HEALTH IT
STANDARDS TESTING INFRASTRUCTURE

Improving Clinical Decision Support Systems by means of Tools and Testing

FITS

Forecasting for Immunization Test Suite

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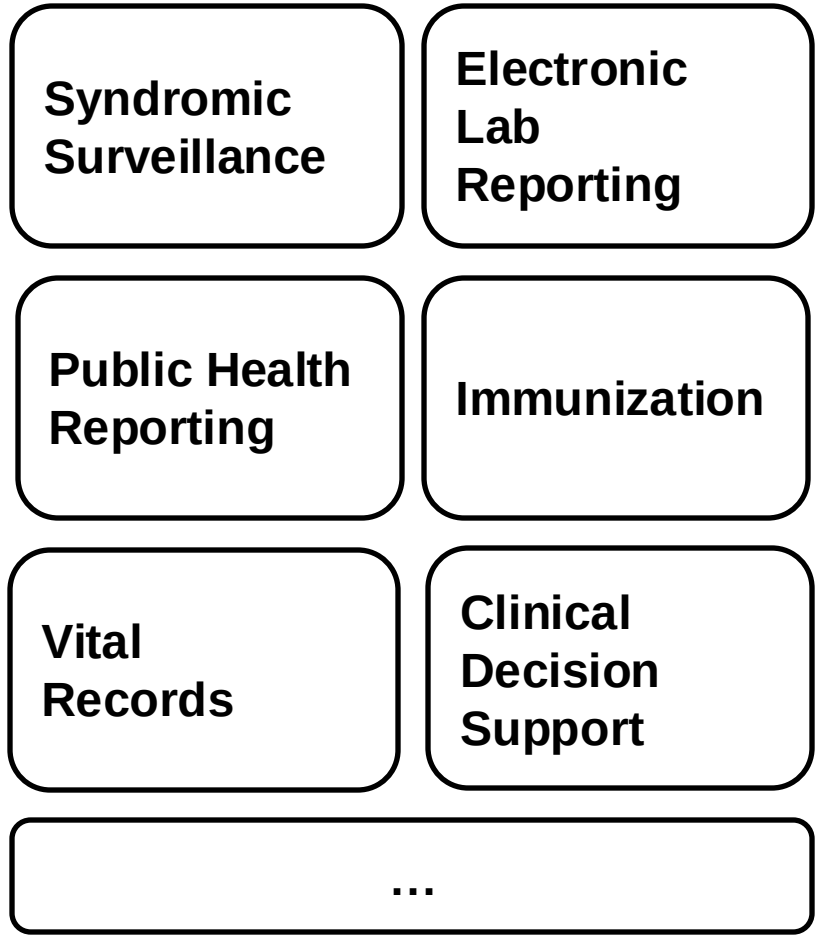
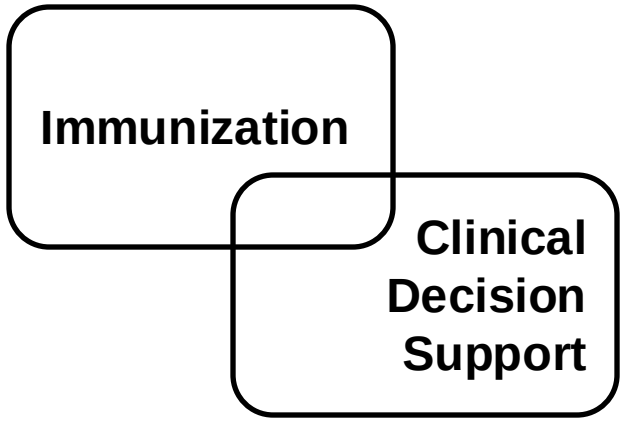
NIST
National Institute of Standards and Technology

Health Information Technology Tools

- Testing Frameworks & Tools
  - Improving Interoperability
  - Improving Quality



Immunization Domain



- HL7 v2 standard testing tools
- SOAP transport testing
- Forecasting for immunization
- Data quality analysis

What is an Immunization?

"the action of making a person or animal immune to infection, typically by inoculation."

- Google

Vaccination

- Best chance against viruses
- Contains weakened/altered version of a virus
- Series of shots to attain immunity

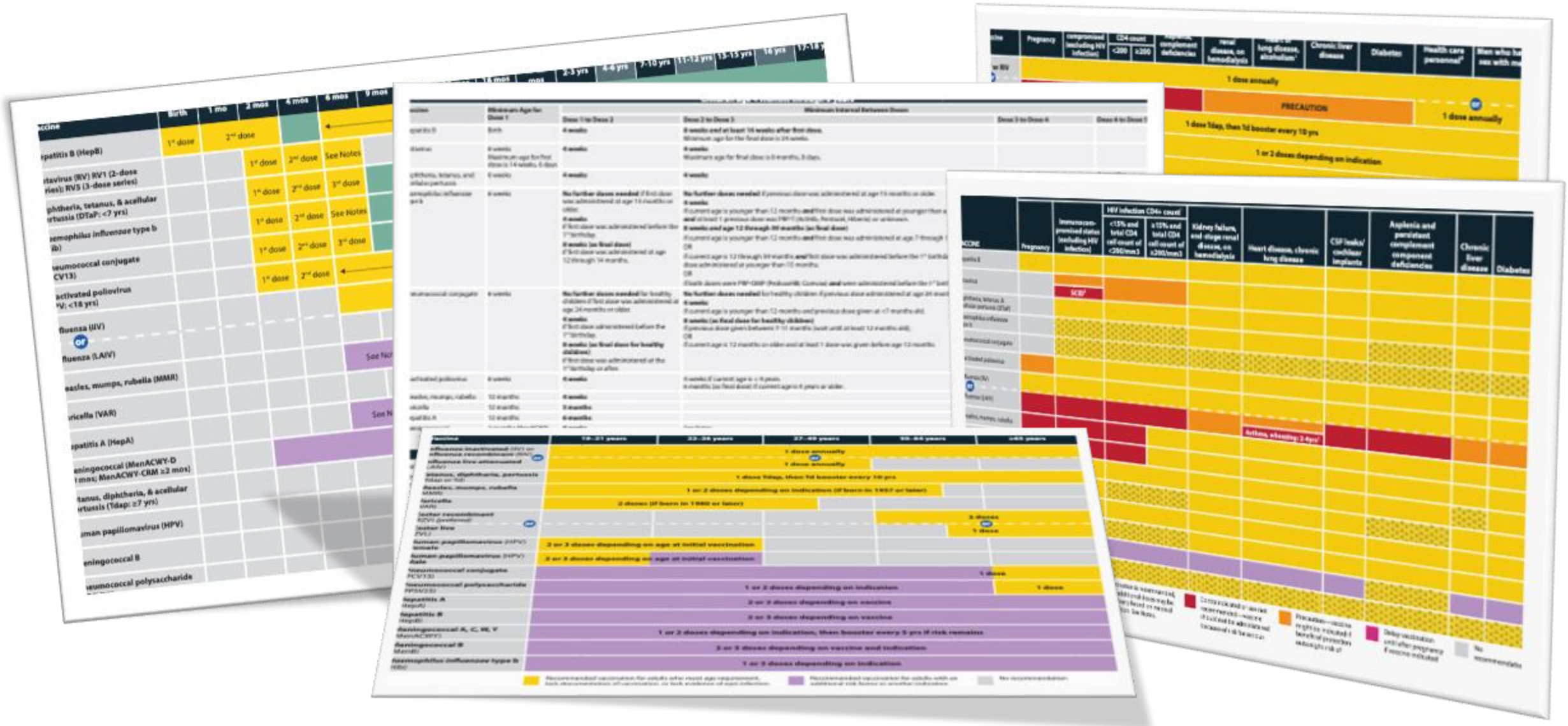
Vaccination Forecast

- Immunity is achieved through series of shots on a set schedule
- What? and When?
  - Earliest, recommended, latest dates
- Parameters
  - Age, Gender, Contraindications, Interactions, Vaccine Type and Manufacturer

ACIP

- Advisory Committee on Immunization Practices
  - Medical and Public Health Experts
- Published recommendations
  - CDC's Morbidity and Mortality Weekly Report
  - Epidemiology and Prevention of Vaccine-Preventable Diseases

Vaccination Recommendations



Forecasting Complexity

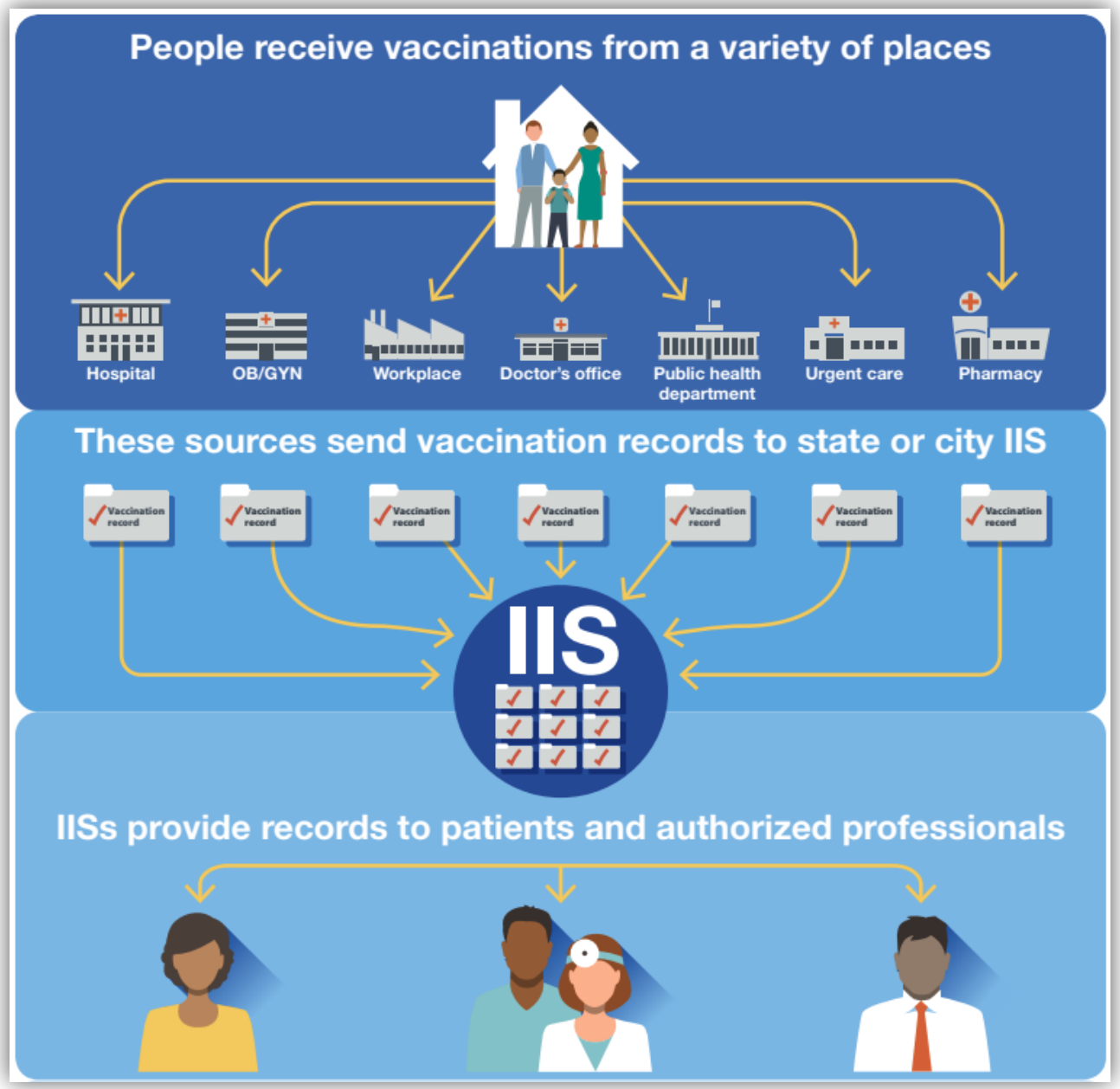
- Multiple parameters to consider
- Multiple vaccine products for same antigen
- Constant evolution
- A lot of literature in clinical language
- Critical implications

Good News!

Well defined rules,
can be delegated to computers

Immunization Information System

- Confidential, population-based, computerized databases
- Store immunization doses administered by participating providers
- By Geopolitical area


People receive vaccinations from a variety of places
Hospital
OB/GYN
Workplace
Doctor's office
Public health department
Urgent care
Pharmacy
These sources send vaccination records to state or city IIS
Vaccination record
IIS
IISs provide records to patients and authorized professionals

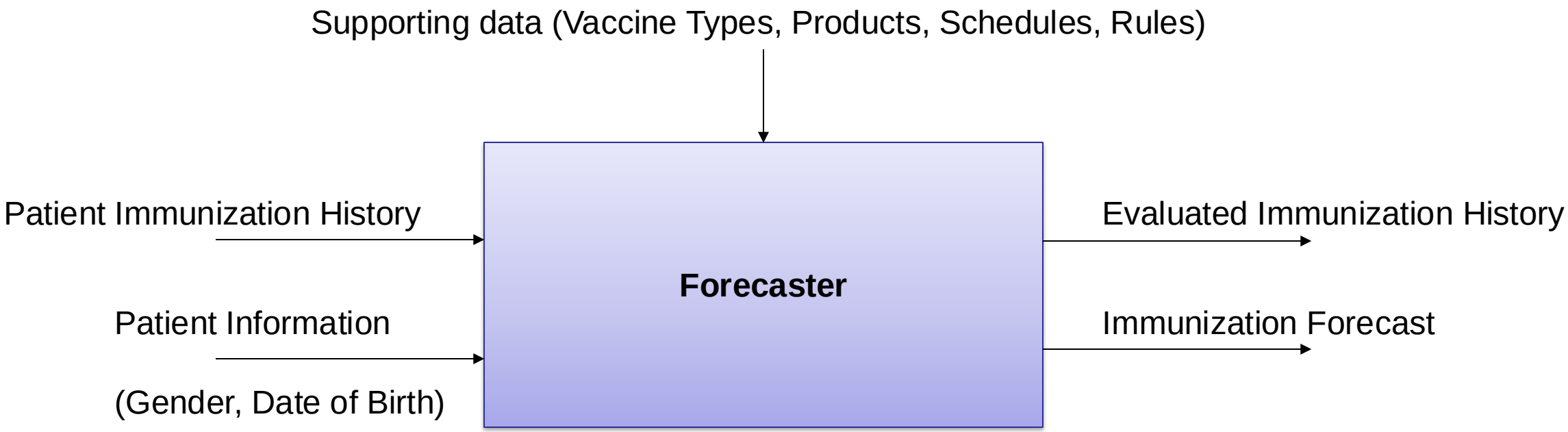
IIS Main Roles

- Collect patient Immunization History
- Consolidate data from different sources
- Provide data to healthcare providers and Immunization programs
- Forecast immunization doses

IIS Vaccination Forecasting

- Stores patient data necessary for forecasting
- Implements immunization forecasting rules

IIS Vaccination Forecasting



IIS Vaccination Forecasting Challenges

- Different software used by IIS
- Own interpretations of forecasting rules
- Sporadic updates of engines
- Managing code sets
  - Vaccine Codes
  - Product Codes

CDSi Project

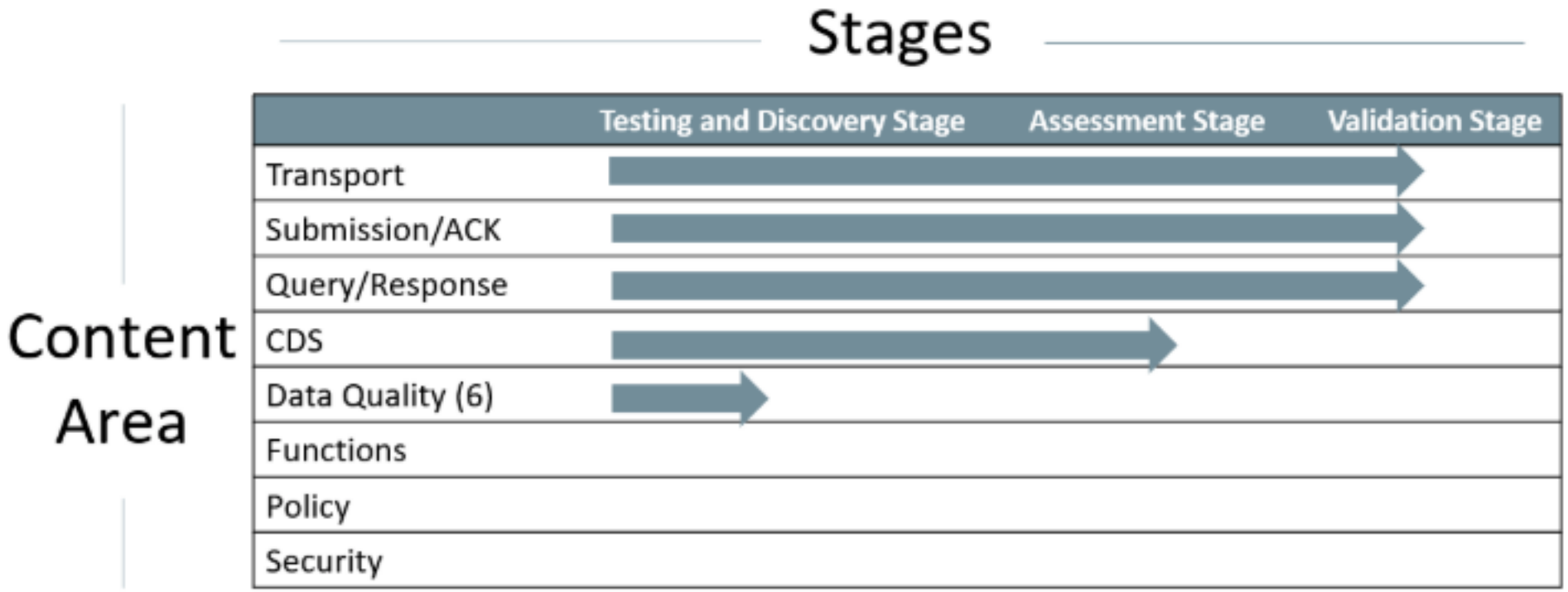
- Center of Disease Control
- Technical specification for vaccine forecasting
  - Understandable by implementers
- Supporting data in standardized format
  - Updated as ACIP recommendations change
- Test Cases for typical and edge forecasting situations

American Immunization Registry Association

"Promoting and supporting the use of immunization information to ensure healthy communities"

- Tools
- Best practices
- Measurements
- Support

AIRA's Measurement & Improvement Initiative



Our Role

Support AIRA's mission by creating testing tools used for assessment, and to inform best practices.

Forecasting For Immunization Testing

CDSi Test Cases use primitive tooling

59 columns
772 rows

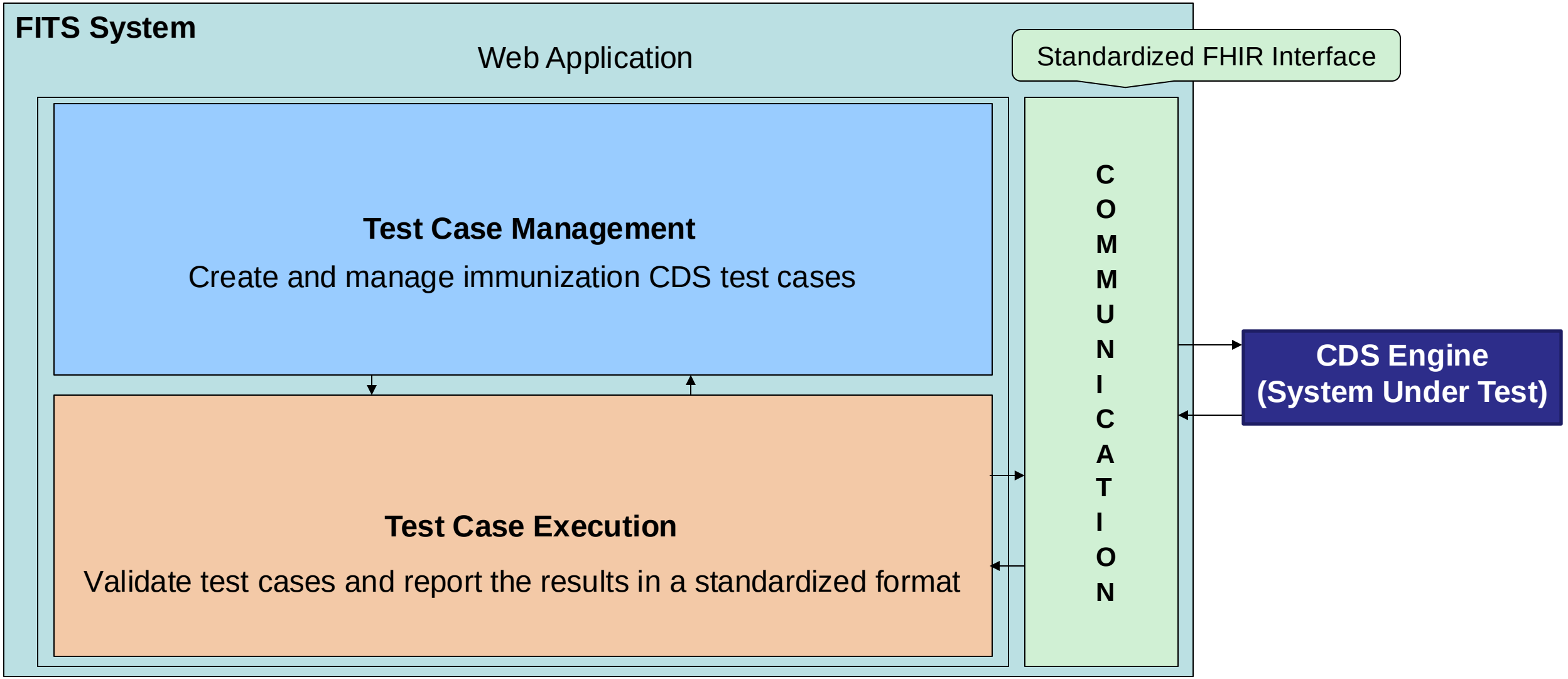
CDC_Test_ID	Test_Case_Name	DOB	gende	Med_History_Text	Med_History_Code	Med_History_Code_Sys	Series_Statu
2013-0001	Newborn Testing	02/21/2019	F				Not complet
2013-0002	DTaP #2 at age 10 weeks-5 days	12/18/2018	F				Not complet
2013-0003	DTaP #2 at 10 wks-4 days	12/17/2018	F				Not complet
2013-0004	DTaP # 2 at age 10 weeks	12/13/2018	F				Not complet
2013-0005	DTaP # 2 at age 4 months	10/21/2018	F				Not complet
2013-0007	# 2 (Tdap) to child age 7. DTaP # 1 given before age 12 months. Forecast # 3 (Td) in 4 weeks.	02/21/2012	F				Not complet
2013-0008	# 2 (Tdap) to child age 7. DTaP # 1 at ≥ 12 months. Forecast dose 3 for 6 months.	02/21/2012	F				Not complet
2013-0010	# 1 (Td) to # 2 (Tdap) interval 28-4 days in child age > 7 years. Forecast # 3 in six months.	10/25/2010	F				Not complet
2013-0011	#3 at age 14 weeks-5 days	11/20/2018	F				Not complet
2013-0012	Age 6. No vaccinations. Forecast DTaP.	02/21/2013	F				Not complet
2013-0013	#3 at age 14 weeks-4 days	11/19/2018	F				Not complet
2013-0014	#3 at age 14 weeks	11/15/2018	F				Not complet

- Time consuming
- Requires extra development to run test cases
- Error prone authoring and updates
- Forecasts expressed in fixed dates

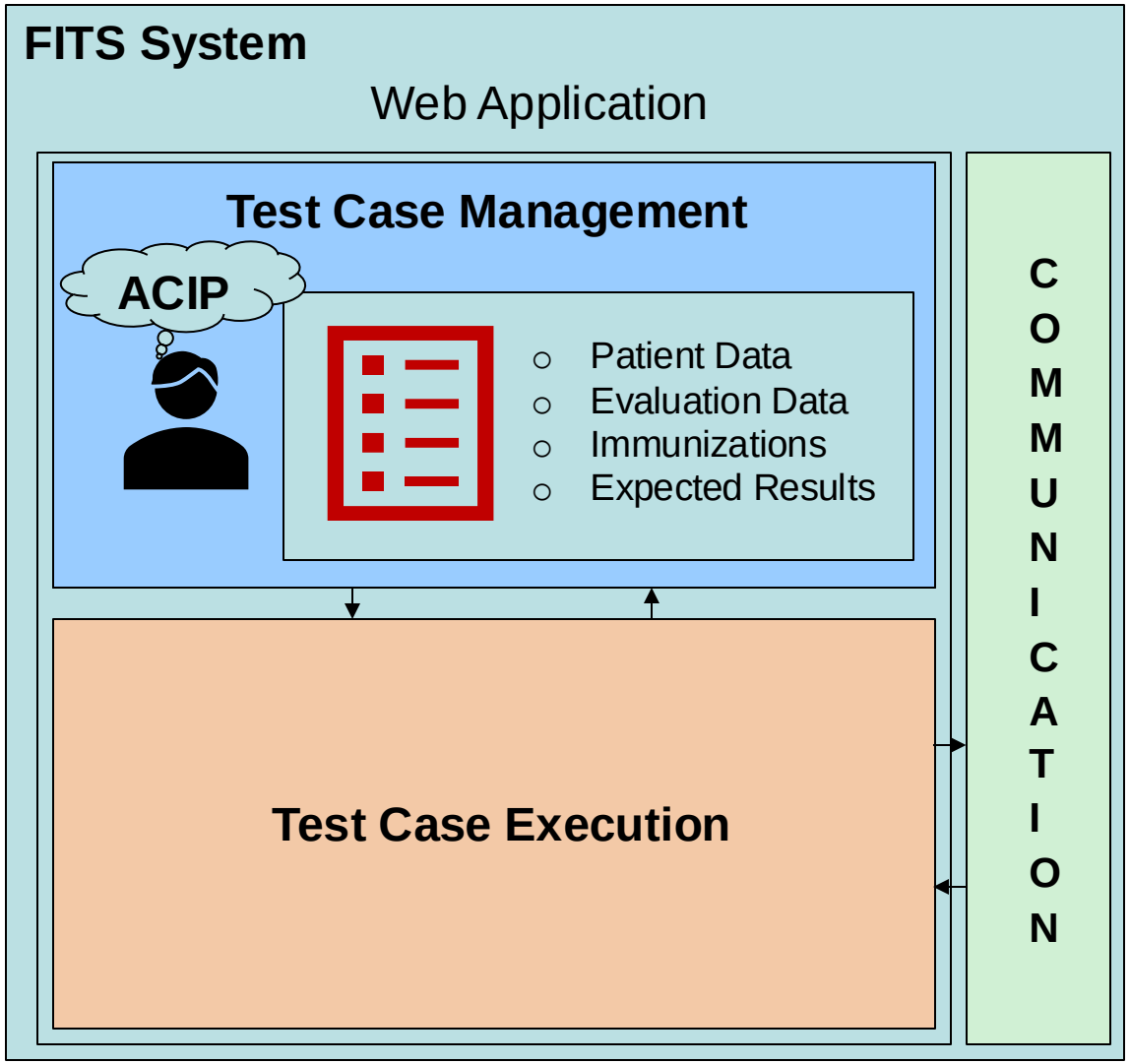
FITS Project

- Collaboration between CDC – AIRA – NIST
- Easy authoring of forecasting test cases
- One stop shop for forecasting test cases
- Enable testing of CDS engines
  - Self testing
  - Third party testing (AIRA)

FITS Overview

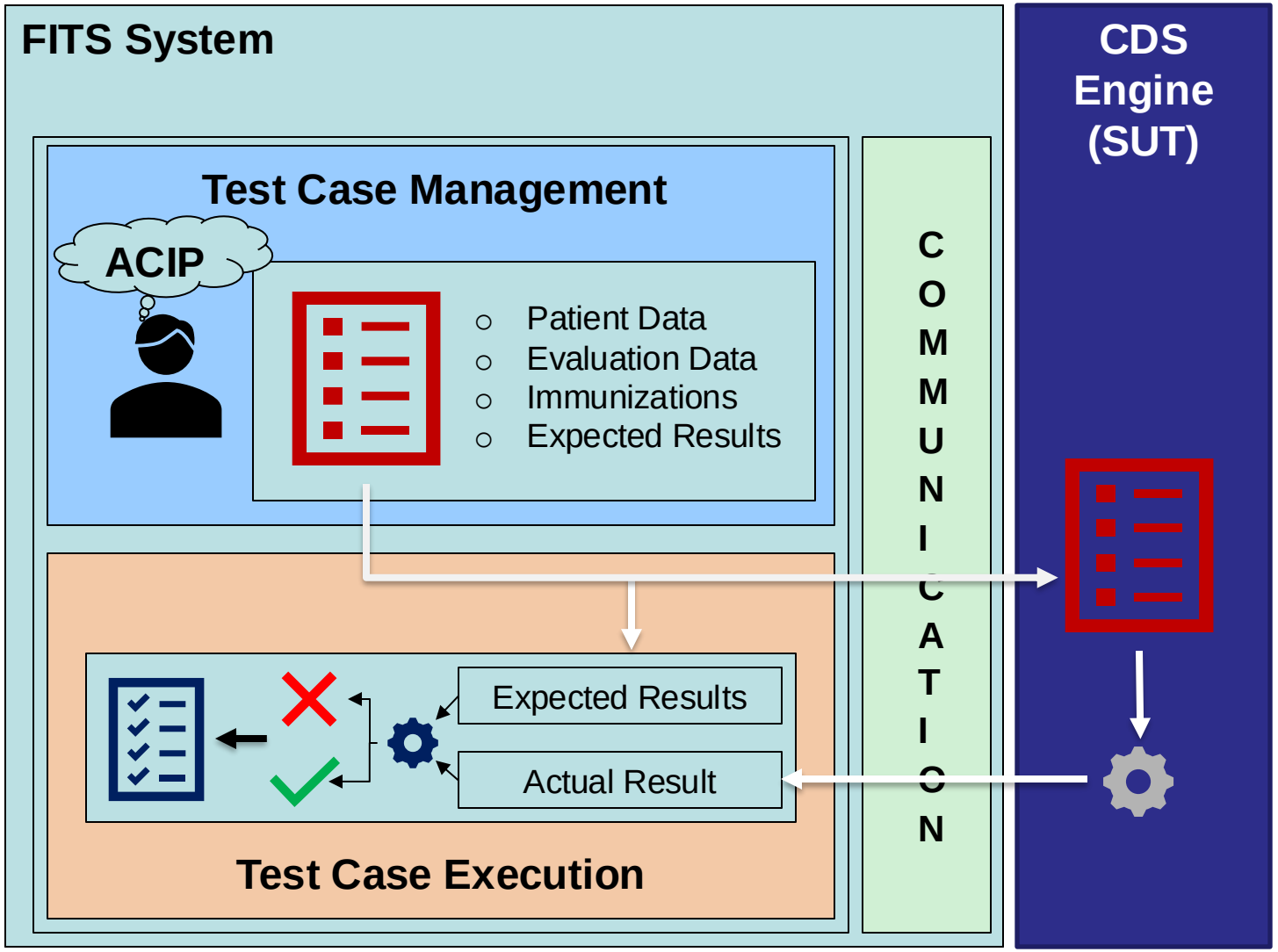


Test Case Management



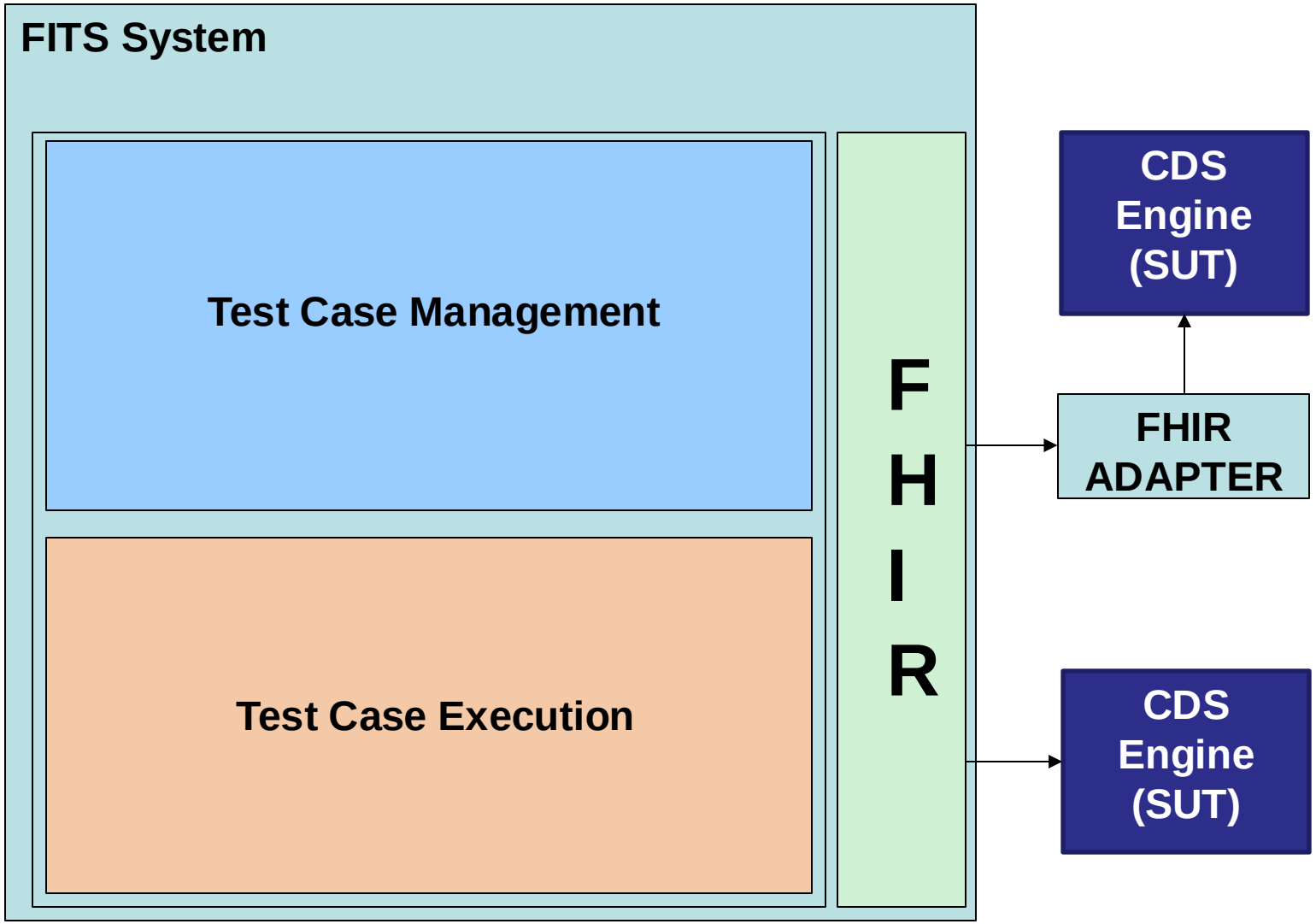
- Creating Test Plans
  - Test Case Groups (e.g. by Antigen)
- Test Cases
  - Expected Evaluation
  - Expected Earliest, Recommended (dates)
- Features
  - Organize / Tag / Lookup test cases
  - Test Cases Summary
  - Share and publish test plans
  - MVX and CVX codes lookup
  - Import from XML or Spreadsheet
  - Export to XML or Spreadsheet or PDF

Test Case Execution



- Engine connection configuration
- Running test cases
- Engine response validation
  - Comparing response values to expected values
- Validation report
  - Export XML
  - Individual / Aggregate

Communication



- Standardized communication
  - FHIR
  - Ballot in September
- FHIR Adapter
  - STC
  - ICE
  - SWP
  - HL7
  - Others

Demo

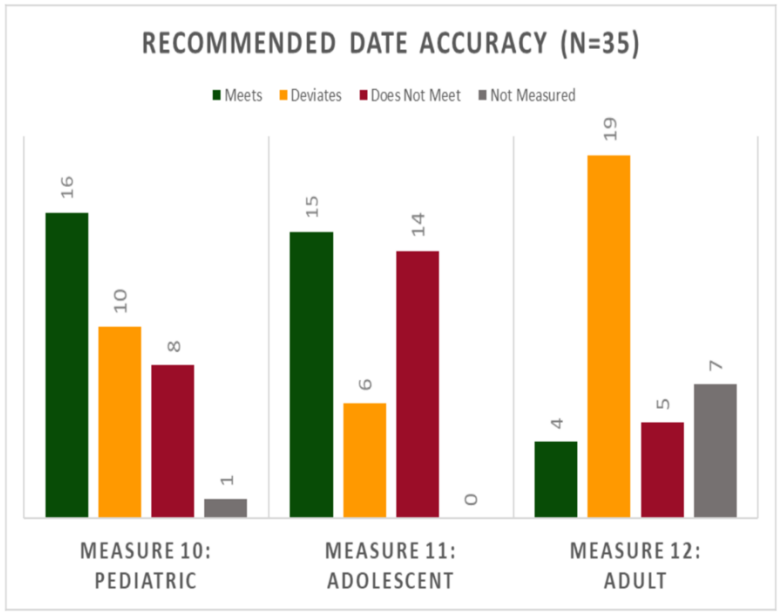
FITS Usage

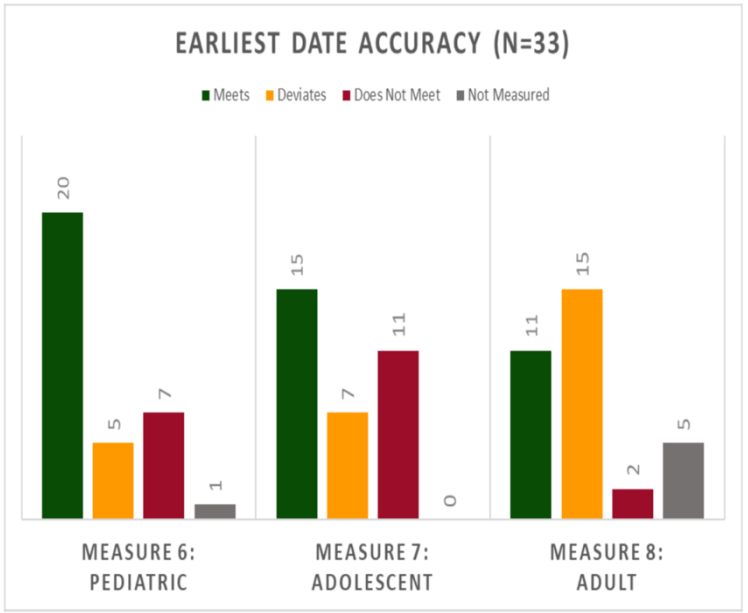
- **CDC** : CDSi project, test cases authoring and management
- **AIRA** : Assessment of IIS's Forecasting capabilities
- **USER** : Get latest published test cases, perform self testing

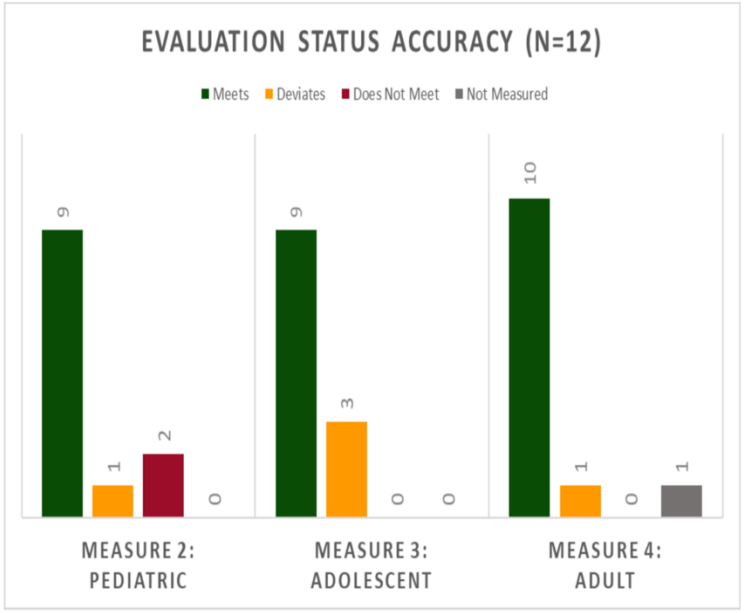
Assessment Results (Support)

CDS Concept	Supports (N=35)
Measure 1: Evaluation Status *Did the dose count?*	**12**
Measure 5: Earliest Date *When could the next dose be given?*	**33**
Measure 9: Recommended Date *When should the next dose be given?*	**35**

Assessment Results (Measures)

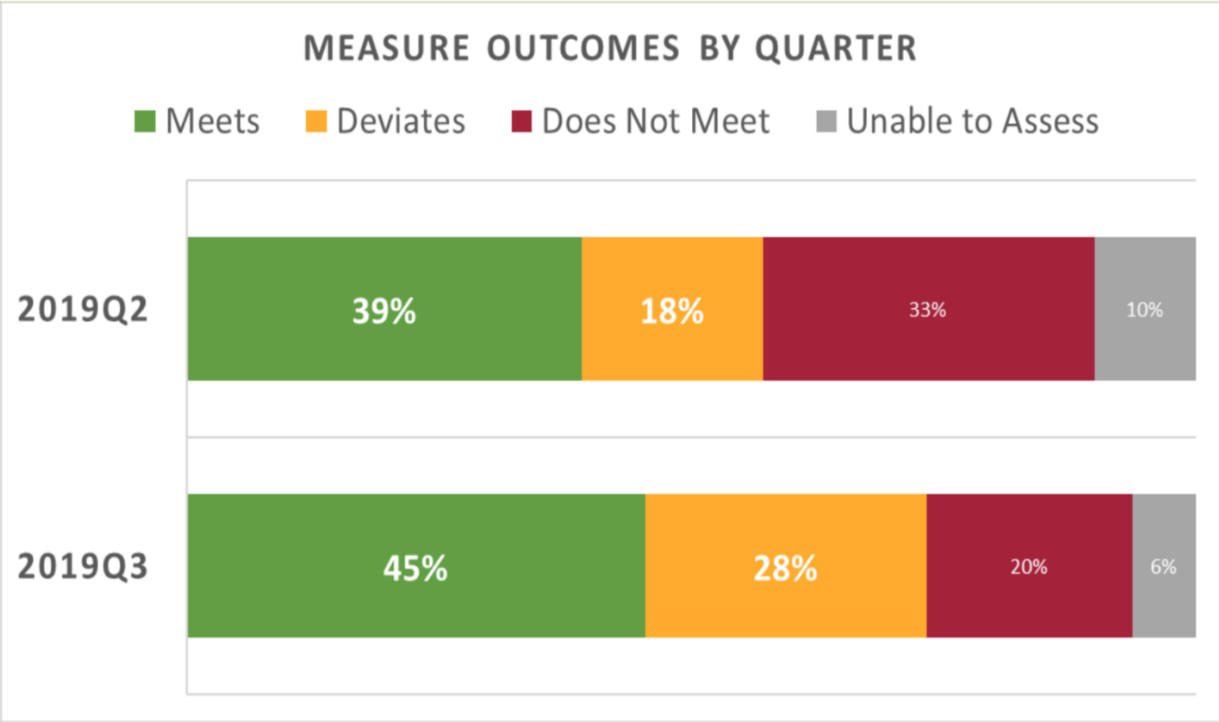


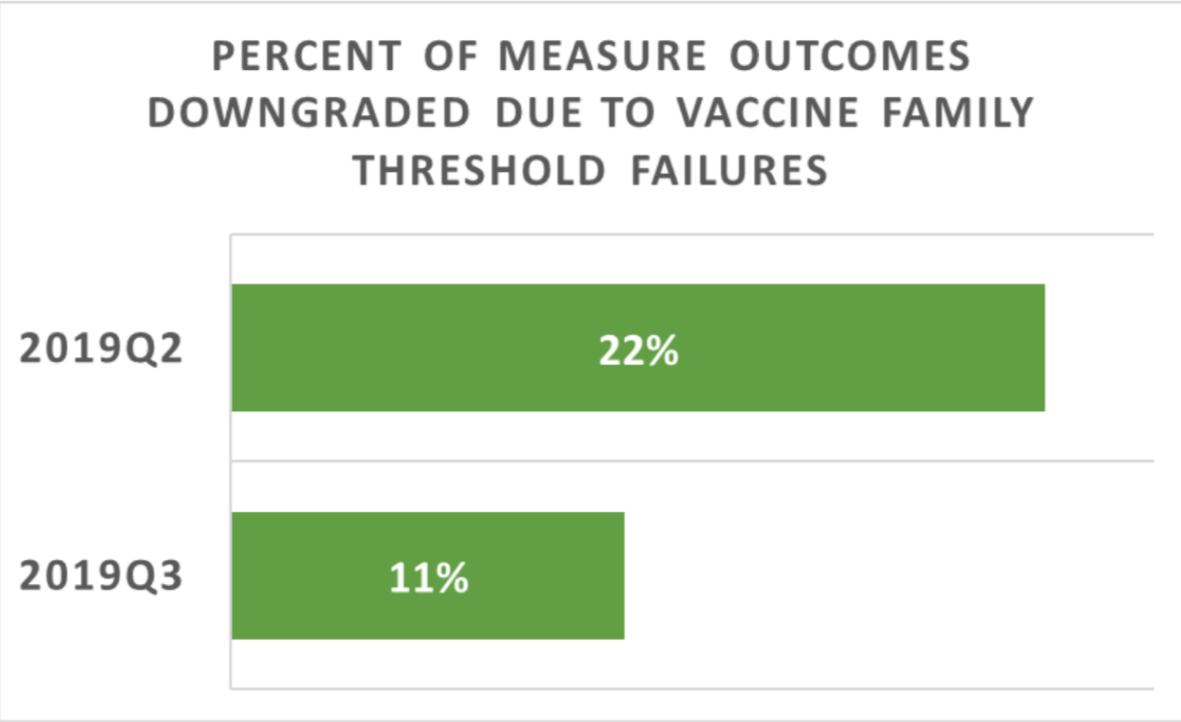




- **Meets:** The IIS has a degree of alignment score of at least 90% or more.
- **Deviates:** The IIS has a degree of alignment score of at least 65% but less than 90%.
- **Does Not Meet:** The IIS has a degree of alignment score of less than 65%.

Assessment Results (Improvement)





Acknowledgments

- NIST Team
  - Rob Snelick – Project Manager
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  - Andrew McCaffrey – FHIR Implementation

- AIRA Team
  - Nathan Bunker
  - Eric Larson

Thank you!

- Tool Link:
  - https://fits.nist.gov
- Sources:
  - https://www.cdc.gov/
  - https://repository.immregistries.org/resource/iis-assessment-aggregate-status-report-clinical-decision-support/