open source market to behave like commercial market• Commercial vendor reactions



A Common Foundation

- Three use cases described here – all use common framework and underlying CDS foundation and products
 - OpenCDS (<http://www.opencds.org/>)
 - HLN CDS Technical Framework (<http://www.cdsframework.org>)
 - CDS Administration Tool (CAT) for:
 - Rule authoring
 - Testing
 - Terminology maintenance





Decision Support Service (OpenCDS)

OpenCDS

- Software platform and toolkit for developers implementing CDS services
- Open source
- Standards-based
- Collaborative project, led by Dr. Kensaku Kawamoto at University of Utah

www.opencds.org



The screenshot shows the OpenCDS website homepage. At the top is the 'OpenCDS' logo and a navigation bar with links: Home, The Solution, Featured Collaborators, Acknowledgements, Join the Community, News, and Contact Us. The main banner features the text 'OPEN CLINICAL DECISION SUPPORT (OPENCDS) TOOLS AND RESOURCES!' with a background image of interlocking red and yellow puzzle pieces. Below the banner is a 'JOIN THE COMMUNITY >' button. The footer contains three columns: 'What Is OpenCDS?' (describing the multi-institutional effort), 'Who Is Involved?' (mentioning Dr. Kensaku Kawamoto), and 'How Can I Learn More?' (providing contact information for Dr. Kawamoto).

OpenCDS

Home The Solution Featured Collaborators Acknowledgements Join the Community News Contact Us

OPEN CLINICAL DECISION SUPPORT (OPENCDS) TOOLS AND RESOURCES!

A consortium effort, connecting collaborators together across the healthcare continuum to improve patient outcomes through the effective use of standards-based, open source clinical decision support.

[JOIN THE COMMUNITY >](#)

What Is OpenCDS?

OpenCDS is a multi-institutional, collaborative effort to develop open-source, standards-based clinical decision support (CDS) tools and resources that can be widely adopted to enable CDS at scale.

Who Is Involved?

OpenCDS was founded by Dr. Kensaku Kawamoto, MD, PhD, who is a faculty member at the University of Utah Department of Biomedical Informatics and a co-chair of the HL7 CDS Work Group. Please see the [Featured Collaborators](#) page for more information on the members of the OpenCDS community.

How Can I Learn More?

Please contact Dr. Kensaku Kawamoto, MD, PhD [[Contact Us](#)]



OpenCDS Software Characteristics

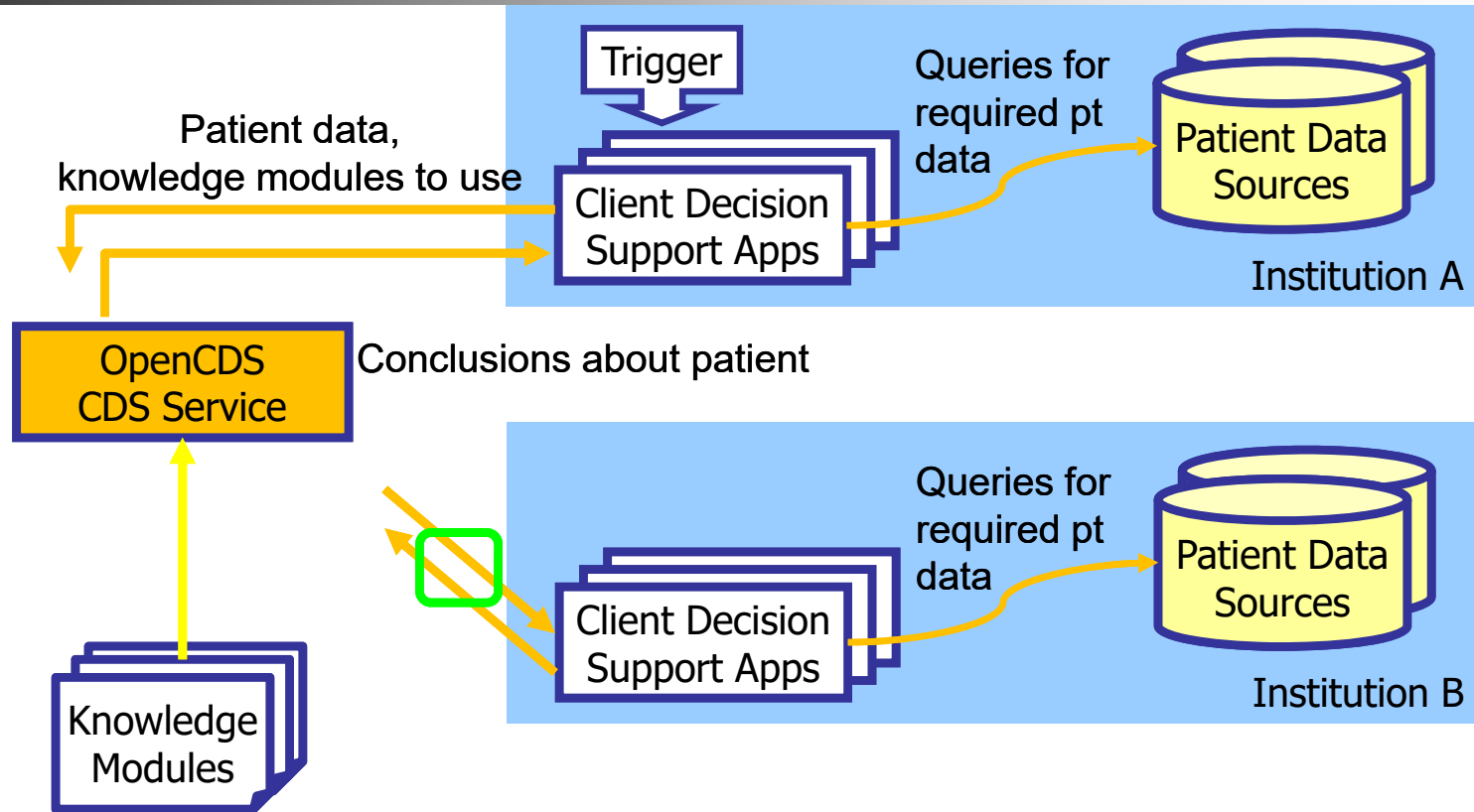
- Open Source
- Standards Based
- Service Oriented Architecture
- Supports multiple knowledge representation approaches
- “Knowledge” is encapsulated in highly reusable components
- Evaluates patient data (inputs) using knowledge modules and returns machine-interpretable conclusions (outputs)



Overview of OpenCDS Functionality

- Fully-featured, standards-based knowledge management platform
 - Knowledge authoring, testing, and maintenance
 - HL7 vMR standard data model for writing rules
 - Leverages relevant open-source resources (e.g., JBoss Drools, JBoss jBPM, Apelon DTS)
- HL7 DSS Standard Service Interface
- Framework for integrating various CDS resources and platforms
- Domain-Optimized Tools and Resources
 - E.g., next-gen vaccine validation and forecasting platform

Architectural Overview





Terminology Management

- External codes converted into customizable OpenCDS concept(s) using terminology service
 - E.g., ICD-10-CM E11.29 →
 - Type 2 diabetes mellitus with other diabetic kidney complication
 - Diabetes mellitus
 - Endocrine disease
- Goal: Separate terminology management from logic engineering



Knowledge Management – CDS Administration Tool (CAT)



CAT Software Characteristics

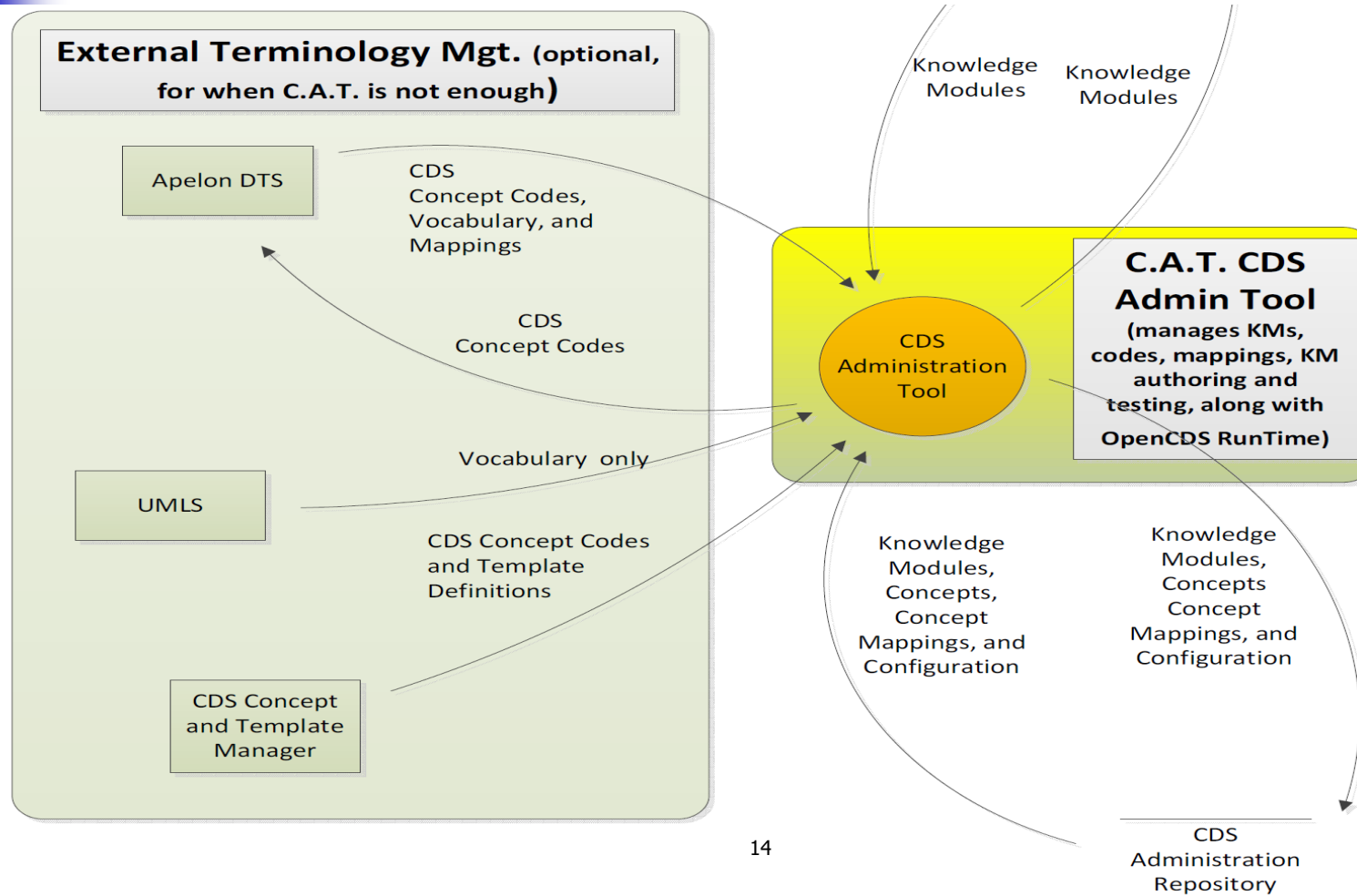
- Open source framework for developing middle tier services and web-based front ends
- Plugin architecture for adding/removing features
 - Core module → administrative functions
 - User management, security, auditing, etc.
 - CDS module → clinical decision support features
 - Custom modules →
 - A means to add additional functionality, if desired
 - May be built on top of/supplement CDS module, or exclude it
 - Example custom modules: ICE, RCKMS Authoring Tool, HL7 QA Tool, Patient Administration



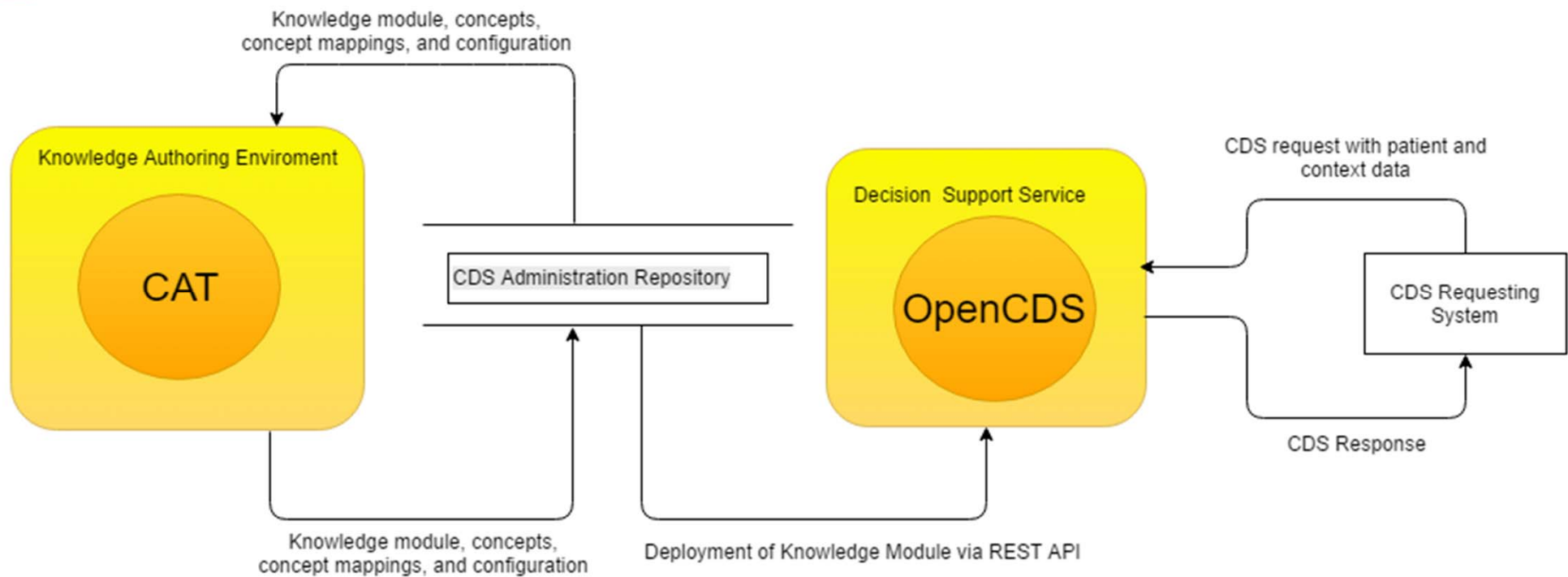
Overview of CAT CDS Functionality

- Value Set Editor → importing, managing value sets
- Concepts Editor → entering concepts and mapping to codes
- Data Model Editor → configure knowledge authoring data model
- List Editor → Context-specific values and dropdowns
- Rule Editor → authoring & deployment of rules
- Test Manager → Validate logic and create/execute test cases

CAT and Terminology Management



CAT and OpenCDS Deployment



Manage Value Sets (RCKMS)

Value Set Editor - [Save Option 3]

Value Set Details | Version Info | Related Code System Codes | Subvalue Set

ID: b2e16ca92c323c2360a44526e36f761b

OID: 2.16.840.1.113762.1.4.1146.238

Code: Chlamydia trachomatis organism identification test

Name: Chlamydia trachomatis organism identification test

Value Set Type: STATIC

Source:

Description: (Clinical Focus: This set of values contains codes for laboratory test names associated with detecting the presence of Chlamydia trachomatis),(Data Element Scope: Laboratory tests names that were ordered or observed.),(Inclusion Criteria: "chlamydia trachomatis [presence]"),(Exclusion Criteria:)

Save Apply Cancel

Manage Concepts (RCKMS)

Signed on: demouser [\[Preferences\]](#) [\[Logout\]](#)

Manage Concepts

Concept Search

Enter or select search criteria, then click the Search button to perform your search.

Note: You may enter partial text.

Code System:

Determination Method:

Knowledge Module Version:

Text Search:

[Search](#) [Clear](#)

[Export Concept Data](#) [Import Concept Data](#)

Concept Search Results (# of Results: 38) - [Lazy Loaded]

[New](#) [Show All](#)

Concept Code	Display Name	Delete
C30	Male	Delete
C31	Female	Delete
C32	Gender (Undifferentiated)	Delete
RCKMQA8	Chlamydia trachomatis antigen detection test	Delete
RCKMS1a	Apnea Symptoms	Delete
RCKMS1b	Evidence of Chlamydia Diagnosis	Delete
RCKMS1d	Lab Result RCMT - Pertussis	Delete
RCKMS2a	Cough Symptoms	Delete
RCKMS3a	Paroxysmal Qualifier	Delete
RCKMS3e	Lab Result (Tuberculosis)	Delete
RCKMS4a	Qual Lab Result Positive for Reportable Conditions	Delete
RCKMS5a	Reportable Interpretation Flag	Delete
RCKMS5b	Lab Result (Chlamydia trachomatis)	Delete
RCKMS5d	Evidence of Pertussis Diagnosis	Delete
RCKMS6d	Pertussis Symptoms	Delete
RCKMS_C1	Paroxysmal Cough	Delete
RCKMS_C2	Inspiratory Whoop	Delete
RCKMS_C3	Post-tussive vomiting	Delete
RCKMSQ11	C. Trachomatis organism identification, nucleic acid detection or antigen detection tests	Delete
RCKMSQ12	Bordetella pertussis Organism Identification Test	Delete



Three Use Cases



Three Software Systems Using CAT/OpenCDS

1. Immunization Calculation Engine (ICE)
2. Reportable Condition Knowledge Management System (RCKMS)
3. Decision Support for Data Segmentation (DS2)

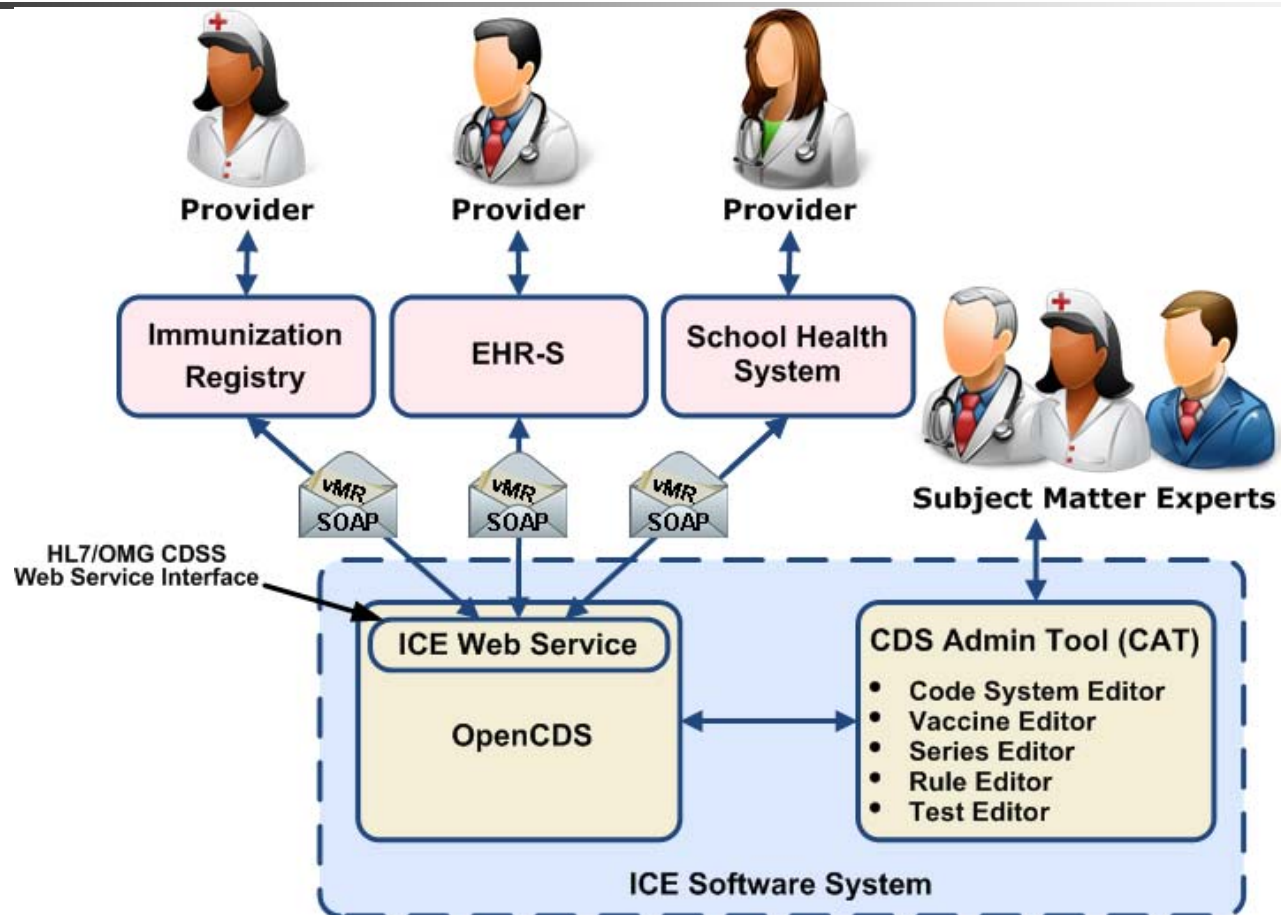


Use Case 1: Immunization Calculation Engine (ICE)

- Service-oriented, standards-based immunization forecasting software system
- Evaluates a patient's immunization history and generates the appropriate immunization recommendations
- Can be deployed in diverse technical environments, centrally or distributed
- Designed to easily integrate with registries, surveillance systems, clinical systems (EHRs, PHRs)



Sample ICE Deployment



ICE Client – Sample Screen

Patient Info

Name: John Smith

DOB: 20140801

Gender: M

Evaluation Date: 20140904

Age @Evaluation: 0y 1m 3d

Patient Output Grid

Vaccine Group

Recommendations

Evaluations

HepB

Date: 20141001
Status: FUTURE_RECOMMENDED
Message: DUE_IN_FUTURE
Vaccine Group: HepB

Date: 20140802
Age: 0y 0m 1d
Valid: true
Vaccine: Hep B,
adolescent/high risk infant (42)

Rule Editor Example: Varicella for Patients Born before 01/01/1980 (CDS module)

Rule Editor

Rule Summary

Rule Details

Advanced

When +

- 1. The Patient information must be known to complete writing this rule
 - a. - The Patient's birthdate is
- 2. There is a Series that needs Forecasting
 - a. - The Series belongs to the Vaccine Group
 - b. - the Series Completion Status is

Then +

- 1. Create a Recommendation as with Status for the Series
- 2. Set the Conditional Recommendation Reason for to
- 3. Include the Recommendation for Consideration in the final Forecast of the Series

Series Editor (ICE custom module)

Series Editor

Name: Influenza 2-dose Series

Code: INFLUENZA 2-DOSE SERIES

Vaccine Group: Influenza

Notes:

Business Scope Version List (# of Results: 1)

Business Scope

Version

Options

ICE - org.nyc.cir	Default ICE Schedule - 1.0.0	
-------------------	------------------------------	--

Dose List - bold vaccine codes are preferred (# of Results: 2)

Dose Number

Abs Min Age

Min Age

Max Age

Earliest Rec Age

Latest Rec Age

CVX Code(s)

Delete

1	6m - 4d	6m		6m		88, 135, 141, 140, 144, 111, 15, 16	
2						88, 135, 141, 140, 144, 111, 15, 16	

Dose Interval List - new series doses won't be selectable until changes are applied (# of Results: 1)

From Dose #

To Dose #

Abs Min Interval

Min Interval

Earliest Rec Interval

Latest Rec Interval

Options

1	2	24d	28d	28d		
---	---	-----	-----	-----	--	--

Season List (# of Results: 3)

Season

Options

2012-2013 Influenza Season (20122013InfluenzaSeason)	
2014-2015 Influenza Season (20142015InfluenzaSeason)	

Test Case Summary (ICE custom module)

Test Reference View:

[Show Date Calculator](#)

Test #: 125

Name: Minimum interval minus one day (51 days) between Dose 2 and Dose 3.

Test Execution Date: 10/21/2011

Patient DOB: 04/01/2011

Age @ Execution Date: 6 months 20 days (203 days)

Administered Immunization Components

ID	Admin Vaccine Code	Comp Vaccine Code	Admin Date	Age @ Admin Date	Evaluation	Reason(s)
263	HepB peds < 20yrs (CVX 08)	HepB peds < 20yrs (CVX 08)	04/29/2011	28 days (28 days)	VALID	
264	HepB peds < 20yrs (CVX 08)	HepB peds < 20yrs (CVX 08)	07/23/2011	3 months 22 days (113 days)	VALID	
265	HepB peds < 20yrs (CVX 08)	HepB peds < 20yrs (CVX 08)	09/12/2011	5 months 11 days (164 days)	INVALID	Below Minimum Interval

Shot Component Intervals

Interval Between...	Interval...
Shot 1 (Group HepB/CVX 08) and Shot 2 (Group HepB/CVX 08)	2 months 24 days (85 days)
Shot 1 (Group HepB/CVX 08) and Shot 3 (Group HepB/CVX 08)	4 months 14 days (136 days)
Shot 2 (Group HepB/CVX 08) and Shot 3 (Group HepB/CVX 08)	1 months 20 days (51 days)

Proof of Immunity/Documented Disease

Antigen	Immunity Date	Age @ Imm Date	Immunity Reason
No records found.			

Recommendations

Recommended Vaccine/Group	Date Due	Age @ Rec Date	Recommendation	Reason
HepB	11/07/2011	7 months 6 days (220 days)	Future Recommendation	Due in Future

Test Suite "Run" (ICE custom module)



Total Tests Passed: 123 of 124
Total Tests Failed: 1 of 124
Total Tests Skipped: 0
Total Duration (ms) : 14,156.43
Avg Duration (ms) : 114.16

Suite Details

Suite Test Results

Suite Test Results for: HepB Tests

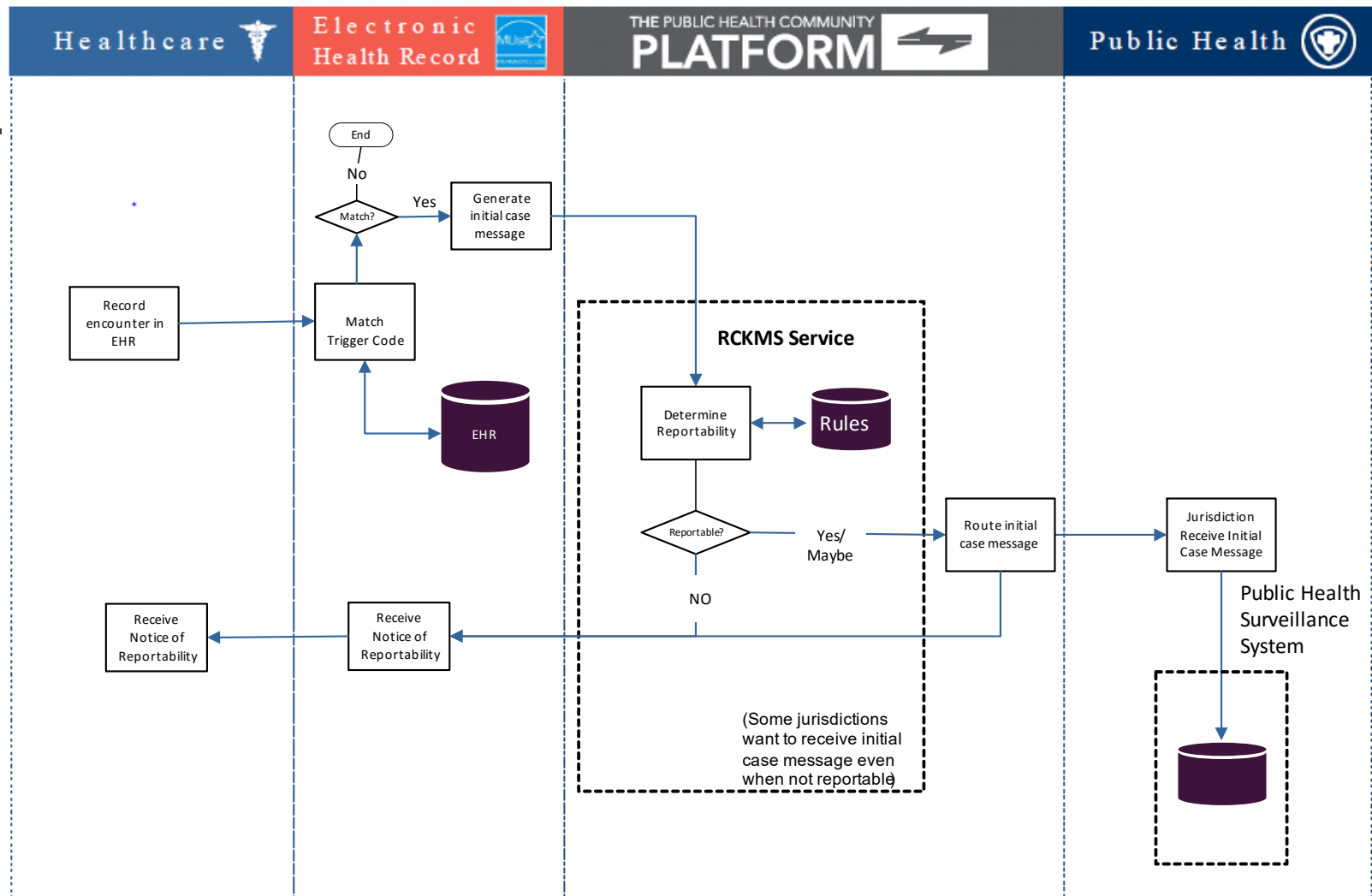
Expand rows to see detailed information						
	ID ▲	Name ◇	Duration (ms)	Eval. Passed?	Rec. Passed?	Passed? ◇
▶	72	Minimum interval minus one day (23 days) between Dose 1 and Dose 2.	97	✓	✓	✓
▶	73	Minimum interval (24 days) between Dose 1 and Dose 2.	115.39	✓	✓	✓
▶	74	Minimum interval plus one day (25 days) between Dose 1 and Dose 2.	93.18	✓	✗	✗
Differences						
Recommendation Date Due date values do not match: ICE =10/01/2011; EXPECTED =10/10/2011						
▶	75	Minimum interval minus one day (51 days) between Dose 2 and Dose 3.	96.92	✓	✓	✓



Use Case 2: Reportable Condition Knowledge Management System (RCKMS)

- Service-oriented, standards-based which allows EHR systems to submit initial electronic case reports to public health based on “triggering” event
- Evaluates conditions for reportability to a state/local jurisdiction and returns decision and instructions
- Expected to be deployed nationally on a shared platform with authoring tool for local jurisdictions to configure their rules

eCR Work Flow



RCKMS Rule Configuration (custom module)

Manage Reportable Condition - [Save Option 3]

Condition Details | Setup Default Reporting Criteria | **Define Default Reporting Specifications** | Default Links and References | Test Cases

Manage Default Logic Sets + Add Logic Set

Logic Set Properties	Lab Reporting Logic Sets	Provider/Facility Reporting Logic Sets	
	Lab1	Lab	Dx
Reporting Timeframe	1 day(s)	1 immediate	1 hour(s)

Define Default Reporting Specifications

Clinical

Chlamydia (i.e., as a Diagnosis or active Problem or mentioned in text as a cause of death or a significant condition contributing to death)

			Sufficient
--	--	--	------------

Death Record

No criteria of this type

Demographic

No criteria of this type

Epidemiologic

No criteria of this type

Laboratory

All result values for laboratory tests specific for detecting chlamydia species organisms, nucleic acid, or antigen by any method in a clinical specimen (i.e., 'negative' and 'positive' results)			
All result values for laboratory tests specific for detecting chlamydia trachomatis organisms, nucleic acid, or antigen by any method in a clinical specimen (i.e., 'negative' and 'positive' results)			
Isolation of C. trachomatis by culture methods in a clinical specimen	Sufficient	Sufficient	
Detection of C. trachomatis antigen by any method in a clinical specimen	Sufficient	Sufficient	
Detection of C. trachomatis nucleic acid by any method in a clinical specimen	Sufficient	Sufficient	

Subordinate

No criteria of this type

Save Apply Cancel

Reusable Criteria Templates (set up by Administrator)

Note: You may enter partial text.

Text Search:














 Search

 Clear

Criteria Search Results (# of Results: 18) - [Lazy Loaded]

 New

 Show All

Name	Description	Type	Last Updated	Delete
Has Sleep Apnea	Has Sleep Apnea (example of criteria that is not configurable by the end user)	Clinical	06/17/2016 05:01 PM	
Patient Record Contains Evidence of	Patient record contains evidence of (problem code selectable); e.g. - "Patient has a diagnosis or active problem of Pertussis"	Clinical	05/12/2016 06:03 PM	
Clinical: Text Only Template (Not Yet Implemented)	Text Only Template (Not Yet Implemented) May be used as a placeholder in the reporting specifications	Clinical	05/15/2016 06:15 PM	
Has Symptom of \$X	Patient has a symptom of \$X (code selectable). e.g. - "Patient has symptom of finding of Apnea"	Clinical	06/12/2015 11:41 PM	
Patient Records contains evidence of {set}	Patient Records contains evidence of {set}	Clinical	05/12/2016 09:50 PM	
Death certificate lists disease due to condition as a cause of or contribution to death	Death certificate lists disease due to condition as a cause of or contribution to death	Death Record	05/15/2016 04:35 PM	
Patient Age	Compare patient's age to elapsed time	Demographic	06/17/2016 10:45 PM	
Contact of a person diagnosed with condition	Contact of a person diagnosed with condition	Epidemiologic	05/10/2016 03:50 PM	
Member of a risk group as defined by public health authorities during an outbreak is TRUE	Member of a risk group as defined by public health authorities during an outbreak is TRUE	Epidemiologic	05/10/2016 04:23 PM	
All Result Values for laboratory test specific for detecting	Lab Result: Any result values for laboratory result	Laboratory	05/12/2016 06:19 PM	
Detection of [organism] [component] by any method in a clinical specimen	Lab Result: Detection of [organism] [component] by any method in a clinical specimen	Laboratory	07/28/2016 02:14 PM	
Isolation of [organism] by any method in a clinical specimen	Lab Result: Isolation of [organism] by any method in a clinical specimen	Laboratory	07/28/2016 01:51 PM	
Lab Test Order	Lab Test Order	Laboratory	06/17/2016 10:45 PM	

Instantiation of a Rule Template as a Rule (by users)

Source Criteria Name: Detection of [organism] [component] by any method in a clinical specimen

Label: Detection of Bordetella Pertussis nucleic acid by any method in a clinical speci

Criteria Predicate List (# of Results: 4)

Predicate


Patient has lab test performed of ==  Bordetella pertussis nucleic acid Detection Test (RCKMSQ13)

AND

▼ Group 1 {

Lab Result Value (ordinal) ==  Positive qualitative lab result (RCKMS4a)

OR

Lab Result Value (nominal) ==  Lab Result Value (Pertussis) (RCKMS1d)

OR

Interpretation ==  Abnormal Interpretation (RCKMS5a)

}

Test Case Summary (RCKMS)

RCKMS Test Case Editor - [Save Option 3]

Details | Jurisdiction and Criteria Details | Test Case Results

ID: 49d943aa7150a18dfa8479aeebb4319b

Skip? ☐

Name: TC-004 - NY > Pertussis > Lab Reporter > Criteria [Isolation of Bordetella pertussis by any method from a clinical specimen/Lab Test Name (Virus)] and Lab result value (Pertussis) > Reportable = Positive > Expected = Y <By Maiko - Do Not Edit>

Description: Testing:

Isolation of Bordetella pertussis virus by culture methods in a clinical specimen
IF
1) Patient has lab results with (test name of [VS: Lab Test Name (Virus)])
and
2) (lab result value of [VS: Lab result value (Pertussis)])
THEN report

Reporter Type: Lab Reporting

Offset Based? ☒ Age Offset: 12y

Date of Birth: 06/15/2004
Execution Date: 06/15/2016
Gender: Male (M) [P](#) [X](#)

Reportable? ☒

[Run Test](#) [Save](#) [Apply](#) [Cancel](#)

Test Case: Expected Output

RCKMS Test Case Editor - [Save Option 3]

Details **Jurisdiction and Criteria Details** Test Case Results

Test Source: ☒ CRITERIA ☐ FILE

Test Case Inputs (# of Results: 1) - [Lazy Loaded] New

Label	Type	Method	Delete
Isolation of Bordetella pertussis virus by culture methods in a clinical specimen	TESTCASE	TEST	

Select expected criteria to fire:


Available

Currently pregnant (375ddf48df5bd26448f369fe38247ea4)
Death certificate lists disease due to condition as a cause of or contribution to death (bcb4604a7c4a250c1ea1c3cf8d700f9d)
Pertussis (i.e., as a Diagnosis or active Problem or mentioned in text as a cause of death or a significant condition contributing to death) (81fcc0a6643827e5fba739b0c38e48d9)
Apnea (bd7082fc570ca1892282b0b8ba92be7d)
Detection of Bordetella Pertussis nucleic acid by any method in a clinical specimen (7caf7fcac32977f5a1858a292e33ae4b)

Expected

Isolation of Bordetella pertussis virus by culture methods in a clinical specimen (222caab33adda2281638e4e3ec39755c)

Run Test Save Apply Cancel



Use Case 3: Decision Support for Data Segmentation (DS2)

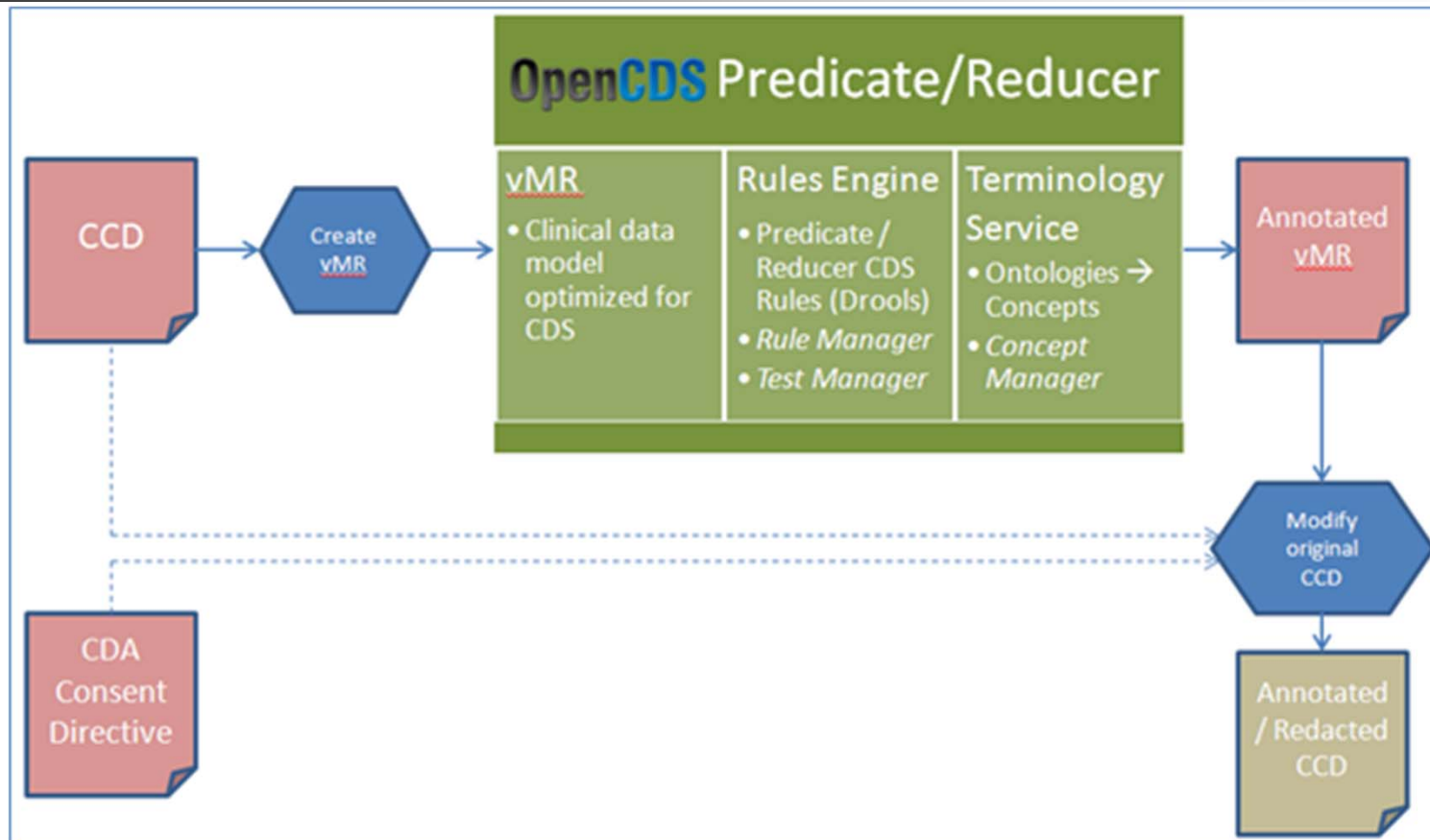
- Part of ONC HITECH SHARP research project in a state-level HIE environment
- Uses OpenCDS to identify and redact selected sensitive conditions from clinical summary documents
- Includes a web-based "inference analyzer" for visualizing the effectiveness and the impact of probabilistic redaction
- Includes a suite of related tools for creating, importing, and editing Continuity of Care (CCD) documents; testing redacted CCDs



DS2 Research Objectives

- Analyze (de-identified) patient problem lists to determine which conditions that may reveal information deemed “sensitive” (*e.g.* - STDs, mental health conditions, substance abuse)
- For HIV: explored ways to remove as little data as possible to not reveal sensitive condition while retaining as much of the medical record as possible
 - Deterministic “Level 1” predicates written using Drools
 - Probabilistic “Level 2” and “Level 3” predicates incorporated using Weka machine learning toolkit
 - By combining a classifier with established deterministic rules, the system could “learn” how “guessable” a condition might be after redacting specific medical data from the patient’s record

DS2 Workflow



DS2: Sample Output from Predicate/Reducer

107.170.66.72/cda-ws-web/

Predicate Reducer

Select ILHIE classifications to disclose:(leave blank to redact all classifications)

☐ HIV (ILHIE_HIV)
☐ Mental Health (ILHIE_MentalHealth)
☐ Substance Abuse (ILHIE_SubstanceAbuse)

Upload file for reducing:

+ Choose a CCD file:

Summary of key clinical facts from selected parts of the the Virtual Medical Record (vMR)

Problems
1. Human immunodeficiency virus [HIV] disease (SNOMED-CT 86406008) ILHIE_HIV
2. Candidiasis of lung (SNOMED-CT 3487004) ILHIE_HIV
3. Other specified bacterial infections in conditions classified elsewhere and of unspecified site, mycoplasma (SNOMED-CT 95889002)
4. Acute maxillary sinusitis (SNOMED-CT 68272006)

Substance Administration
1. combivir (RxNorm 192254) ILHIE_HIV
2. norvir (RxNorm 196479) ILHIE_HIV
3. procrit (RxNorm 227303)
4. azithromycin (RxNorm 18631)
5. fluconazole (RxNorm 4450)

Encounters

Procedures
1. Laparoscopic appendectomy (SNOMED-CT 470.1)

Version: 1.0

DS2: Redacted Output/Consent Document

Predicate Reducer

Redacted output (CCD with redactions based on returned vMR and selected preferences) for: sample-CCD-3.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<ClinicalDocument xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:hl7-org:v3" xmlns:sdctc="urn:hl7-org:sdctc"
  <realmCode code="US"/>
  <typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>
  <templateId root="2.16.840.1.113883.10.20.22.1.1"/>
  <templateId root="2.16.840.1.113883.10.20.22.1.2"/>
  <id root="2.16.840.1.113883.19.5.99999.1" extension="TT988"/>
  <code code="34133-9" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LOINC" displayName="Summarization of Episode Note"
  <title>Community Health and Hospitals: Health Summary</title>
  <effectiveTime value="201209150000-0400"/>
  <confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25"/>
  <languageCode code="en-US"/>
  <setId root="2.16.840.1.113883.19.5.99999.19" extension="sTT988"/>
  <versionNumber value="1"/>
  <recordTarget>
    <patientRole>
```

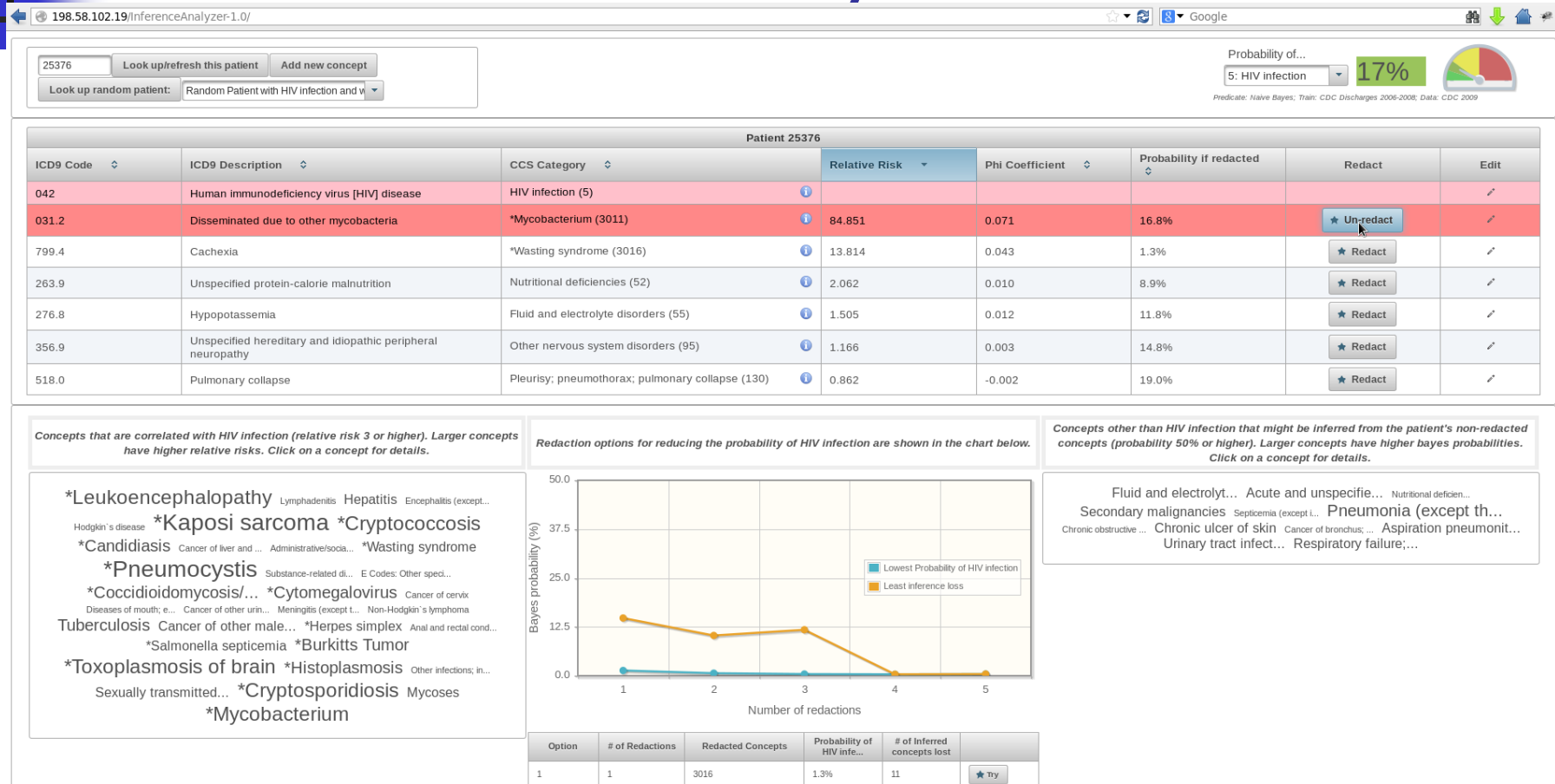
Download

Consent document:

```
<?xml version="1.0" encoding="UTF-8"?>
<ClinicalDocument xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:hl7-org:v3" xsi:schemaLocation="urn:hl7-
  <realmCode code="US"/>
  <typeId root="2.16.840.1.113883.1.3" extension="09230"/>
  <templateId root="2.16.840.1.113883.10.20.3"/>
  <templateId root="2.16.840.1.113883.3.445.1"/>
  <id root="1.3.6.4.1.4.1.2835.888888" extension="8686dada-2de1-474f-892a-2a41aad0f27c"/>
  <code code="57016-8" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LOINC" displayName="Privacy Policy Acknowledgement"
  <title>Consent Authorization</title>
  <effectiveTime xsi:type="IVL_TS" value="20140819"/>
  <confidentialityCode code="N" codeSystem=""/>
  <recordTarget>
    <patientRole>
      <patient>
        <id root="2.16.840.1.113883.3.933" extension="6fc36ff3-6fe4-4529-a3bb-56e87c0b5965"/>
      </patient>
```

Download

DS2: Inference Analyzer





Objectives Moving Forward



HLN Objectives Moving Forward

- ICE
 - Continued feature development
 - Ongoing maintenance and improvement of rules. Compliance with ACIP guidelines. Publish rules publicly on website
 - Improve documentation
 - Build a community of users to foster quality in immunization forecasting in general
- CAT
 - Support HLN's own authoring needs and others who are interested
 - Continued improvement of the CAT technical framework and develop new modules that utilize it
- Make software freely available to anyone who wants to use it



Open Source Resources

- HLN CDS Framework (ICE, CAT, SHARPS)
<https://www.cdsframework.org/>
- OpenCDS
<http://www.opencds.org>
- Open Source Initiative
<http://opensource.org/>
- Open Source Electronic Health Record Alliance
<http://osehra.org/>
- OSEHRA License Terms Document
https://www.osehra.org/sites/default/files/osehra_licensing_terms_v.1.0.pdf
- Draft Federal Source Code Policy
<https://sourcecode.cio.gov/>
- RCKMS
<http://www.cste.org/group/RCKMS>
- Weka
<http://weka.wikispaces.com>



Contact Information

Noam H. Arzt

President, HLN Consulting, LLC

858-538-2220 (Voice)

858-538-2209 (FAX)

arzt@hln.com

<http://www.hln.com/noam/> @noamarzt

Daryl Chertcoff

Project Manager, HLN Consulting, LLC

310-928-1051 (Voice)

daryl@hln.com