Using NIST Tools for Evaluation of Immunization Clinical Decision Support Systems

**FITS – Forecasting for Immunization Test Suite**

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Agenda

- Why are we doing this?
- FITS Overview
  - Test Case Creation
  - Test Case Execution
  - FHIR Interface
- FITS Demonstration
- Plans for Assessment
- What’s next
- Resources and Wrap up
Acknowledgements

- Collaborative Effort
  - AIRA
  - CDC
  - NIST

- NIST Team
  - Mike Indovina – Lead, Analyst, and IG Development
  - Hossam Tamri – Tool Architect and Developer
  - Andrew McCaffrey – FHIR Implementation
Purpose and Need

- **Current Challenges**
  - CDSi Test Cases use primitive tooling
  - Time consuming
  - Easy to make an error
  - Difficult to keep timely
  - Only published in one format

- **Benefits of Future Tooling**
  - Fixes the current challenges
  - Available for all to use and develop their own CDS test cases
  - Shareable test cases
  - Allows for real time execution
  - Useable by AIRA for CDS Assessment
FITS Overview

- Measures immunization CDS engines against the ACIP recommendations
- Create and manage immunization CDS test cases
- Validates test cases and reports the results in a standardized format
- Standardize FHIR interface
Test Cases

- Allows user to create test cases
- Users provide the expertise based on ACIP recommendations
- FITS Provides:
  - Organization
  - Management
  - Look-up Assistance
  - Test Case Summaries
- Import and Export Capabilities
  - Import CDC Excel Spreadsheet format
  - Import XML format
  - Export XML format and CDC Excel Spreadsheet Format
  - Export PDF of test cases
Validation

- Executes test cases
- Provides summary and detail validation reports
- Filtering capabilities
- Maintains history of validation reports
- Export reports in XML
Standardize API for Immunization CDS Engines

- Current CDS engines use proprietary interfaces
- Standardized interface using HL7 FHIR
  - FHIR – Fast Healthcare Interoperability Resources
    - Data formats and elements (known as "resources") and an API for exchanging healthcare data using HTTP-based RESTful protocol
  - Based on:
    - Patient base resource
    - Immunization base resource
    - Immunization Recommendation base resource
  - Profiled for testing Immunization CDS Engines
    - Patient resource for Gender and DOB
    - Immunization resource for history
    - Immunization recommendation for evaluation
  - Organized as a FHIR Implementation Guide
    - Describes scope and purpose
    - Describes how to use the FHIR API
FITS Demonstration
AIRA Assessment Process

- **MACAW**
  - Measurement for Assessment and Certification Advisory Workgroup
  - Responsible for
    - providing direction
    - creating measures

- **AART**
  - Aggregate Analysis Reporting Tool
  - Maintained by AIRA
  - Community uses to access reports
AIRA Assessment of Forecasting Engines

- NIST provides platform for self-testing or test programs
- MACAW to develop test cases for assessment
- AIRA uses FITS to conduct CDS Engine testing
- Community will access results via AART
- CDS Engine developers can view assessment results
- AART maintains history and progress reports
What’s Next?

- Beta release available now—1st official release by mid-Summer
- Give it a try!
  - Create test cases
  - Evaluate your engine
  - Build a FHIR interface to your engine

- Operationalize
  - Plan for creating and managing test cases
  - Updates and versioning
  - Adopted by the CDSi project

- Future capabilities
  - Test Case Verification Assistance
  - Support for collaboration
  - HL7 v2 End-to-end Testing
Resources

- Tool Link:
  
  https://fits.nist.gov

- Google Group – List Server for Discussion/Questions
  
  - Google Group Site Link:
    
    https://groups.google.com/d/forum/fits-immunization-testing

  - Send messages to:
    
    fits-immunization-testing@googlegroups.com
Welcome to the NIST Forecasting for Immunization Test Suite (FITS)

FITS Overview

FITS (Forecasting for Immunization Test Suite) is a web-based application for testing immunization CDS engines against ACOE recommendations. FITS creates and manages test cases, runs and validates the test cases, creates reports in standardized formats, and provides standardized (FHIR) and non-standardized (proprietary) interfaces to the CDS engines.

FITS can be used to validate immunization CDS engines independently of the system in which the CDS resides or is associated (e.g., an EHR or HIS). FITS will contain a set of test cases authored and maintained by the CDC CDSI project (https://www.cdc.gov/vaccines/programs/fis/cdsi.html) that are available to test CDS engines. Additionally, a user can create and persist their own test cases.

FITS is developed by the NIST in collaboration with the CDC and AIRA.

Have a Question?

A Google Group FITS has been established for discussion questions about the tool. No membership is required. A Google account is required for posting:

- Site: https://groups.google.com/forum/#!forum/fits-immunization-testing
- Email: fits-immunization-testing@googlegroups.com

Supported Browsers

The following browsers are supported:

- Chrome (Recommended)
- Firefox
- Safari
FITS Demo: Test Case Browser
FITS Demo: Test Case Meta Data
# FITS Demo: Vaccination Browser

<table>
<thead>
<tr>
<th>Vaccine Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVX 01</td>
<td>DTP (Diphtheria, Tetanus Toxoid, and Pertussis Vaccine)</td>
</tr>
<tr>
<td>CVX 03</td>
<td>MMR (Measles, Mumps, and Rubella Virus Vaccine)</td>
</tr>
<tr>
<td>CVX 05</td>
<td>Measles Virus Vaccine</td>
</tr>
<tr>
<td>CVX 07</td>
<td>Mumps Virus Vaccine</td>
</tr>
<tr>
<td>CVX 09</td>
<td>Td (Adult), Adsorbed (Tetanus and Diphtheria Toxoids, Adsorbed, For Adult Use)</td>
</tr>
<tr>
<td>CVX 08</td>
<td>Hep B, Adolescent Or Pediatric (Hepatitis B Vaccine, Pediatric Or Adolescent Dosage)</td>
</tr>
<tr>
<td>CVX 110</td>
<td>DTaP-Hep B-IPV (Diphtheria, Tetanus, Acellular Pertussis, Hepatitis B, and Inactivated Poliovirus Vaccine)</td>
</tr>
<tr>
<td>CVX 02</td>
<td>OPV (Oral Poliovirus Vaccine)</td>
</tr>
<tr>
<td>CVX 04</td>
<td>M/R (Measles And Rubella Virus Vaccine)</td>
</tr>
<tr>
<td>CVX 06</td>
<td>Rubella Virus Vaccine</td>
</tr>
<tr>
<td>CVX 09</td>
<td>Polio, Unspecified Formulation (Poliovirus Vaccine, Unspecified Formulation)</td>
</tr>
<tr>
<td>CVX 88</td>
<td>Influenza, Unspecified Formulation (Influenza Virus Vaccine, Unspecified Formulation)</td>
</tr>
</tbody>
</table>
# FITS Demo: Test Case Summary

## Dose # 1 at age 12 months-5 days

### Test Case Metadata

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Dose # 1 at age 12 months-5 days</td>
</tr>
<tr>
<td>ID</td>
<td>2013-0189</td>
</tr>
<tr>
<td>Group</td>
<td>HepA</td>
</tr>
<tr>
<td>Description</td>
<td>Dose # 1 at age 12 months-5 days</td>
</tr>
<tr>
<td>Last Changed in Test Plan Version</td>
<td>1.0</td>
</tr>
<tr>
<td>Change Log</td>
<td></td>
</tr>
<tr>
<td>Date Created</td>
<td>04/05/2017</td>
</tr>
<tr>
<td>Date Last Updated</td>
<td>04/05/2017</td>
</tr>
<tr>
<td>Type</td>
<td>Imported</td>
</tr>
</tbody>
</table>

### Test Case Data

#### Assessment Date and Patient Information

- **Assessment Date:** 11/28/2006 - Sunday, November 26, 2006
- **Date Of Birth:** 12/01/2005 - Thursday, December 1, 2005
- **Gender:** Female

#### Vaccination History and Expected Evaluations

<table>
<thead>
<tr>
<th># 0 - Hep A, unspecified formulation - CVX : 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Administered</td>
</tr>
<tr>
<td>Evaluations</td>
</tr>
<tr>
<td>CVX</td>
</tr>
<tr>
<td>85</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Expected Forecasts

- **Hep A, unspecified formulation # 85**
  - **Series Status:** Not complete
  - **Reason:**
  - **Earliest Date:** 12/01/2006 - Friday, December 1, 2006
  - **Recommended Date:** 12/01/2006 - Friday, December 1, 2006
  - **Past Due Date:** 12/28/2007 - Friday, December 28, 2007
  - **Latest Date:**

---

[Health IT Standards Testing Infrastructure]
FITS Demo: Loading to Test Cases to Validate
FITS Demo: Validation Results I
FITS Demo: Validation Results Filters
### General Analysis

<table>
<thead>
<tr>
<th>Total Test Cases Validated</th>
<th>Correct Test Cases</th>
<th>Test Cases with Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

**Correct:** 91.67% with errors 8.33%

### Detailed Analysis

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Correct</th>
<th>Errors</th>
<th>Warnings</th>
<th>Incomplete</th>
<th>Total Requirements</th>
<th>Completion</th>
<th>Correctness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evaluations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation Status</td>
<td>16</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>100%</td>
<td>94%</td>
</tr>
<tr>
<td><strong>Forecasts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dose Number</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>12</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Earliest Date</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Recommended Date</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>100%</td>
<td>65%</td>
</tr>
<tr>
<td>Past Due Date</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Latest Date</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
### FITS Demo: Individual Test Case Results

#### Test Case Data

- **Assessment Date:** 02/02/2012
- **Patient Date Of Birth:** 02/02/2011
- **Patient Gender:** F

#### Summary

<table>
<thead>
<tr>
<th></th>
<th>Evaluations</th>
<th>Forecasts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CORRECT</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>ERRORS</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>WARNINGS</strong></td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>INCOMPLETE</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>CORRECTNESS</strong></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>COMPLETION</strong></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

#### Events

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Expected</th>
<th>Actual</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>#52 - Hep A, adult</td>
<td>VALID</td>
<td>INVALID</td>
<td>FAILED</td>
</tr>
</tbody>
</table>

#### Forecasts

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Expected</th>
<th>Actual</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>2</td>
<td>#</td>
<td>WARNING</td>
</tr>
<tr>
<td>Earliest</td>
<td>02/02/2012</td>
<td>02/02/2012 minus 182 days</td>
<td>FAILED</td>
</tr>
<tr>
<td>Recommended</td>
<td>02/02/2012</td>
<td>02/02/2012 minus 182 days</td>
<td>FAILED</td>
</tr>
<tr>
<td>Past Due</td>
<td>03/01/2013</td>
<td>02/02/2013 minus 27 days</td>
<td>WARNING</td>
</tr>
</tbody>
</table>