Improving Immunization Information Systems

H. Tamri, M. Indovina, R. Snelick - National Institute of Standards and Technology (NIST), Gaithersburg, MD, USA

1 Overview

- **What is NIST Doing?**
  - Building methods and measurement tools to assess and improve Immunization Information Systems
- **What is the Impact?**
  - Better systems with better data lead to **better healthcare outcomes**.
- **Who are the collaborators?**
  - American Immunization Registry Association (**AIRA**)
  - Center for Disease Control and Prevention (**CDC**)
- **Who does it benefit?**
  - State and Local Jurisdiction Immunization Information Systems
  - Doctors and Patients
- **What is the NIST Approach?**
  - Tool for evaluating Vaccine Forecasting (FITS Project)
  - Tool for assessing Immunization Information Systems data quality (qDAR Project)

2 Immunization Information Systems

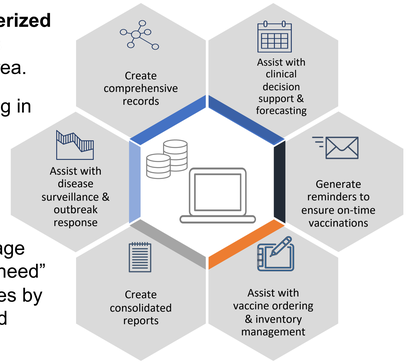
Also called **Immunization Registries or IIS**

Confidential, **population-based**, **computerized databases** that record immunization doses administered within a certain geographic area.

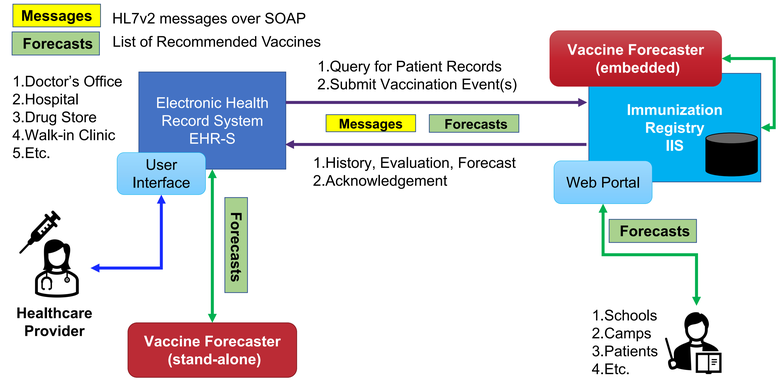
62 population-based registries are operating in all 50 US states, territories, and localities.

Started in the late 1990s with the goal of >95% participation rate

Enable measurement of vaccination coverage rates across the US to identify ”pockets of need” and reduce the spread of infectious diseases by supplying critical information to patients and policy makers.



3 IIS in Practice



4 Vaccine Forecasting

*“**Vaccine forecasting**, is an automated process that determines the recommended immunizations needed for a patient and delivers these recommendations to the healthcare provider. ”*

* dates in this example are not accurate

Gender: F
Birthdate: 10/1/2013
Assessment Date: 04/11/2018
Vaccination History:

Vaccine	Dose 1	Dose 2	Dose 3	Dose 4
DTaP	20131202	20140206	20140416	20150331
Hib	20140120	20140306	20140509	20150127
HepB	20151119	20160408	20160819	

Vaccinations Recommended For 04/11/2018

Vaccine	Antigen	Status	Dose	Valid	Due	Overdue	Finished
HepB	HepB	overdue	3	07/03/2016	07/03/2016	07/03/2016	10/01/2213
DTaP	Diphtheria	due	B	10/01/2017	10/01/2017	10/01/2020	10/01/2163
IPV	Polio	due	B	10/01/2017	10/01/2017	10/01/2020	10/01/2031
Var	Varicella	due	2	05/06/2016	10/01/2017	10/01/2020	10/01/2078
Influenza	Influenza	overdue	1	07/01/2017	08/01/2017	12/01/2017	10/01/2163

Vaccinations Due After 04/11/2018

Vaccine	Antigen	Status	Dose	Valid	Due	Overdue	Finished
MCV4	Mening	due later	1	11/26/2013	10/01/2024	10/01/2026	10/01/2032
HPV	HPV	due later	1	10/01/2022	10/01/2024	10/01/2026	10/01/2040
Zoster	Zoster	due later	1	10/01/2063	10/01/2063	10/01/2064	10/01/2133

Vaccinations Completed or Not Recommended

Vaccine	Status
Hib	complete
PCV13	complete
Rota	complete
MMR	complete
HepA	complete

Evaluation of Vaccination History

Output

Vaccine Forecaster

Input

5 Needs and Challenges

“Clear, reliable & consistent forecasting is important“

- Forecasters are Increasingly used by doctor’s, hospitals, clinics, schools, etc.
- Assists with “catch up”– especially after missed visits (ex. due to pandemic)
- Automated vaccine “Reminder/Recall” systems use Forecasters
- Forecasters are used by public health agencies to assess “coverage”

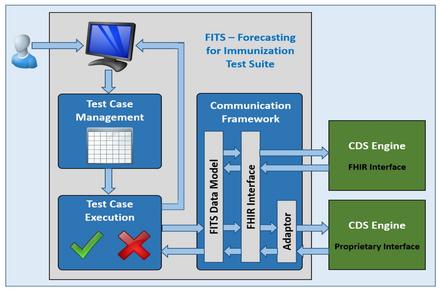
The CDC created the **CDSi** Project with the stated goal *of “Improving alignment w/ community-vetted standards and recommendations.”*

- Advisory Committee on Immunization Practices (ACIP) recommendations are changing with the development of new vaccines and as new research becomes available
- Testing is **key** in improving accuracy and alignment of Forecasters with standards and recommendations
- CDSi Project initially authored test cases (based on ACIP) for all vaccines on the routine schedule using Excel spreadsheets (with 59 columns…) and fixed dates

No publicly available tools existed for creating, updating, or executing tests cases, nor for measuring forecaster performance

6 FITS

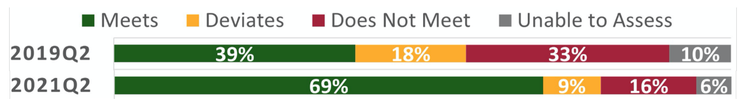
Forecasting for Immunization Test Suite Project



NIST has developed a web-based application that provides an integrated platform for authoring and managing Immunization CDS test cases, and direct testing of Immunization Forecast (CDS) engines

Implements a novel Fast Healthcare Interoperability Resources (FHIR)-based Forecast (CDS) engine interface developed by the community in collaboration with **NIST**

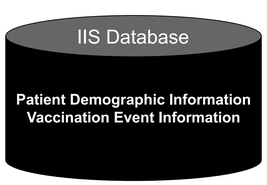
Measurement outcome over 2 years using FITS (Improvement)



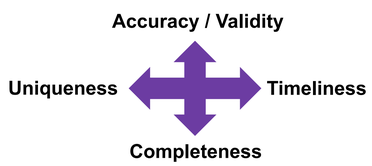
7 Quality of data stored in IISs

“The usefulness of an IIS is dependent on the quality of its data. Trustworthy data is needed for clinical decision-making, vaccine tracking and accountability, vaccination coverage assessments, and public health research.” - AIRA

IISs store data that includes and is not limited to the CDC endorsed data elements published in the IIS Functional Standards



Data Quality Dimensions



8 Needs and Challenges

Why measuring the quality of data at rest is important ?

Analyzing aggregated data on a large scale will allow us to identify data quality issue trends that give an indications on what areas need improvement and guide us in the creation of **focused** solutions to **fix and improve** data quality such as

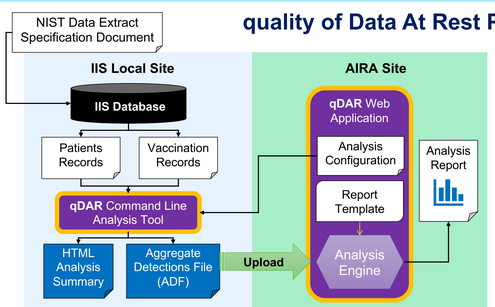
- Improving areas of communication and functional standards
- Identifying the source of data quality issues and fixing the problem upstream

Challenges of a uniform quality measurement of data in all state IISs ?

- **Data Format:** Each IIS stores data using different technologies
- **Data Size:** IISs Store millions of patient records
- **Confidentiality:** Allow for third party (AIRA) analysis of real patient records containing Personally Identifiable Information (PII)
- **Flexibility:** As metrics for data quality are bound to evolve, the tool must be flexible to evolve with it

9 qDAR

quality of Data At Rest Project



Developed by **NIST**, qDAR is the first project enabling uniform measurement of immunization data at the state IIS and national level

Consist of a **Command Line tool** and a **Web Application** to perform a **2-steps** data analysis allowing for a fast and confidentiality friendly data analysis

- **AIRA/CDC** has completed two pilot testing phases in 8 states using qDAR
  - 1st phase conducted at MCIR (Michigan Care Improvement Registry)
  - 2nd phase conducted with **7 other states**
  - Largest pilot site was California, with **1.4M patient records** measured

Reference Links (AIRA / CDC) https://www.cdc.gov/vaccines/programs/iis/cdsi.html https://repository.immregistries.org/files/resources/5c002cbde216d/aira_dq_guide_data_at_rest_-_final.pdf https://www.cdc.gov/vaccines/programs/iis/about.html https://repository.immregistries.org/resource/iis-assessment-aggregate-status-report-clinical-decision-support/ https://fits.nist.gov