

# Towards Computable Guidelines and Beyond with FHIR

**Maria Michaels**

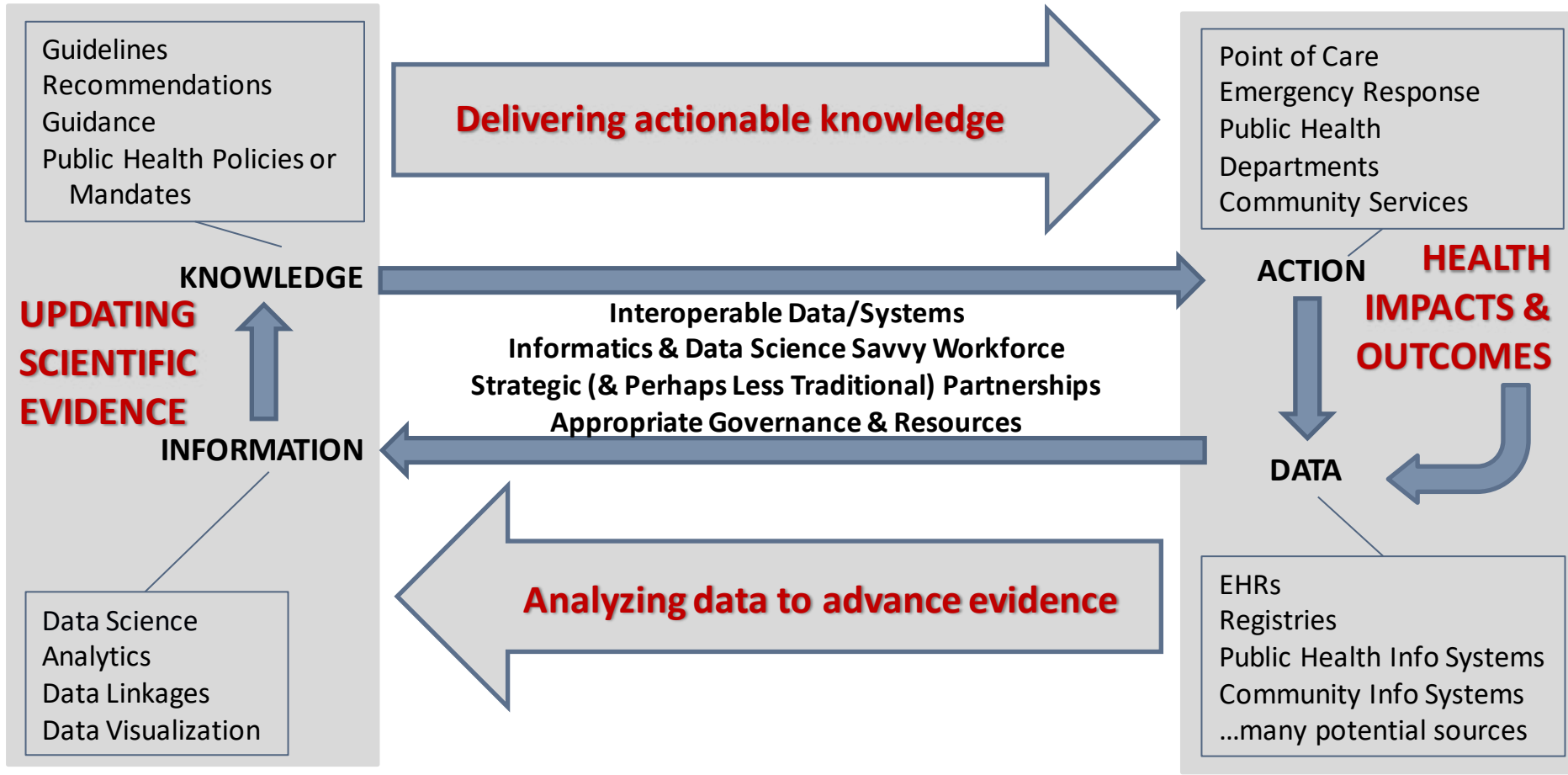
**Public Health Advisor for the**

**Deputy Director of Public Health Science and Surveillance**

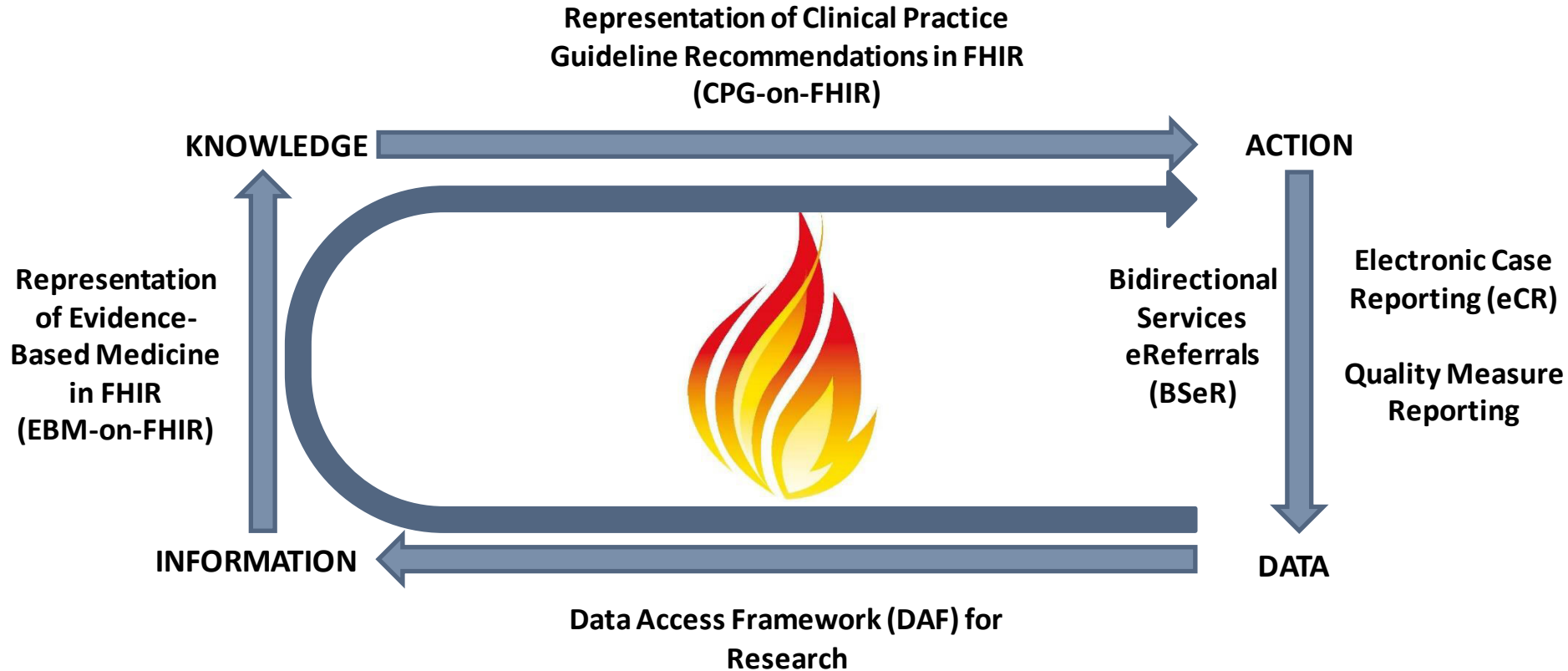
**Centers for Disease Control and Prevention**



# The Data Lifecycle & Impacts to the Public's Health

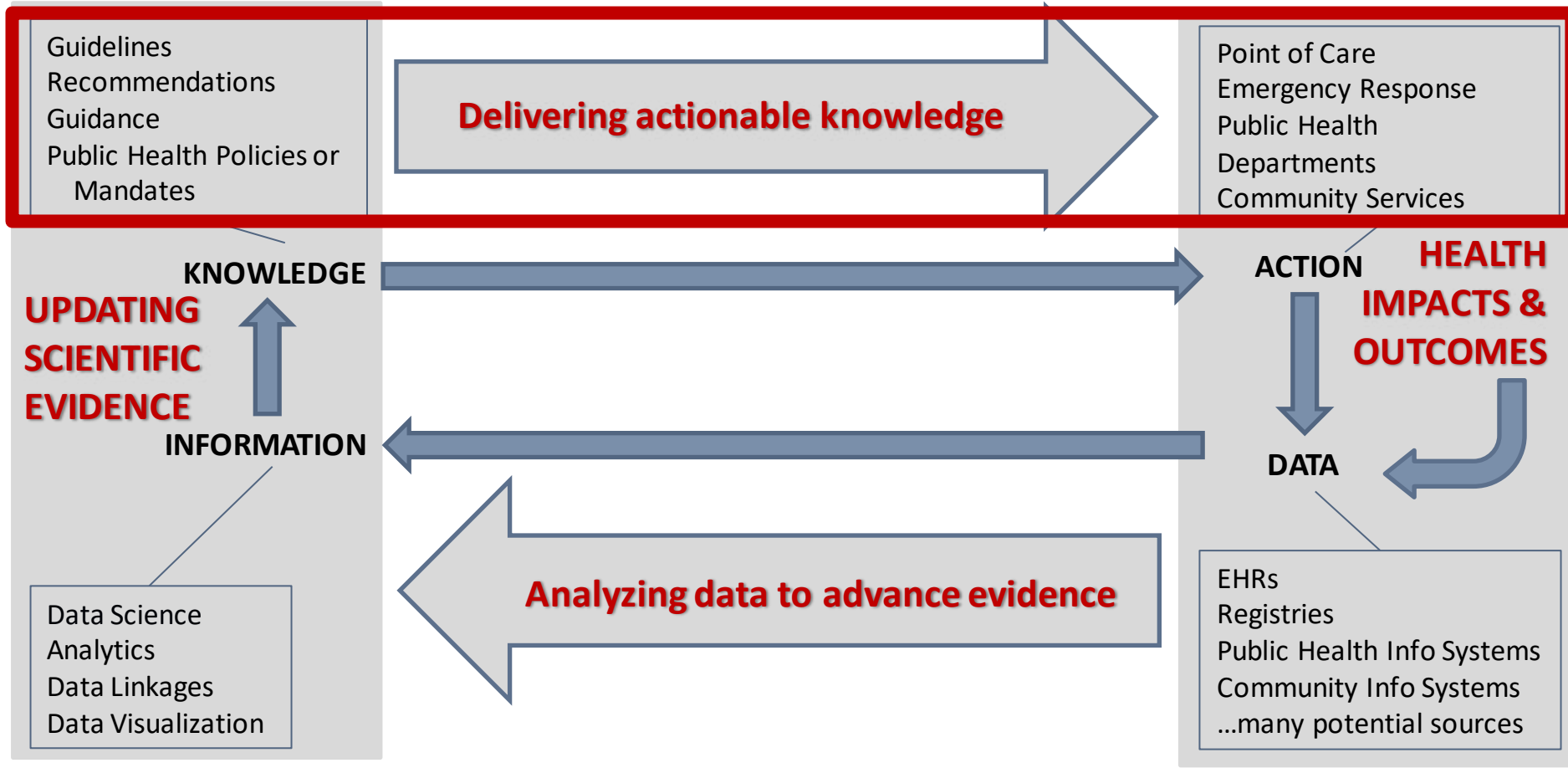


# How FHIR Facilitates the Data Lifecycle (examples)



NOTE: This is not an exhaustive list of examples

# The Data Lifecycle & Impacts to the Public's Health



# Today's Guideline Development and Implementation

Long Implementation Time

## Develop guidelines

Research  
Results

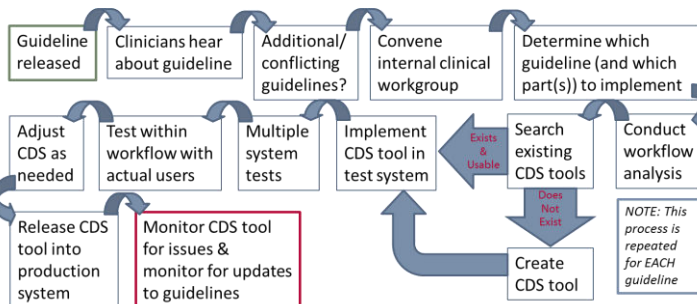
Literature  
Review

Meta-  
analysis

Guideline  
Narrative



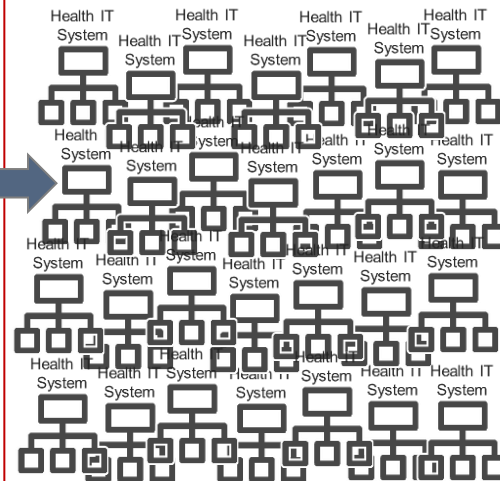
## Interpret guidelines



Performed by up to 95% of ~5500 hospitals  
Performed by up to 82% of ~355,000 clinics

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

## Implement guidelines



# 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



LINEAR

CURRENT STATE

Guidelines

10s-100s of translations

CDS

100s-1000s of translations

Patient Care

CQMs

Inconsistent (or nonexistent) feedback loop

Communications  
Informatics  
Implementation  
Evaluation (maybe)

NON-LINEAR

PROPOSED FUTURE STATE

Guidelines,  
CDS, & CQMs

Guidelines  
Informatics  
Communications  
Implementation  
Evaluation

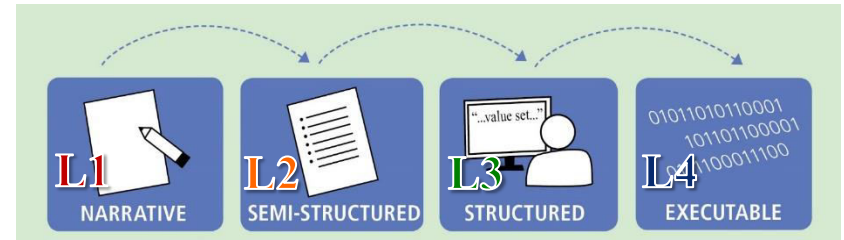
Concurrent guideline development and translation & upfront planning

Local Implementation

Patient Care

Consistent feedback loop

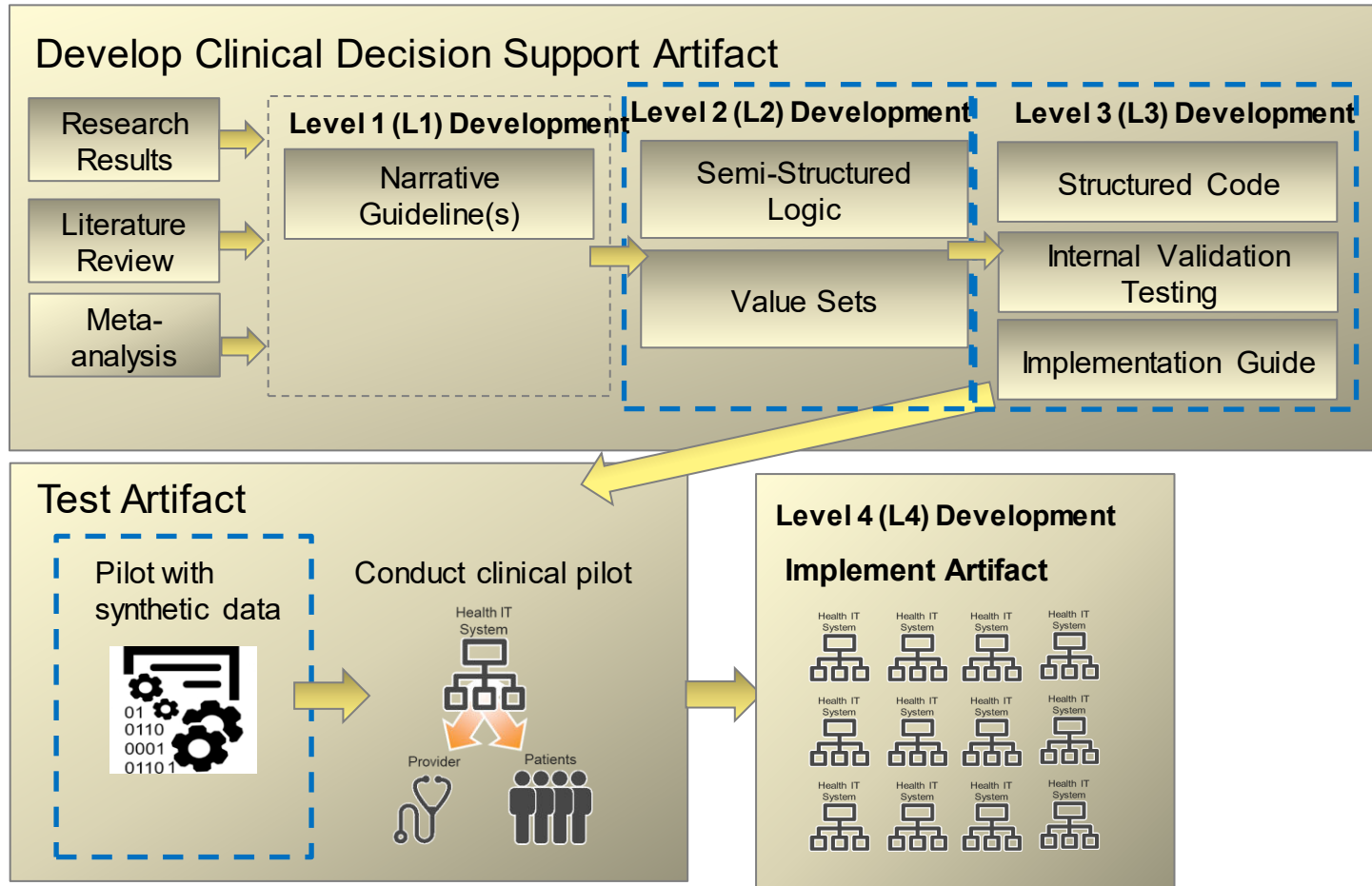
# Translating Evidence to Executable CDS



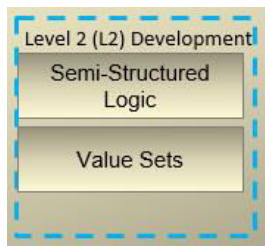
Knowledge Level	Description	Example
L1	Narrative	Guideline for a specific disease that is written in the format of a peer-reviewed journal article
L2	Semi-structured	Flow diagram, decision tree, or other similar format that describes recommendations for implementation ( <b>HUMAN READABLE</b> )
L3	Structured	Standards-compliant specification encoding logic with data model(s), terminology/code sets, value sets that is ready to be implemented ( <b>COMPUTER/MACHINE READABLE</b> )
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

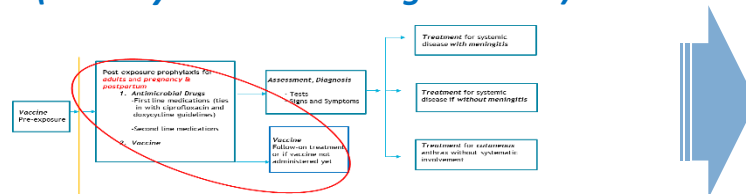


# Level 2: Semi-structured Representation



Anthrax Post-Exposure Prophylaxis (PEP) for Asymptomatic Patients

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



## 1. Identified Pertinent Guidelines (17 total)

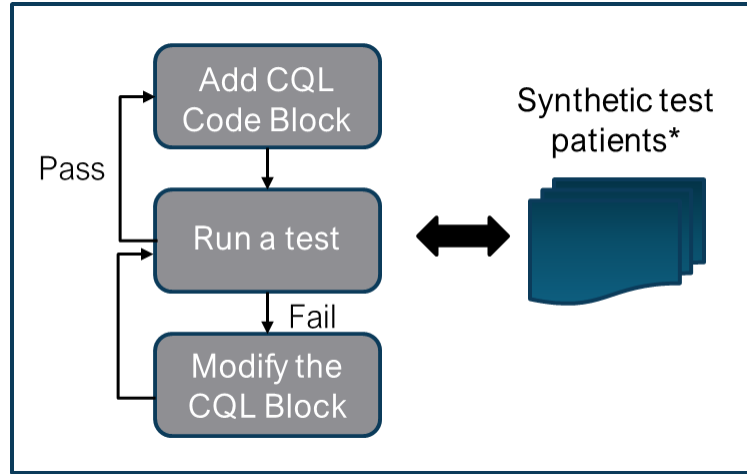
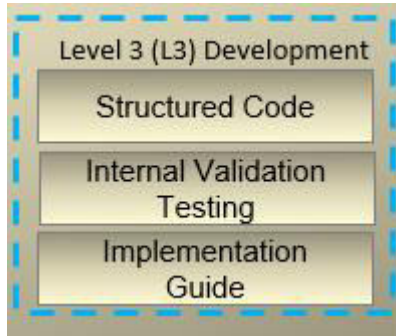
## 4. Assessed Recommendation Statement(s) to Derive Artifact

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

## 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

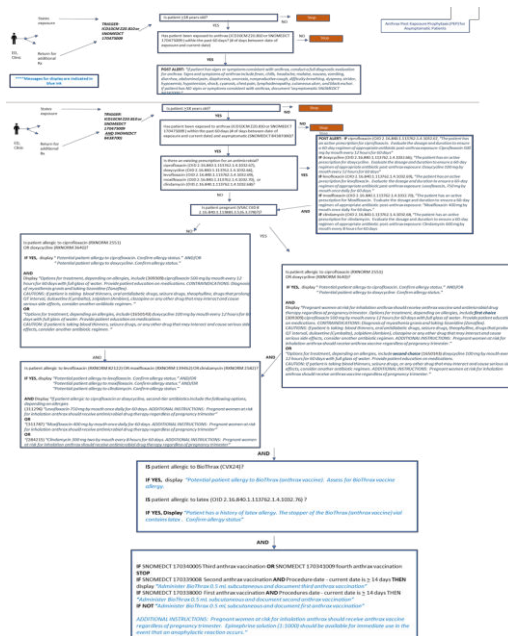


\* Not the same as those used in synthetic pilot

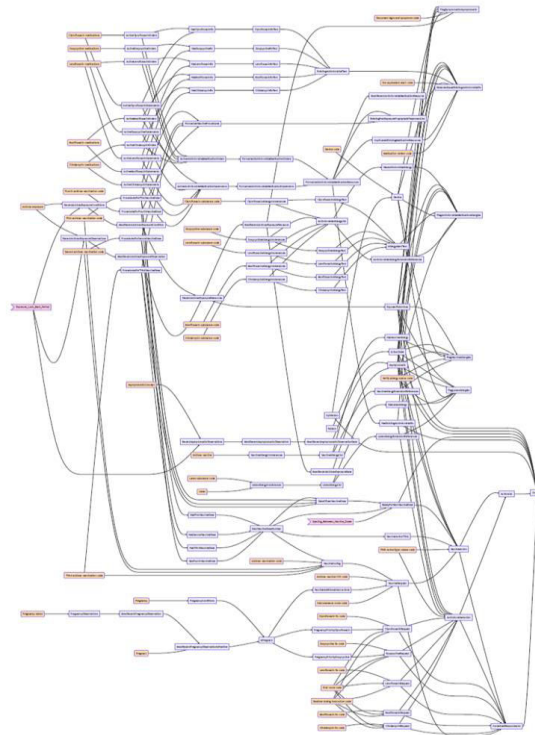
- **Based on L2 semi-structured logic and value sets,**
  - Developed CDS code in the Clinical Quality Language (CQL) representation for clinical concepts, such as order sets and alerts
  - Incrementally tested (test-driven development)

# Final Anthrax CDS for Anthrax Post-exposure Prophylaxis

## Detailed L2



## Detailed L3



**Complex CDS artifact with:**

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



# Anthrax CDS Published on CDS Connect


PATIENT-CENTERED OUTCOMES RESEARCH

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## Clinical Decision Support

Accelerating Evidence into Practice through CDS

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## 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

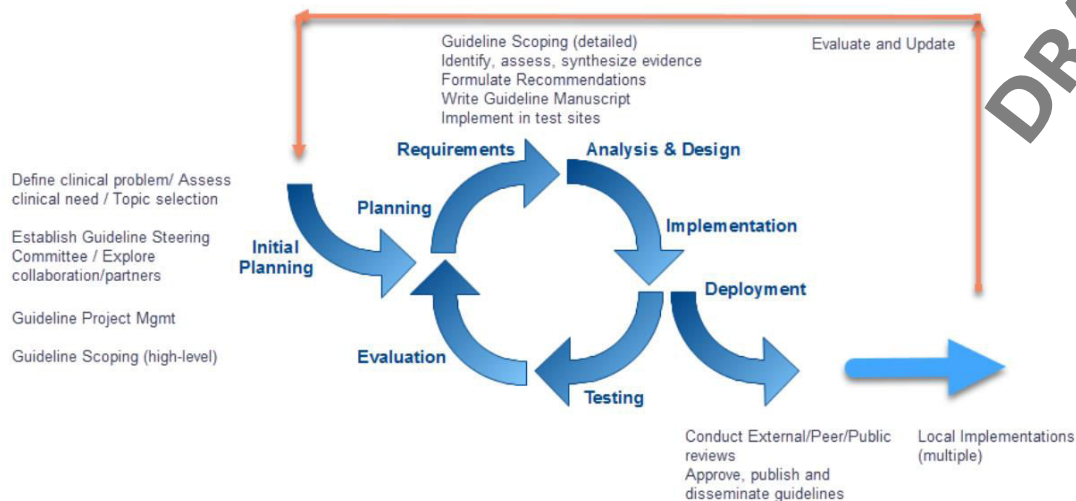
# Implementation Guide: Representation of Clinical Practice Guideline Recommendations in FHIR



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 🌐



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



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