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Immunization Calculation Engine (ICE)
**an Open Source Immunization Decision Support System
for Integration with Immunization Information Systems**

Mike Suralik, HLN Consulting, LLC

Vikki Papadouka, NYC DOHMH Bureau of Immunization

Daryl Chertcoff, HLN Consulting, LLC

Kristen Forney, NYC DOHMH Bureau of Immunization



Maintaining Clinical Decision Support (CDS) for immunizations is hard...

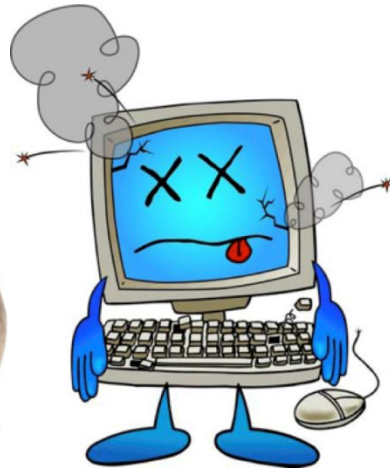
- New vaccines coming to market
- Large and growing rule set
- Rules are increasingly complex
- Evolving recommendations from ACIP



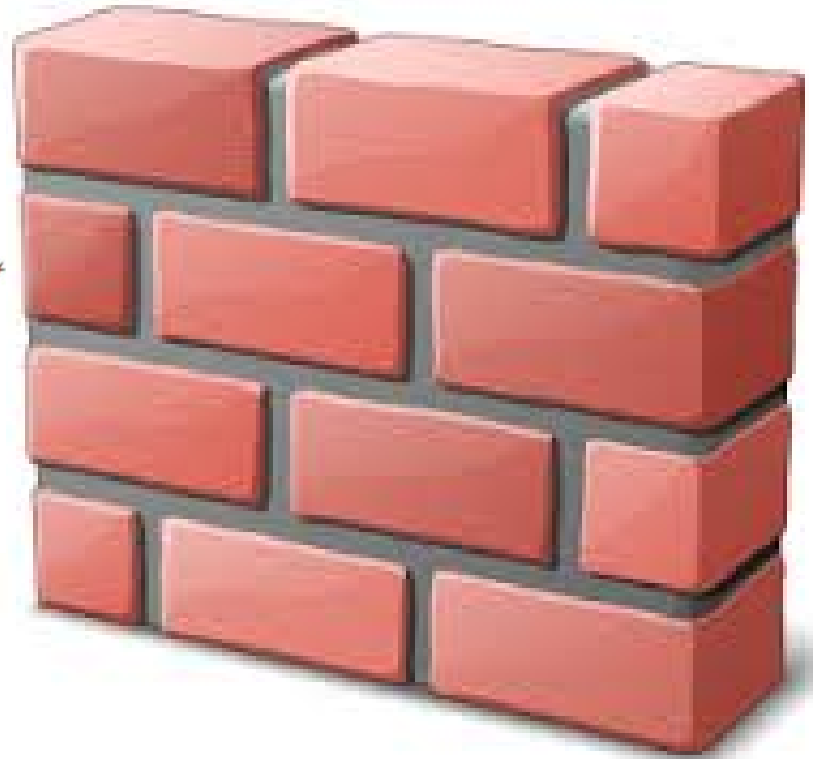
...complicated by a challenging national environment for IIS

- Aging technologies
- Continual growth of IIS responsibilities
- Lack of funds for major upgrades
- Less IIS autonomy due to IT centralization

How can an IIS overcome these challenges?

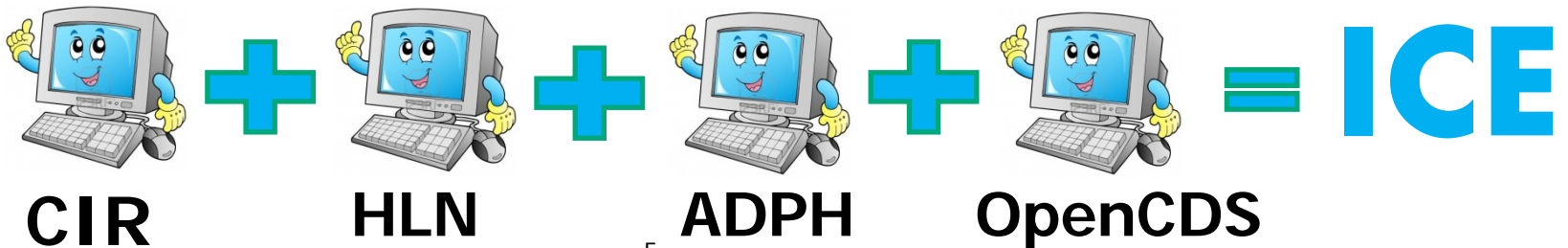


IIS



Joint Development of Immunization Calculation Engine

- Multiple organizations pooling resources to **jointly develop** a CDS solution that meets a common IIS need
- ICE Collaborators
 - New York City Citywide Immunization Registry
 - HLN Consulting, LLC
 - Alabama Department of Public Health
 - OpenCDS Team, led by the University of Utah





Goal of the ICE Project

“Create a freely available immunization decision support system that promotes clinical best practices, adapts to changing requirements, and easily integrates with other health information systems.”



Design Principles

- Collaborative process
- Rigorous approach
- Standards-based
- Rich configuration tools
- Scalable
- Open source software, no vendor lock-in
- Flexible deployment options



Components of ICE Software System

- ICE Web Service

- Provides immunization forecasting to IIS and other clinical information systems
- Implemented in OpenCDS, a tool set for developing CDS web services

- Clinical Decision Support Administration Tool (CAT)

- Enables non-technical subject matter experts (SMEs) to manage ICE
- Web-based application with graphical user interface



Pre-Configured with Immunization Schedules

- Childhood, adolescent, and adult schedules for 14 vaccine groups
- Pre-configured by SME Workgroup
- Follows ACIP guidelines
- Informed by CDC's CDSi project



Pre-Configured Vaccine Groups

1. HepB
2. Rotavirus
3. DTP (in progress)
4. Hib
5. PCV Pneumococcal Conjugate
6. Polio (in progress)
7. MMR
8. Varicella
9. HepA
10. Meningococcal (in progress)
11. PPSV Pneumococcal Polysaccharide
12. HPV
13. Influenza (in progress)
14. H1N1 (in progress)

Publicly Accessible Documentation of Pre-Configured Rules

Immunization Series: Hep B Newborn Series

The Hep B Newborn series is complete after 3 doses.

Vaccine Dose Parameters - Minimum and Routine Ages

Dose	Series Name	Absolute Minimum Age	Minimum Age	Routine Age	Valid CVX Code(s) per Dose for this Series	Invalid CVX Code(s) per Dose for this Series
1	Hep B Newborn	0 days	0 days	0 days	08, 42, 45, 43, 44, 51, 110, 104	N/A
2	Hep B Newborn	24 days	28 days	2 months ¹	08, 42, 45, 43, 44, 51, 110, 104	N/A
3	Hep B Newborn	164 days	168 days	6 months	08, 42, 45, 43, 44, 51, 110, 104	N/A

Vaccine Dose Parameters - Minimum and Recommended Intervals

Doses	Series Name	Absolute Minimum Interval	Minimum Interval	Recommended Interval
Dose 1 to 2	Hep B Newborn	24 days	28 days	N/A ²
Dose 2 to 3	Hep B Newborn	52 days	56 days	56 days

Series Special Rules

There are no special rules for this series.

Notes

- The routine age for dose 2 in the table above (2 months)¹ differs from the CDC CDSi routine age of 1 month. The ICE Workgroup recommends 2 months as the routine recommended age for the following reasons:
 - Two months is a routine age for preventive care visits and the recommended age for several other vaccine groups.
 - If combination Hep B vaccines are used, these are not licensed before 6 weeks of age.
 - For a routine recommendation for a healthy child, it is not necessary to squeeze dose 2 in before 2 months of age.



Clinical Decision Support Administration Tool (CAT)

- Graphical user interface
- Non-Technical SMEs may configure ICE
- Create, edit, delete...
 - Vocabulary and code sets
 - Schedule parameters
 - Rules
 - Test cases

Ex: Creating the Varicella Rule for Patients Born before 01/01/1980

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



Standards Based

Attribute of ICE	Conforms to Relevant Technical Standard
Messaging framework	Simple Object Access Protocol (SOAP)
Web Service interface	Decision Support Service (DSS) – an HL7 & OMG standard
Data model	Virtual Medical Record (vMR) – an HL7 standard

Technical Documentation for ICE's Standards-Based Interface

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Flexible Deployment Options

- Runs on a wide variety of hardware and operating system platforms
- Can be deployed in a variety of ways
 - On the same server as the IIS
 - On the same network, but on a different server
 - On a different network
- Can be hosted and/or managed by the IIS jurisdiction or by a 3rd party



Scalable

- Supports simultaneous processing of multiple patients
- Supports multiple complete schedules
- Fully automated testing process



Open Source

- Releasing under a standard open source license
- Lesser General Public License version 3 (LGPL v3)
 - Any IIS (or other system) may utilize/modify/integrate with ICE at no cost
 - Any modifications to ICE software must be shared
- No dependencies on any commercial software or commercial services



Production Use of ICE by an EHR System

- eClinicalWorks (eCW) v10 uses ICE to deliver evaluations and recommendations
- Integrated by eCW developers, with minimal support from ICE team
- No modifications to the default configuration
- ICE is hosted by eCW at central location
- Beta customers began use in spring 2013
- Nationwide availability 2nd half of October

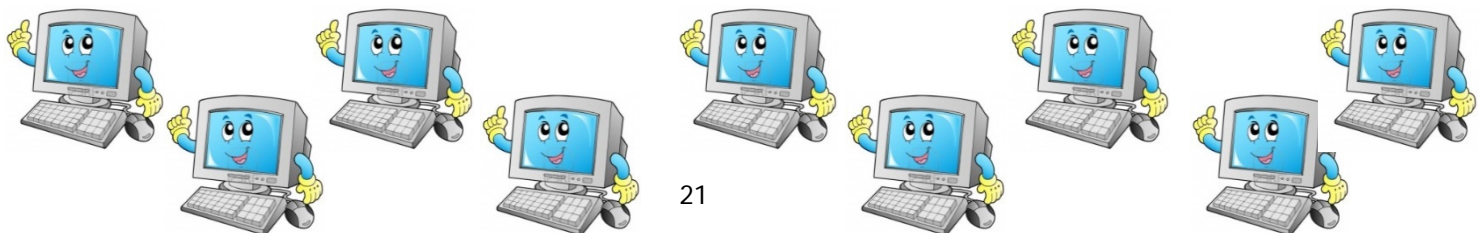


Learn More About ICE Through...

- Website (www.hln.com/ice)
 - Rule documentation
 - Interface documentation
- Demonstrations
- Executable distribution of software
- Access HLN-hosted test instance of ICE
- Talk with the ICE Collaborators

Summary

- ICE is immunization forecasting software
- ICE can integrate with any IIS
- ICE is freely available
- ICE is transparent
- ICE can be maintained by non-developers
- Collaborating enables better solutions
- Let's collaborate to make ICE even better!





Questions? Suggestions?

Mike Suralik

856-751-1094

suralik@hln.com

Vikki Papadouka

347-396-2547

vpapadou@health.nyc.gov

URL: www.hln.com/ice

Email: ice@hln.com