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Immunization Calculation Engine (ICE)

An Open-Source
Immunization Decision Support System
for Integration with IIS

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Objectives

- Major Components of ICE Software System
- Distinguishing Qualities / Benefits to IIS
- Development Process, Status, Schedule

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What is ICE?

Components of ICE Software System

- ICE Web Service

  - Provides immunization forecasting to IIS, EHR-S, Health Information Exchanges (HIE), etc.

- Tool to Manage ICE

  - Web-based application with graphical user interface

  - Enables IIS staff, or other subject matter experts (SMEs), to manage ICE

ICE Web Service
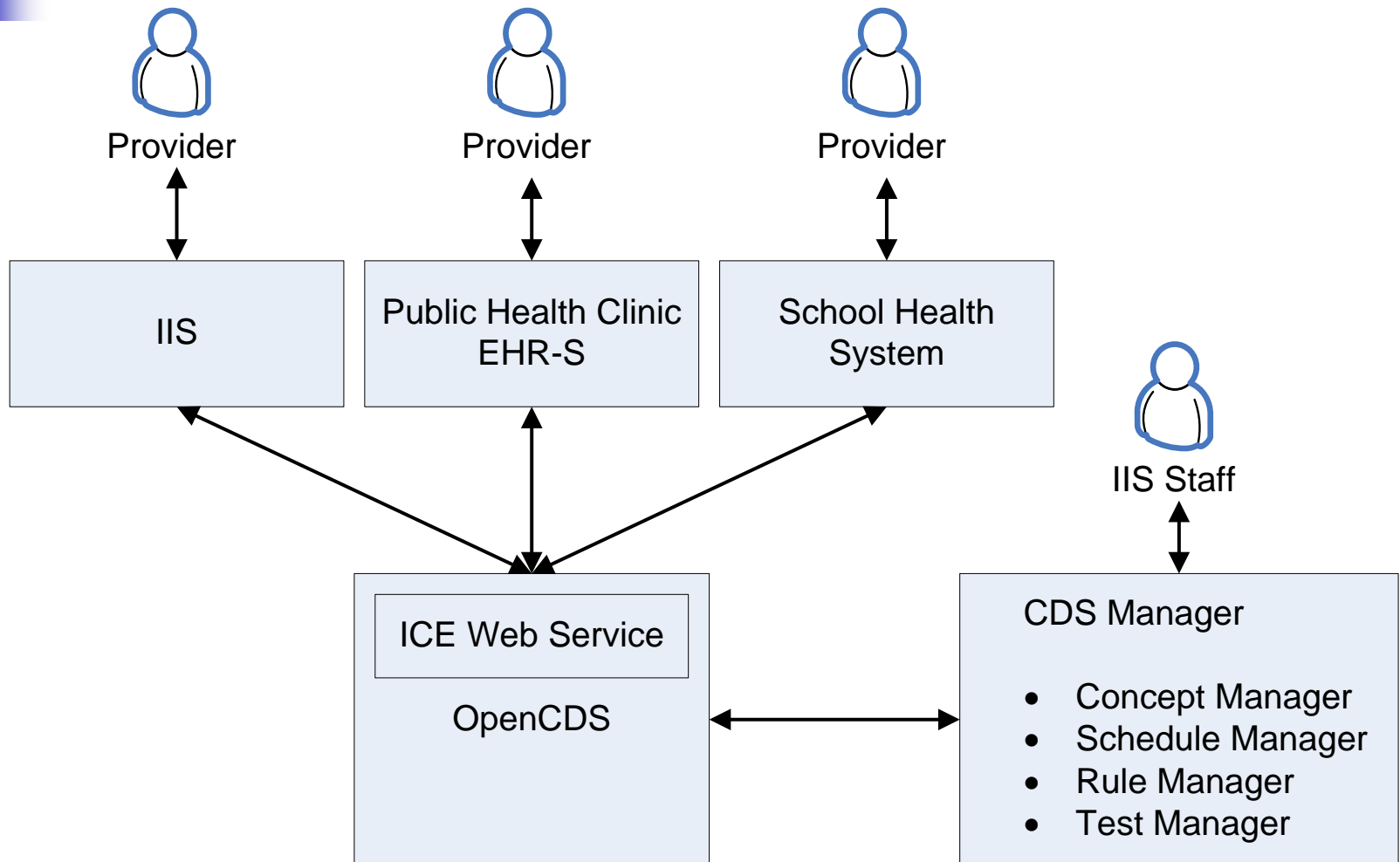
- Inputs:
    - DOB
    - Gender
    - Immunization History
    - Disease Immunity

- Outputs:
    - Validity of immunization history + reasons
    - Immunization recommendations + reasons

Tool to Manage ICE:
Clinical Decision Support (CDS) Manager

- **Four Sets of Features**
  - Concept Manager
  - Schedule Manager
  - Rule Manager
  - Test Manager

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Sample ICE Deployment

Concept Manager

Schedule Manager

ICE Series Edit

ICE Series Details | **ICE Series Doses**

Series Doses | # of Results: 2 | New

	Dose #	Min Age	Max Age	Min Rec Age	Max Rec Age	Grace Period	Ref Dose # For Int	Min Interval	Rec Interval	Max Rec Interval	Delete
⏵	1	361d		1y			0	24d	28d		🗑
⏵	2	385d		4y			0				🗑

Rule Manager

Rule Editor

| Rule | **Business Rules** | Dslr |

When +

1. The Patient has Immunity to a Disease   − +

  a. - The Vaccine Group affected by the reported Immunity is `HepB` ▼   −

2. Administered Shot `oTargetDose1`   − +

3. There is a Series `oTargetSeries1`   − +

  a. - the Series belongs to the Vaccine Group `HepB` ▼   −

  b. - the Series also contains Dose `oTargetDose1`   −

Then +

2. Mark the Dose `oTargetDose1` as Accepted for this series due to "Proof of Immunity"   −
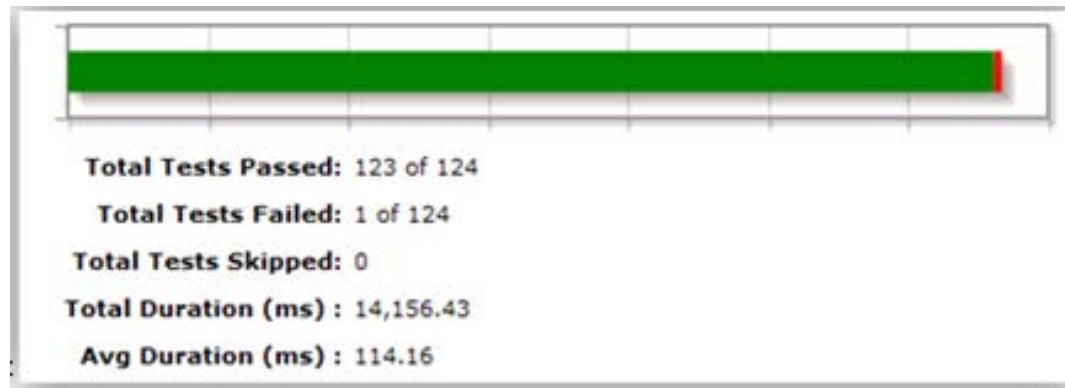
3. Specify that evaluation of this shot `oTargetDose1` is complete and therefore should not be evaluated or overridden by any other rules   −

Test Manager

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	✔	✔	✔

What are the Qualities that Distinguish ICE?

What are the Benefits of ICE to IIS?

Flexible

- Comes with initial configuration
  - Childhood, adolescent, and adult schedules
- Can be adapted for <u>any</u> IIS in the country
- Can adapt to changing needs
  - New vaccines come to market
  - Changes to the ACIP recommendations
- Can be adapted and managed by IIS staff
  - No developers necessary

Easy to Integrate with IIS

- Freely available to all IIS (and other organizations)
- Standards-based (rules, interface, data model)
- Can run on different (or same) server as the IIS
- Can run on variety of hardware/operating system platforms
- Single ICE instance could support
  - Multiple IIS installations
  - Multiple schedules for different clinical settings (schools, public health clinics, etc.)

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Open-Source

- ICE built with/uses only software that is open source
- No dependencies on any commercial software
- When completed, ICE will be released under an open-source license
- GNU Lesser General Public License version 3 (LGPL v3)
  - Any system (even proprietary systems) may use/modify/integrate with ICE at no cost
  - Any modifications to ICE software must be shared
  - No warranty

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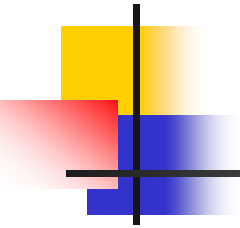
How has ICE been Developed?

What is the
Schedule for Completion?

Origin of the ICE Project

- Began as project to replace IZ algorithm for the New York City Citywide Immunization Registry (CIR)
  - CIR's current algorithm is clinically accurate
  - But lacks key advantages of ICE

	CIR's Current Algorithm	ICE
Maintained By	HLN Developers	CIR SMEs
Testing Process	3-Stage Manual Testing (by HLN developers, HLN testers, and CIR testers)	Fully Automated
Permitted # of Complete Schedules	1	Unlimited
Processing of Patients	1 at a time	Simultaneously

ICE Collaboration

- Too big for any organization to do on its own
- Transitioned to collaborative partnership of four organizations
  - NYC Citywide Immunization Registry (CIR)
  - HLN Consulting
  - Alabama Department of Public Health (ADPH)
  - University of Utah, Department of Biomedical Informatics
- All are contributing significant resources to this Open Source project

Major Activity Streams

April 2011 — Development of ICE Software → **December 2012**

HLN

April 2011 — Enhancements to OpenCDS Platform → **December 2012**

University of Utah

October 2011 — Configuration of ICE → **April 2013**

CIR
ADPH
HLN

Configuration of ICE
Rules and Test Cases

Implemented
(6 vaccine groups)

- HepB
- Rotavirus
- Hib
- MMR
- Varicella
- HepA

In Progress
(7 vaccine groups)

- DTP
- PCV Pneumococcal Conjugate
- PPSV Pneumococcal Polysaccharide
- Polio
- Influenza
- Meningococcal
- HPV

Early Adopters of ICE

- IIS
  - CIR (New York City)
  - ImmPRINT (Alabama)

- EHR-S
  - eClinicalWorks (Leading ambulatory EHR-S among small practices)

Acknowledgments

ICE Project Team (alphabetical order)

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