

Towards Computable Guidelines and Beyond with FHIR

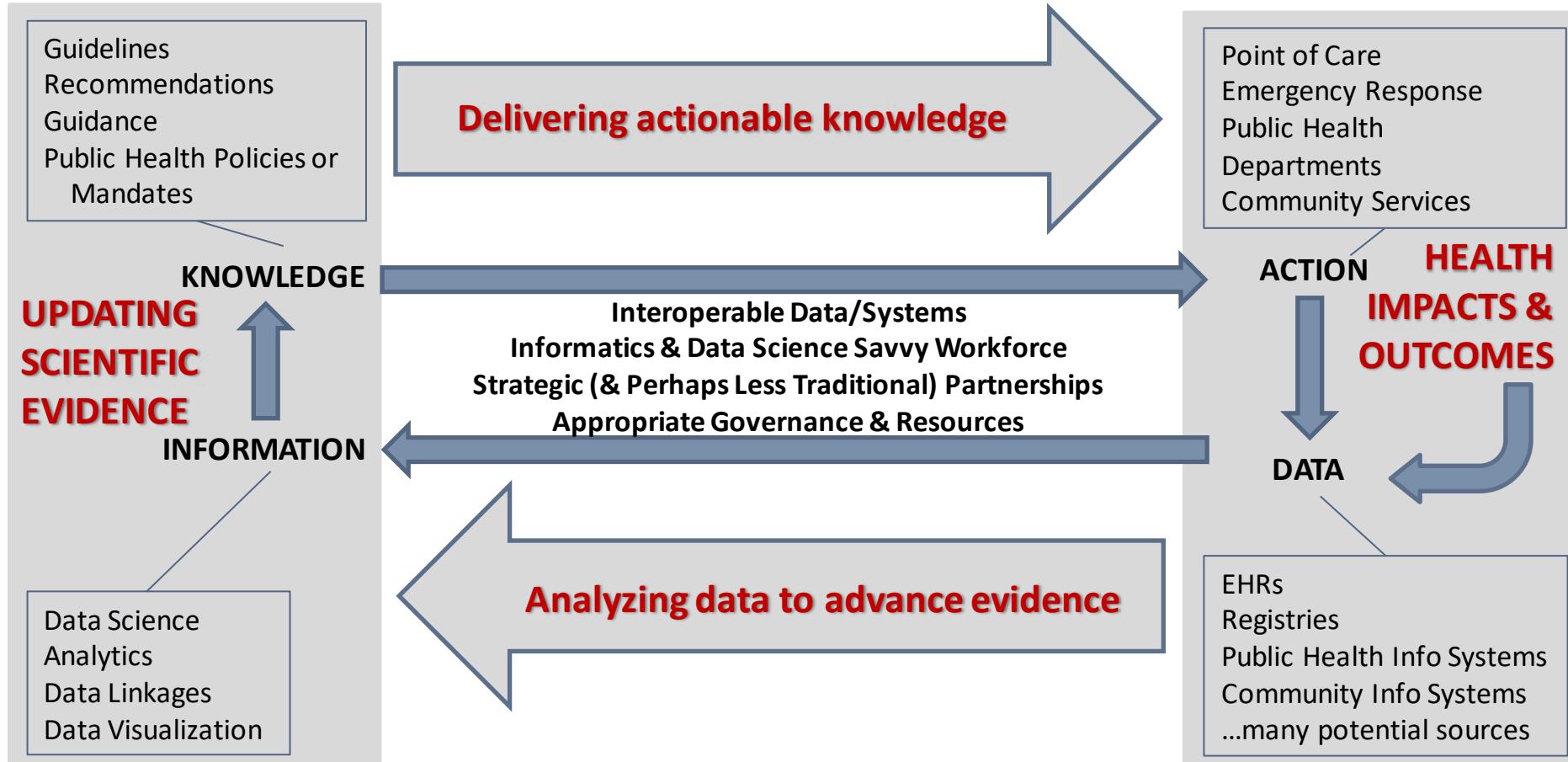
Maria Michaels

Public Health Advisor for the
Deputy Director of Public Health Science and Surveillance
Centers for Disease Control and Prevention

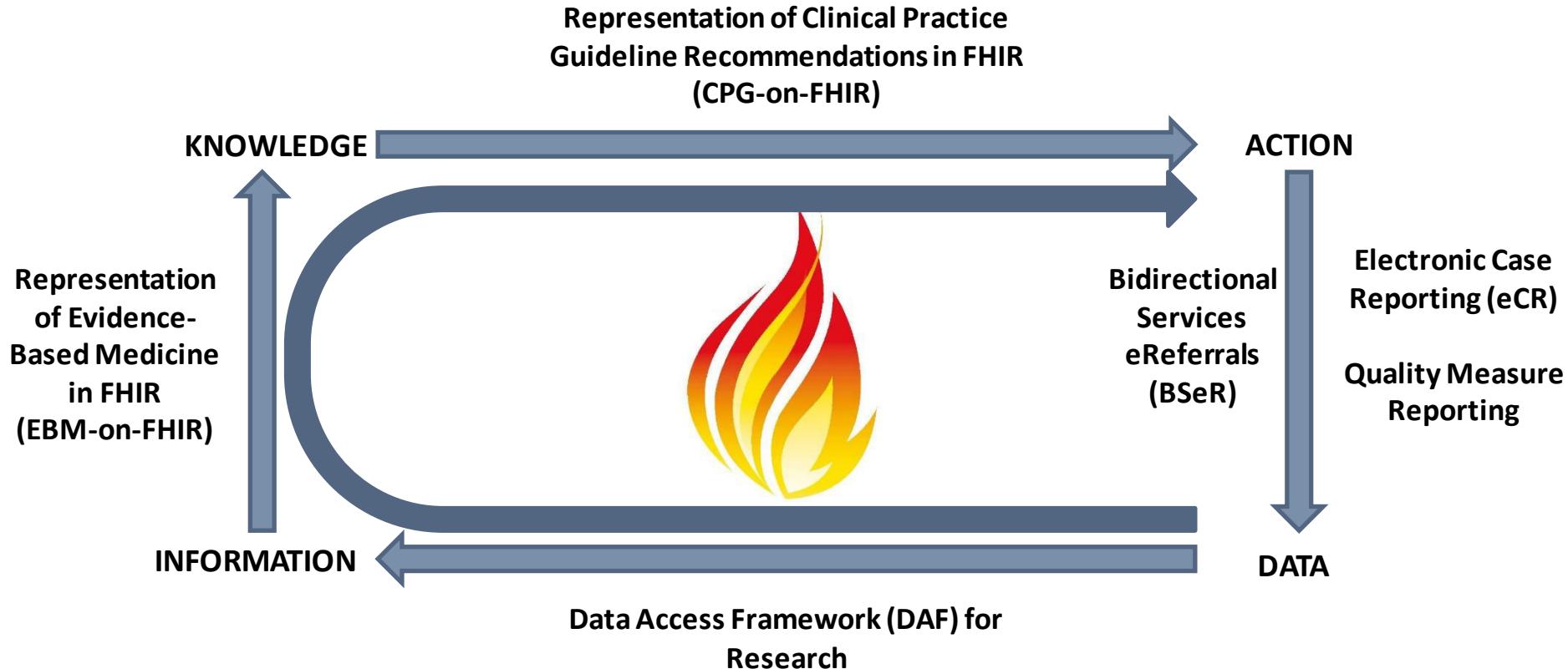


U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

The Data Lifecycle & Impacts to the Public's Health



How FHIR Facilitates the Data Lifecycle (examples)



NOTE: This is not an exhaustive list of examples

The Data Lifecycle & Impacts to the Public's Health

Guidelines
Recommendations
Guidance
Public Health Policies or Mandates

Delivering actionable knowledge

Point of Care
Emergency Response
Public Health
Departments
Community Services

KNOWLEDGE
UPDATING SCIENTIFIC EVIDENCE
INFORMATION

Data Science
Analytics
Data Linkages
Data Visualization

Analyzing data to advance evidence

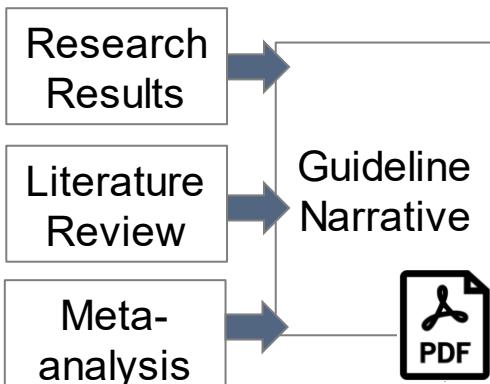
ACTION
HEALTH IMPACTS & OUTCOMES
DATA

EHRs
Registries
Public Health Info Systems
Community Info Systems
...many potential sources

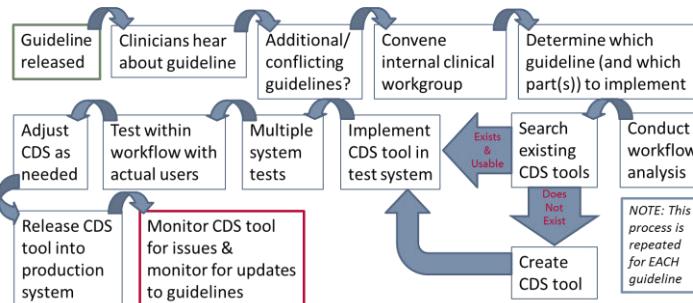
Today's Guideline Development and Implementation

Long Implementation Time

Develop guidelines



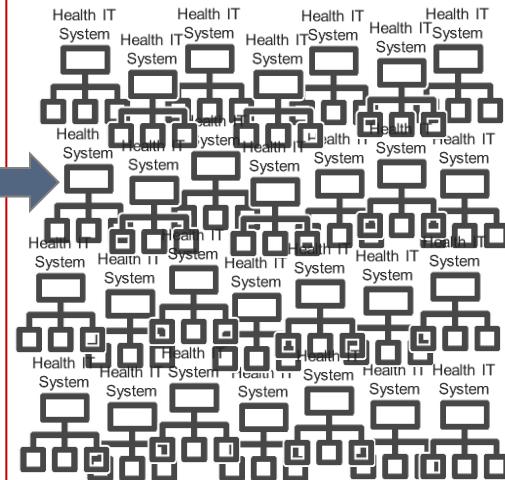
Interpret guidelines



Performed by up to 95% of ~5500 hospitals

Performed by up to 82% of ~355,000 clinics

Implement guidelines



<https://dashboard.healthit.gov/quickstats/quickstats.php>

Participating Stakeholder Groups

- Guideline authors
- Health IT developers
- Communicators
- Clinicians
- Patients / Patient Advocates
- Medical Societies
- Public Health Organizations
- Evaluation experts



- Standards experts
- Clinical decision support developers
- Clinical quality measure developers
- Policy or technical support for implementation

CDC Kaizen Event: Scope & Value Streams

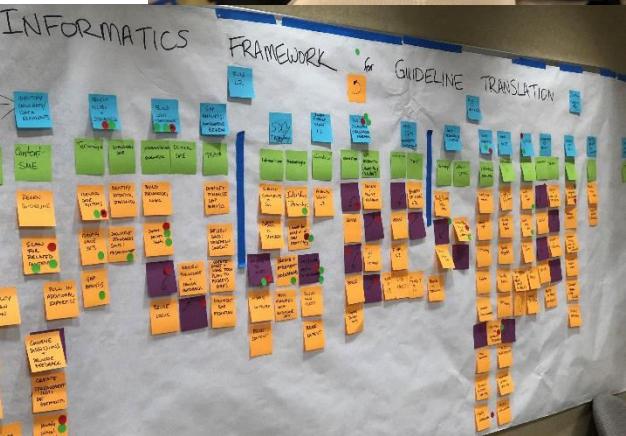
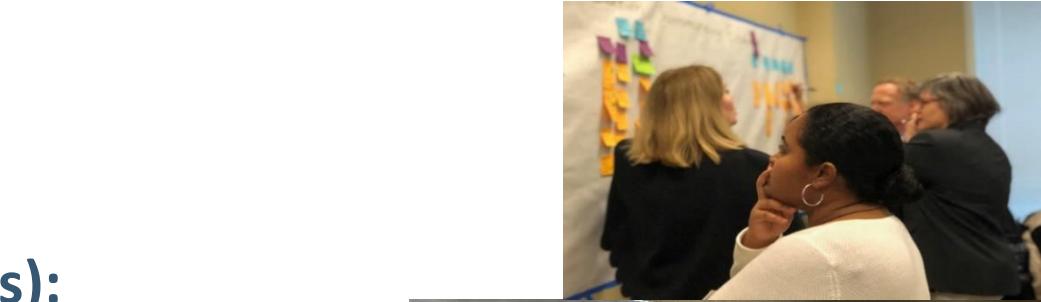


SCOPE:

- **START:** Guidelines Creation
- **END:** Evaluation

VALUE STREAMS (Focus Areas):

- Guidelines Creation
- Informatics
- Dissemination Tools and Communication
- Translation and Implementation
- Evaluation



Adapting Clinical Guidelines for the Digital Age

Problem: Long Lag Time, Inconsistencies, and Inaccuracies in Translation



Leads to an average of 17 years for scientific evidence to apply in patient care

Reason: Playing the “Telephone Game”



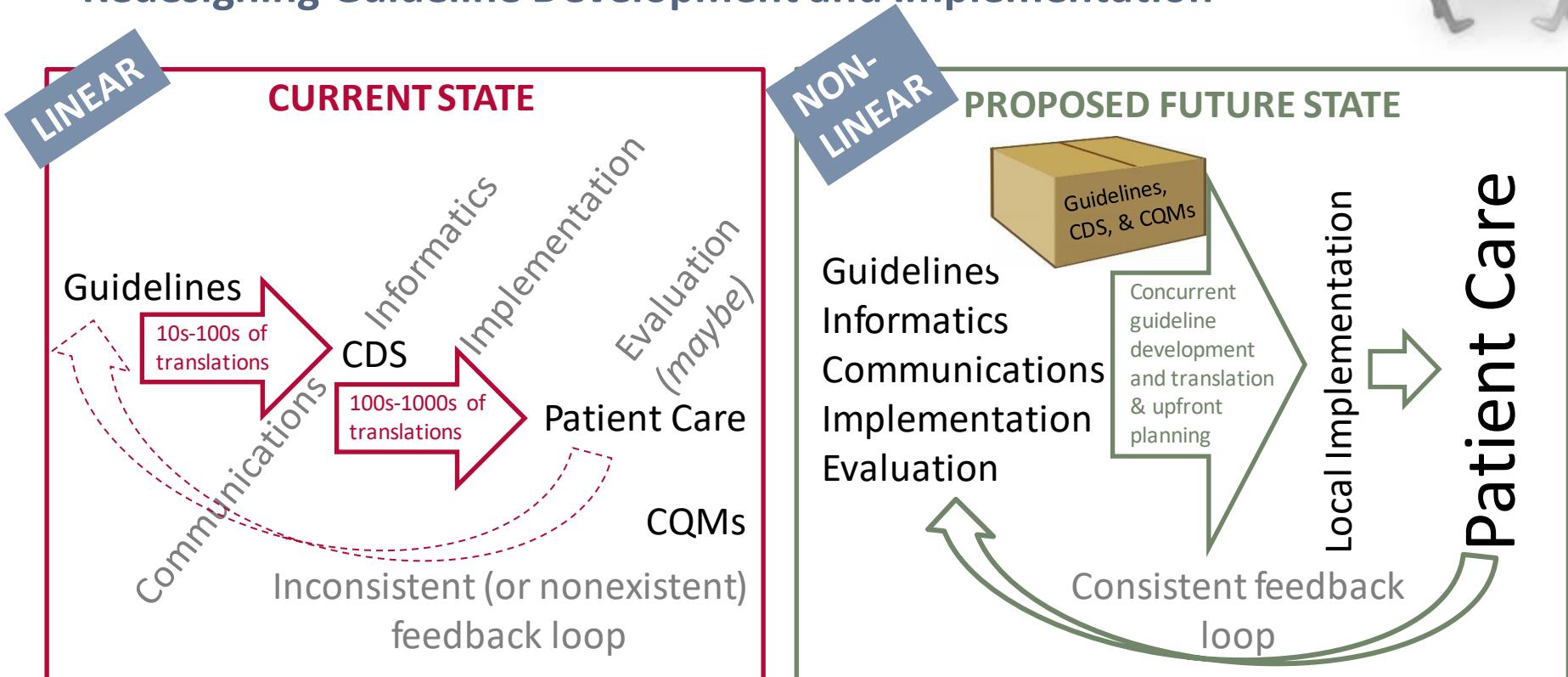
Multiple translations of guidelines add complexity, opportunity for error, and variation across sites/providers

Solution: Developing Tools and Guidelines Together

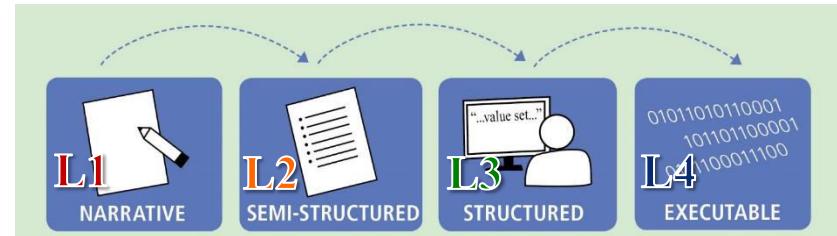


Can help evidence apply to patient care more easily, quickly, accurately, and consistently

Adapting Clinical Guidelines for the Digital Age: Redesigning Guideline Development and Implementation



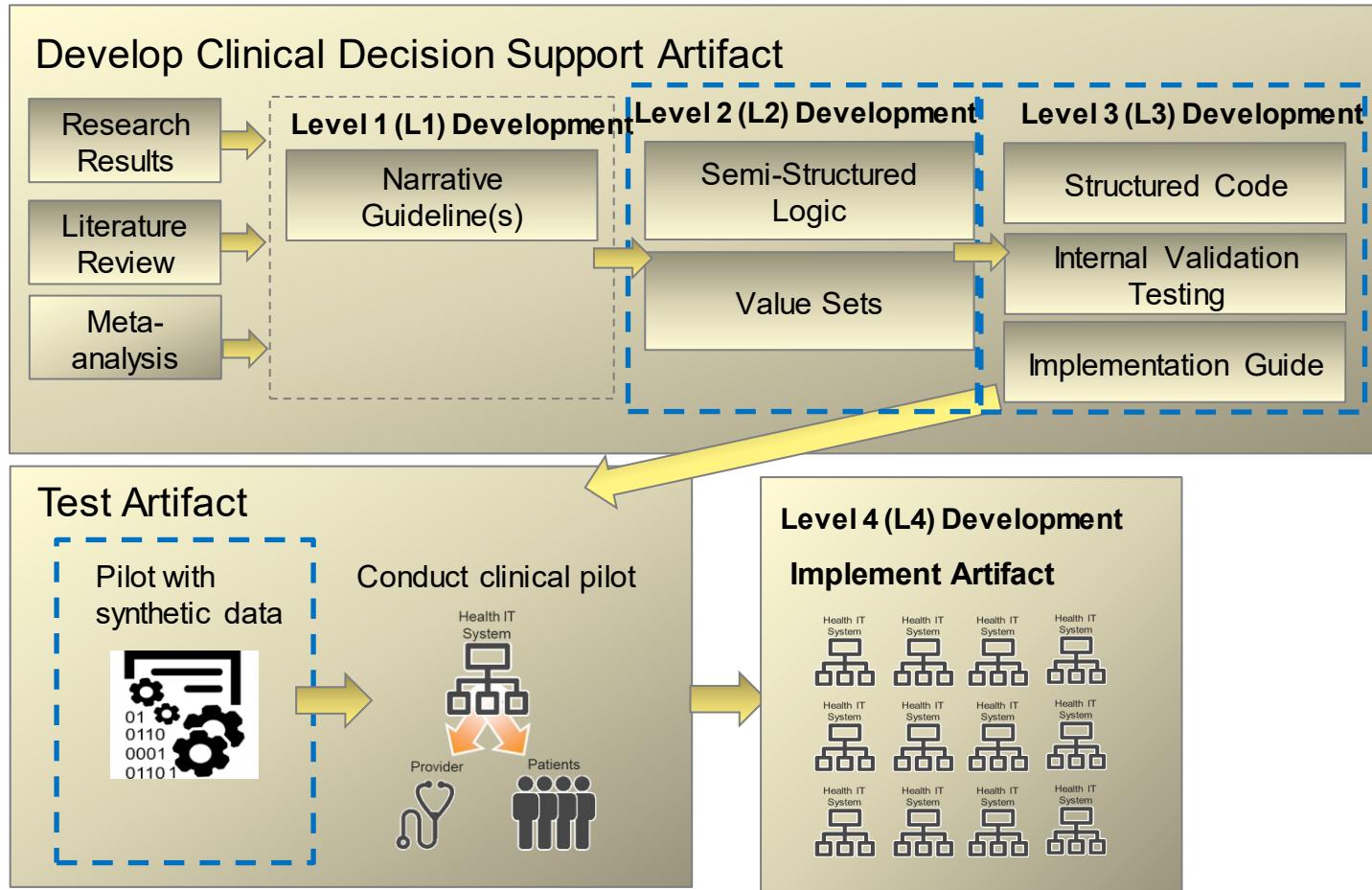
Translating Evidence to Executable CDS



Knowledge Level	Description	Example
L1	Narrative	Guideline for a specific disease that is written in the format of a peer-reviewed journal article
L2	Semi-structured	Flow diagram, decision tree, or other similar format that describes recommendations for implementation (HUMAN READABLE)
L3	Structured	Standards-compliant specification encoding logic with data model(s), terminology/code sets, value sets that is ready to be implemented (COMPUTER/MACHINE READABLE)
L4	Executable	CDS implemented and used in a local execution environment (e.g., CDS that is live in an electronic health record (EHR) production system) or available via web services

Learning from the Development of CDS for Anthrax Emergencies

Overarching CDS Development Approach



Level 2: Semi-structured Representation

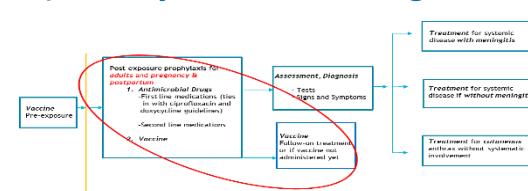


1. Identified Pertinent Guidelines
(17 total)



Anthrax Post-Exposure Prophylaxis (PEP) for Asymptomatic Patients

2. Developed Skeletal Clinical Flow to Visualize Guidelines & Focal Areas
(initially narrowed to 7 guidelines)



3. Assessed Guidelines per Defined Criteria
(selected 5 guidelines)



4. Assessed Recommendation Statement(s) to Derive Artifact

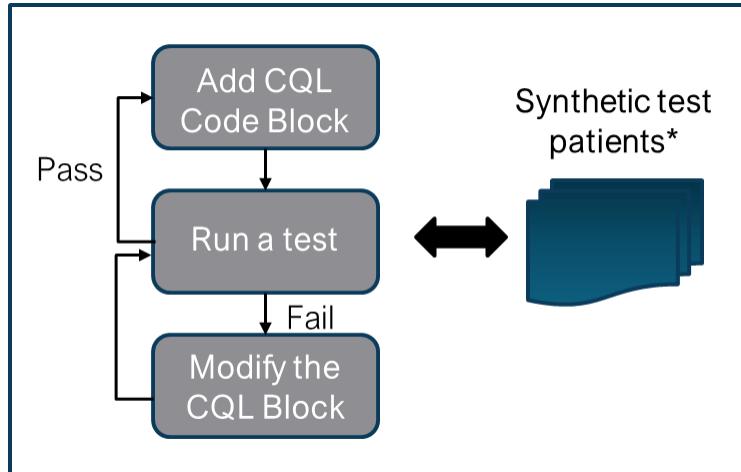
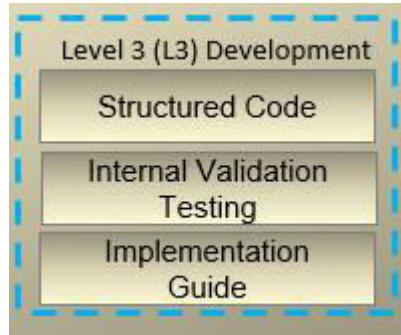


5. Documented Detailed Clinical Workflow with Semi-structured Representation of CDS



What if each clinical organization had to do this work?

Level 3: Iterative Development and Testing

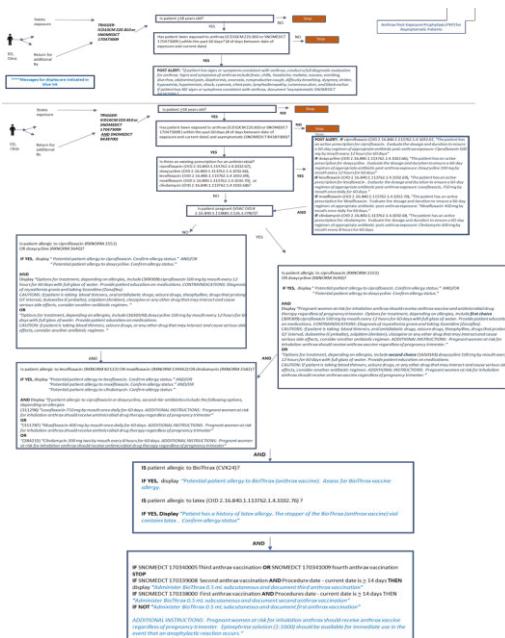


* Not the same as those used in synthetic pilot

- **Based on L2 semi-structured logic and value sets,**
 - Developed CDS code in the Clinical Quality Language (CQL) representation for clinical concepts, such as order sets and alerts
 - Incrementally tested (test-driven development)

Final Anthrax CDS for Anthrax Post-exposure Prophylaxis

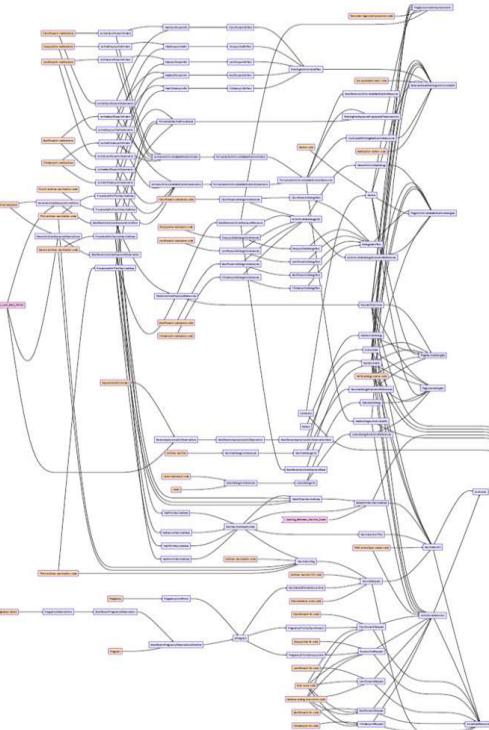
Detailed L2



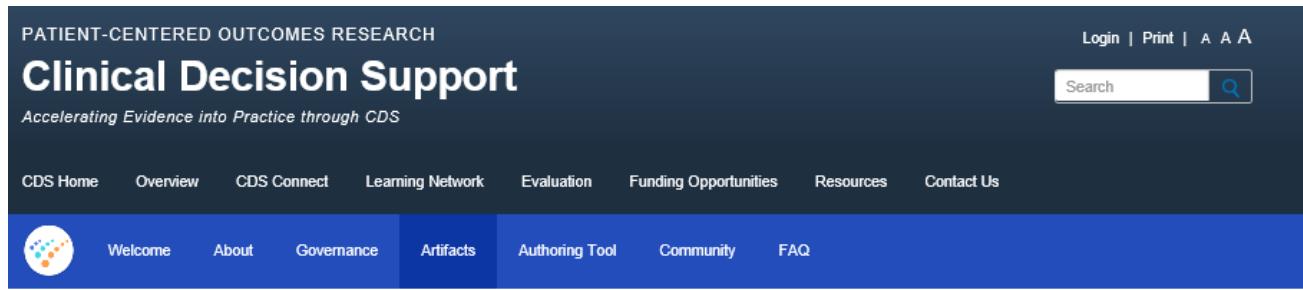
Complex CDS artifact with:

- 8 value sets
 - 105 CQL expressions
 - 232 dependencies
 - 1215 lines of code

Detailed L3



Anthrax CDS Published on CDS Connect



The screenshot shows the homepage of the Clinical Decision Support website. The header includes the text "PATIENT-CENTERED OUTCOMES RESEARCH" and "Clinical Decision Support" with the tagline "Accelerating Evidence into Practice through CDS". The top right features "Login | Print | A A A" and a search bar. The main navigation menu includes "CDS Home", "Overview", "CDS Connect", "Learning Network", "Evaluation", "Funding Opportunities", "Resources", and "Contact Us". Below the menu is a secondary navigation bar with links for "Welcome", "About", "Governance", "Artifacts" (which is the active tab, highlighted in blue), "Authoring Tool", "Community", and "FAQ". The page content area shows the "Anthrax Post-Exposure Prophylaxis" artifact details, including its description, artifact type (Multimodal), creation date (Thu, 10/25/2018 - 12:00), version (0.1), status (Draft), experimental status (True), and a link to the artifact page.

Anthrax Post-Exposure Prophylaxis

Provides information for treating patients greater than or equal to 18 years old exposed to anthrax within the past 60 days, who do not have anthrax. It is divided into two parts:

Part #1 - For patients that may be symptomatic to flag the need to conduct a full diagnostic evaluation to rule out anthrax before proceeding with post-exposure prophylaxis (PEP)

Part #2 - For patients who are asymptomatic (not displaying signs and symptoms of anthrax), it provides recommended PEP regimen

Artifact Type

 Multimodal

Creation Date

Thu, 10/25/2018 - 12:00

Version

0.1

Status

Draft

Experimental

True

- **Metadata**
- **CQL**
- **Built-in synthetic test patients**
- **Implementation guide**
- **Validation report**

<https://cds.ahrq.gov/cdsconnect/artifact/anthrax-post-exposure-prophylaxis>

Formalizing into a Framework Implementation Guide

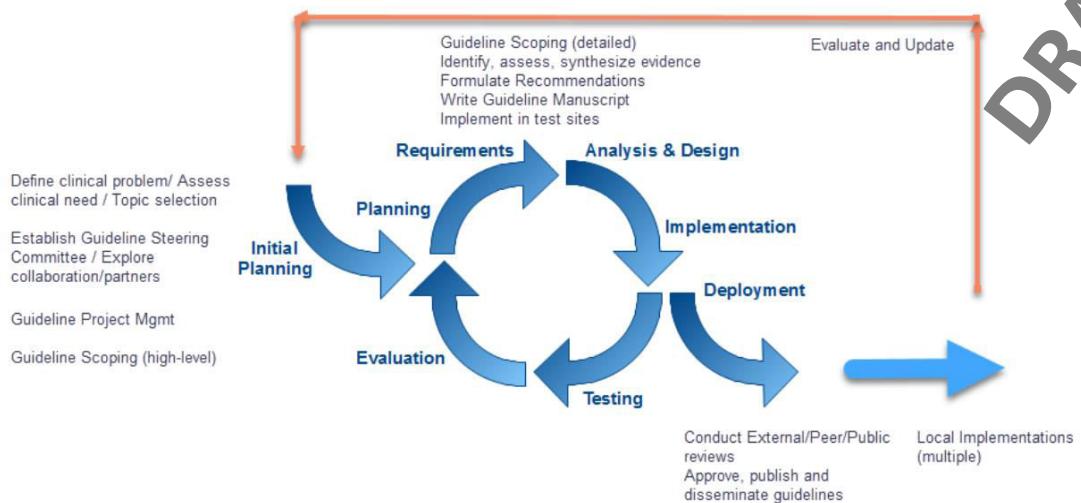
Implementation Guide: Representation of Clinical Practice Guideline Recommendations in FHIR

 FHIR[®]

Home Profiles Artifacts Terminology Examples Extensions Test Data Documentation Downloads L2 Checklist L3 Checklist Future State Tables

Representation of Clinical Practice Guideline Recommendations in FHIR

1.0.0 Representation of Clinical Practice Guideline Recommendations in FHIR



DRAFT

“CPG-on-FHIR”

Targeted for ballot:
September 2019

Related FHIR DevDays Sessions

- For more detail and hands-on application, consider attending:
 - **Mechanics of FHIR in Reporting and Referrals** (PUBLIC HEALTH – Arun Srinivasan, John Loonsk)
 - **FHIR in Population Health Ecosystem** (PUBLIC HEALTH – John Loonsk, Jason Hall)
 - **Next Generation Quality Measurement with FHIR** (QUALITY MEASURES – Ben Hamlin/Sam Sayer)
 - ***Let's build!* Next Generation Quality Reporting with FHIR** (QUALITY MEASURES – Bryn Rhodes)
 - ***Let's build!* CDS Hooks Services** (CLINICAL – Dennis Patterson)
 - **A Computable Guideline in FHIR: Opioid Prescribing Support** (CDS – Bryn Rhodes, Maria Michaels)
 - ***Let's build!* Clinical Practice Guideline Recommendations with FHIR** (CDS – Bryn Rhodes)

For questions or more information please contact:
Maria Michaels – maria.michaels@cdc.gov

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention