How to develop and test guidelines with FHIR and CQL

Dec 3, 2025 – **Ward Weistra**

xShare Working Group on Care Plans

Who am I?

Ward Weistra

- Product lead at **Firely**
- Head of programming for FHIR DevDays at **Firely**
- Member of the FHIR Management Group at HL7 **International**

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We need open standards for Clinical Practice Guidelines

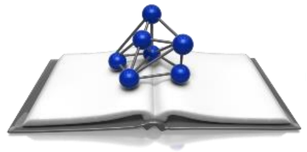
- Open health data APIs (e.g. FHIR) are encouraging competition and innovation
  - Prevent monopolies and expensive one-off integrations
  - Faster innovation on the applications: prediction models, innovative specialized interfaces, etc.

- Open standards can do the same for clinical knowledge
  - Right now, every knowledge organization producing guidelines needs to…
    - Define CPG format
    - Create CPG editor / visualizer
    - Create execution engine
    - One-off integration projects with every care provider
  - Let them focus on the content, not to be a full-stack software company!

The Quality Improvement Ecosystem in FHIR

EBM

1. RESEARCH, PAYER/INSURANCE & PUBLIC HEALTH SURVEILLANCE



CPG IG

2. GUIDELINES
(Professional Societies, CDC, etc.)

CDS Hooks

3. CLINICAL DECISION SUPPORT

Patient, provider, population, public

CR

QI Core

CQL

4. CLINICAL CARE

DEQM

5. MEASUREMENT ANALYTICS

QM IG

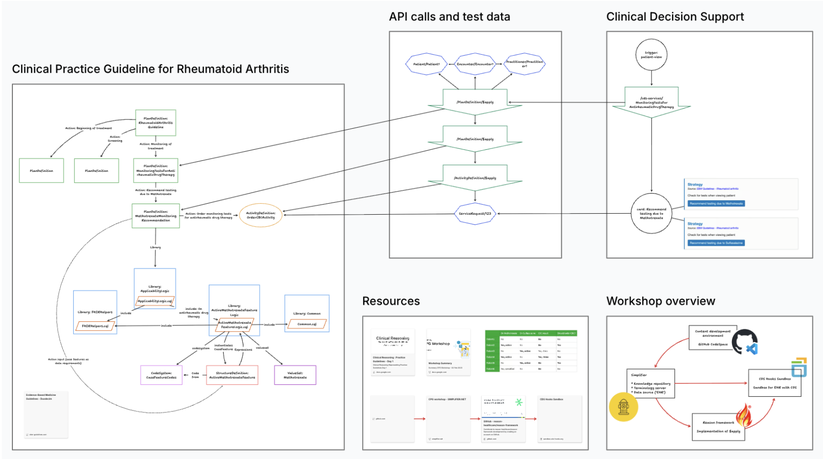
6. REPORTING

eCR

firely

Clinical Guidelines in CQL and FHIR

An example of clinical decision support with a guideline



Guideline

- **Pathway**: Rheumatoid Arthritis guideline
  - **Strategy**: Beginning of treatment
  - **Strategy**: Screening
  - **Strategy**: Monitoring of treatment
    - **Recommendation**: Methotrexate Monitoring
      - When on Methotrexate, monitor Complete Blood Count (CBC) every 6 months

FHIR and CQL

- **PlanDefinition**: Rheumatoid Arthritis guideline
  - **PlanDefinition**: Beginning of treatment
  - **PlanDefinition**: Screening
  - **PlanDefinition**: Monitoring of treatment
    - **PlanDefinition**: Methotrexate Monitoring
      - **CQL logic**: When on Methotrexate and no CBC in last 6 months, recommend ordering a CBC
      - → **ActivityDefinition**: Order CBC
      - → **ServiceRequest**: CBC

Conclusions

- **CQL and FHIR's Quality Improvement framework** are rapidly gaining adoption
  - US is leading with CQL based measures by NCQA and CMS
  - Multiple full CQL engines now exist: Smile, Firely, Blaze, Google, …
    - Aligned in the Digital Quality Implementers Community (DQIC)
  - "Computable guideline, measures and other knowledge content in HL7 FHIR" session at the HL7 Europe WGM 2025 Lisbon.

- Biggest challenges and where **xShare / EHDS** can help:
  1. Encourage/mandate support for open Clinical Decision Support standards
  2. Continue to encourage/mandate open data APIs
     - Care plans as a health data category
  3. Encourage an open, competitive clinical logic ecosystem to let knowledge providers focus on content
     - Break the chicken-egg problem of content and tools
     - Knowledge editors / visualization to translate narrative guidelines to computable
     - CDS/CQL/CarePlan execution engines

Thanks to Brian Kaney (ReasonHub/Vermonster), Joonas Mäkinen and Joonatan Vuorinen (Duodecim) and the CQF community.

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Guidelines with FHIR and CQL

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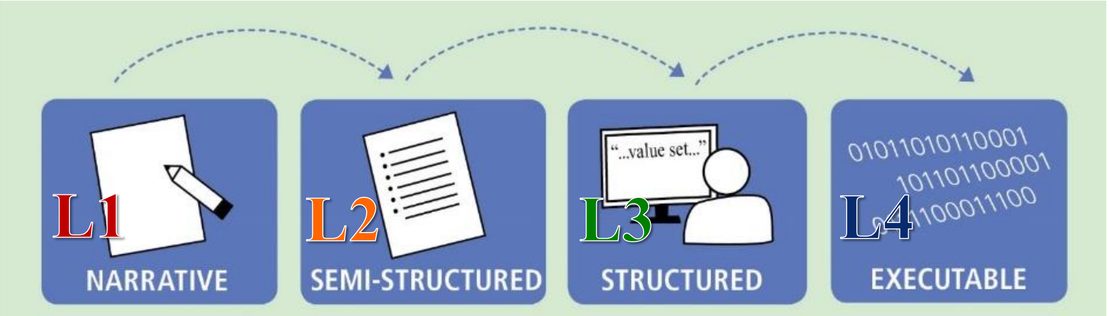

Knowledge Level	Description	Example
L1	Narrative	Guideline for a specific disease that is written in the format of a peer-reviewed journal article
L2	Semi-structured	Flow diagram, decision tree, or other similar format that describes recommendations for implementation **(HUMAN READABLE)**
L3	Structured	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

Guidelines with FHIR and CQL

Adapted from: Boxwala, AA, et al.. A multi-layered framework for disseminating knowledge for computer-based decision support. *J Am Med Inform Assoc* 2011(18) i132-i139.

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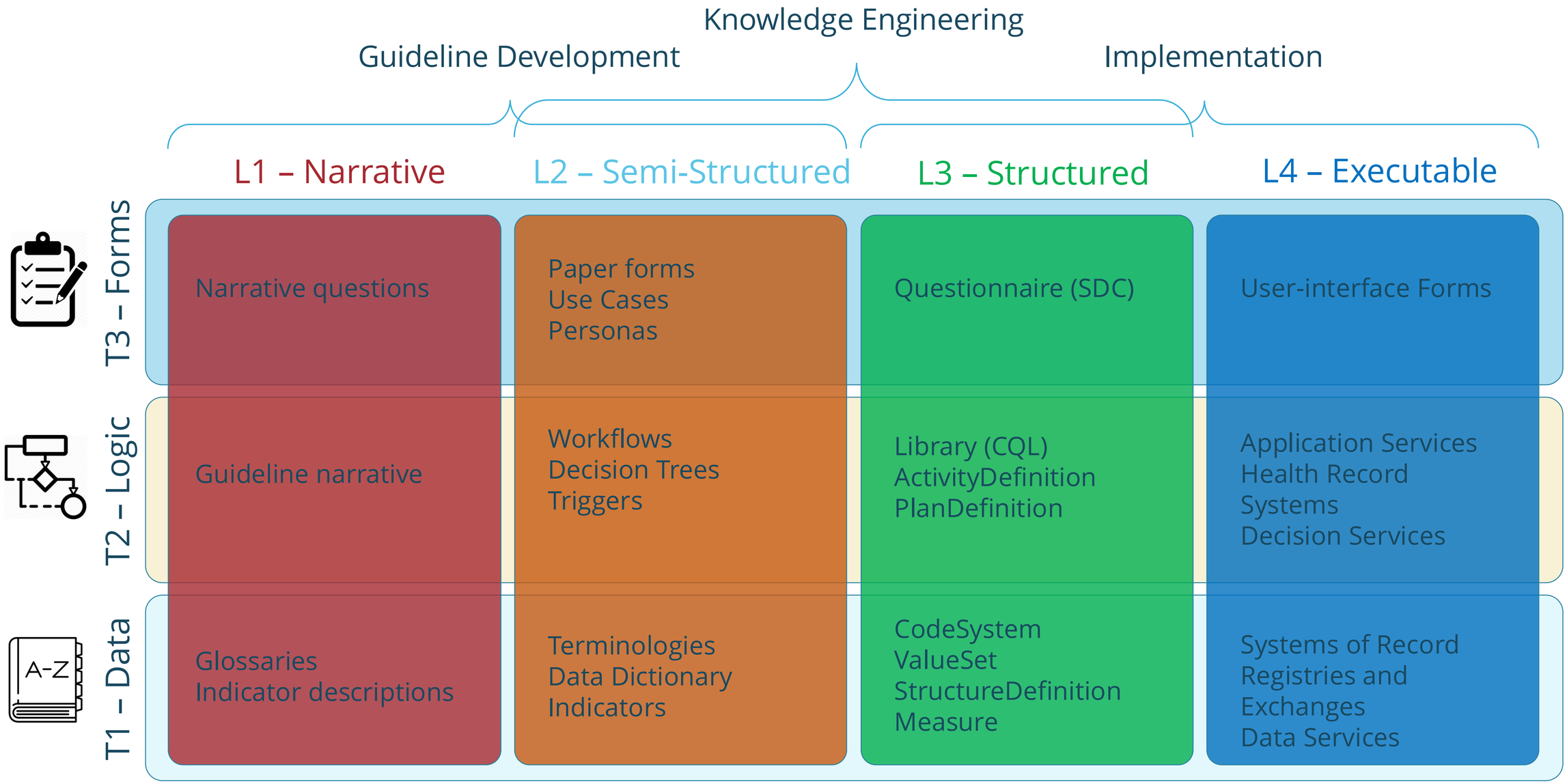
T1 

T2 
T3 

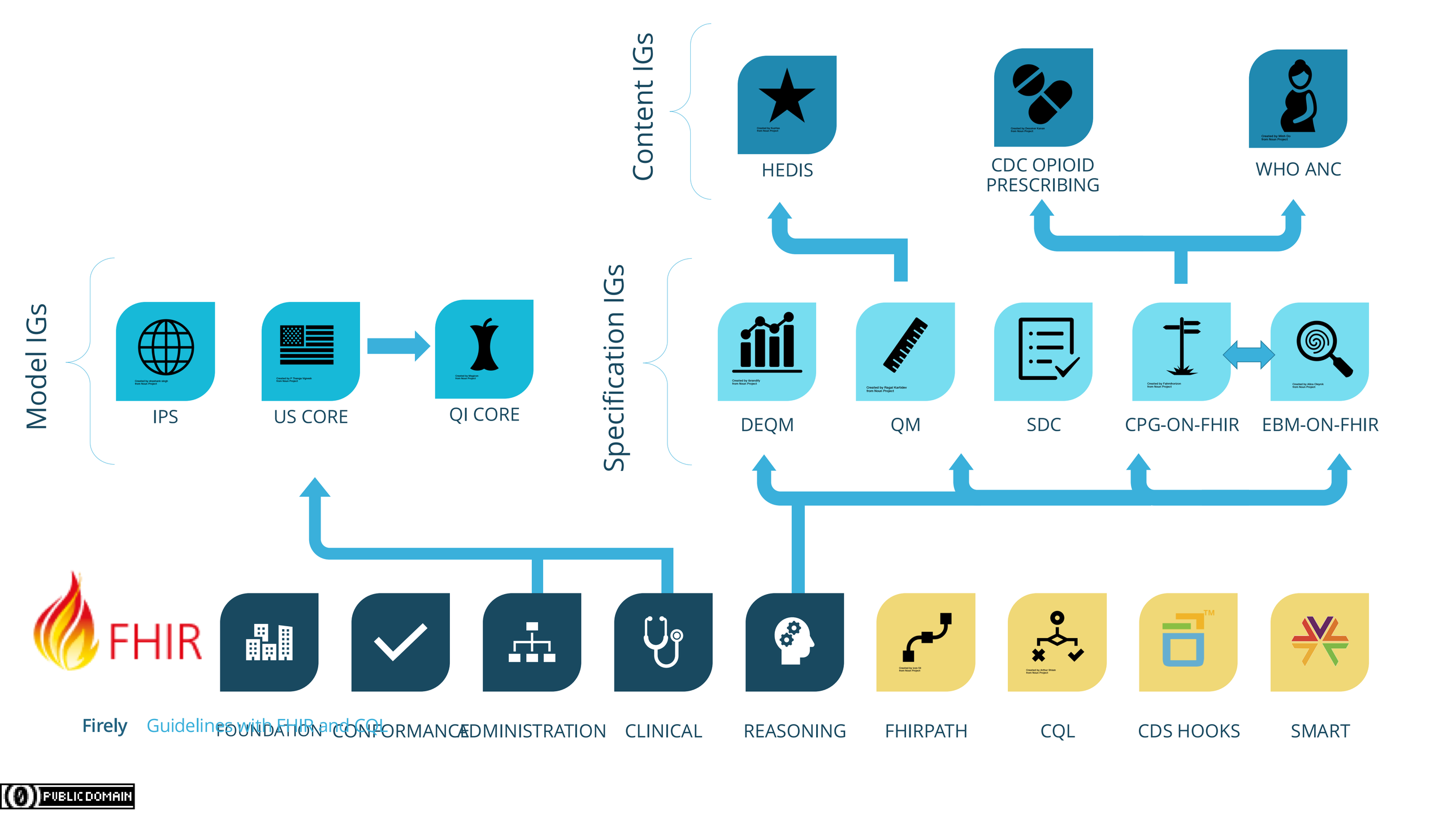
Tier	Description	Example
T1	Data	Glossaries, data elements and dictionaries, terminologies, data access services
T2	Logic	Guideline narrative, workflows, libraries, application services
T3	Forms	Use cases, personas, questionnaires, and user-interfaces

Adapted from: Boxwala, AA, et al.. A multi-layered framework for disseminating knowledge for computer-based decision support. *J Am Med Inform Assoc* 2011(18) i132-i139.



Guidelines with FHIR and CQL

Boxwala, A. A., Rocha, B. H., Maviglia, S., Kashyap, V., Meltzer, S., Kim, J., Tsurikova, R., Wright, A., Paterno, M. D., Fairbanks, A., & Middleton, B. (2011). A multi-layered framework for disseminating knowledge for computer-based decision support. *Journal of the American Medical Informatics Association : JAMIA*, *18 Suppl 1*(Suppl 1), i132–i139. https://doi.org/10.1136/amiajnl-2011-000334



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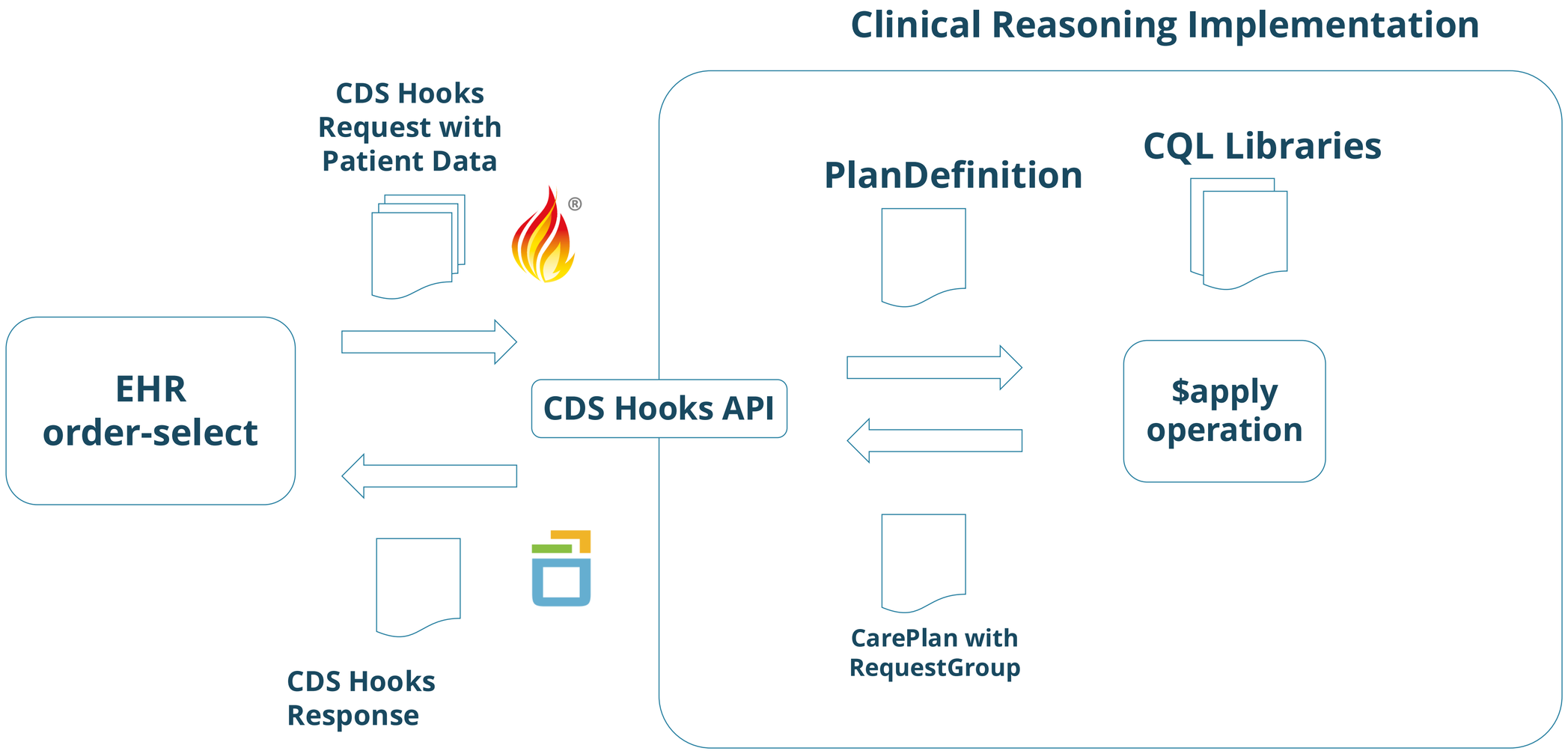
1. **Use CQL as a specification** *(manual development)*
   Developers will still need to hand code own code based off of that published “L3” CQL. Although, the most time consuming option, this is still faster than starting from the narrative artifacts “L1”

2. **Translate CQL** *(automated translation)*
   Translate “L3” CQL into the code base used in the current legacy system

3. **Consume CQL** *(native implementation)*
   Directly intake “L3” CQL artifacts natively


Clinical Reasoning Implementation
CDS Hooks Request with Patient Data
EHR order-select
CDS Hooks API
PlanDefinition
CQL Libraries
$apply operation
CarePlan with RequestGroup
CDS Hooks Response