Office of the National Coordinator for Health Information Technology

ONC Tech Forum
Clinical Decision Support Series
Session #2

The Future of CDS (part 1)

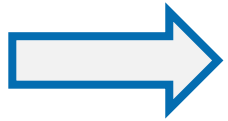
Sept. 27, 2023

Upcoming workshop

Session #3 Creating Value by Modernizing and Measuring Clinical Decision Support

- **Wednesday, Nov. 8, 2023, 12 p.m. – 3 p.m. ET**
- This session will discuss how new technologies can add value to CDS and how the impact of CDS can be measured and evaluated.
- Registration is open.

More information about workshops here



Agenda

- CDS Hooks and SMART apps
- CDS Connect

CDS Hooks and SMART apps

Isaac Vetter, Epic

CDS Hooks & SMART Apps

ONC Tech Forum: CDS, Sept 2023

isaac vetter, *epic*

CDS Hooks & SMART Apps

- **CDS Hooks Intro & Roadmap**
- Nuts & Bolts of SMART on FHIR

… realtime, clinician-facing, remote decision support

- simple HTTP APIs using FHIR
- standardized clinical workflow via hooks

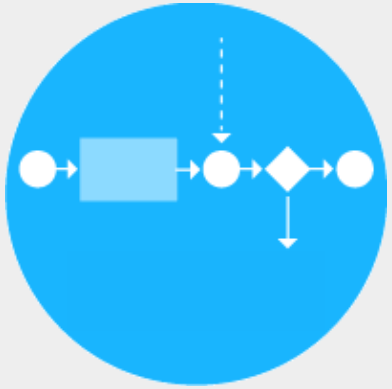
CDS Service

A service that is:

invoked via a **hook**,

evaluates **its own logic** using FHIR data,

returns decision support via **cards**



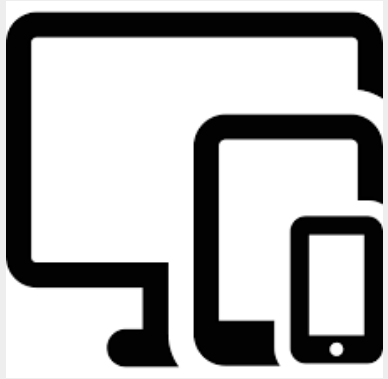
CDS Client

A CPOE or EHR or other clinical workflow system that:

invokes CDS Service via a **hook**,

consumes decision support,

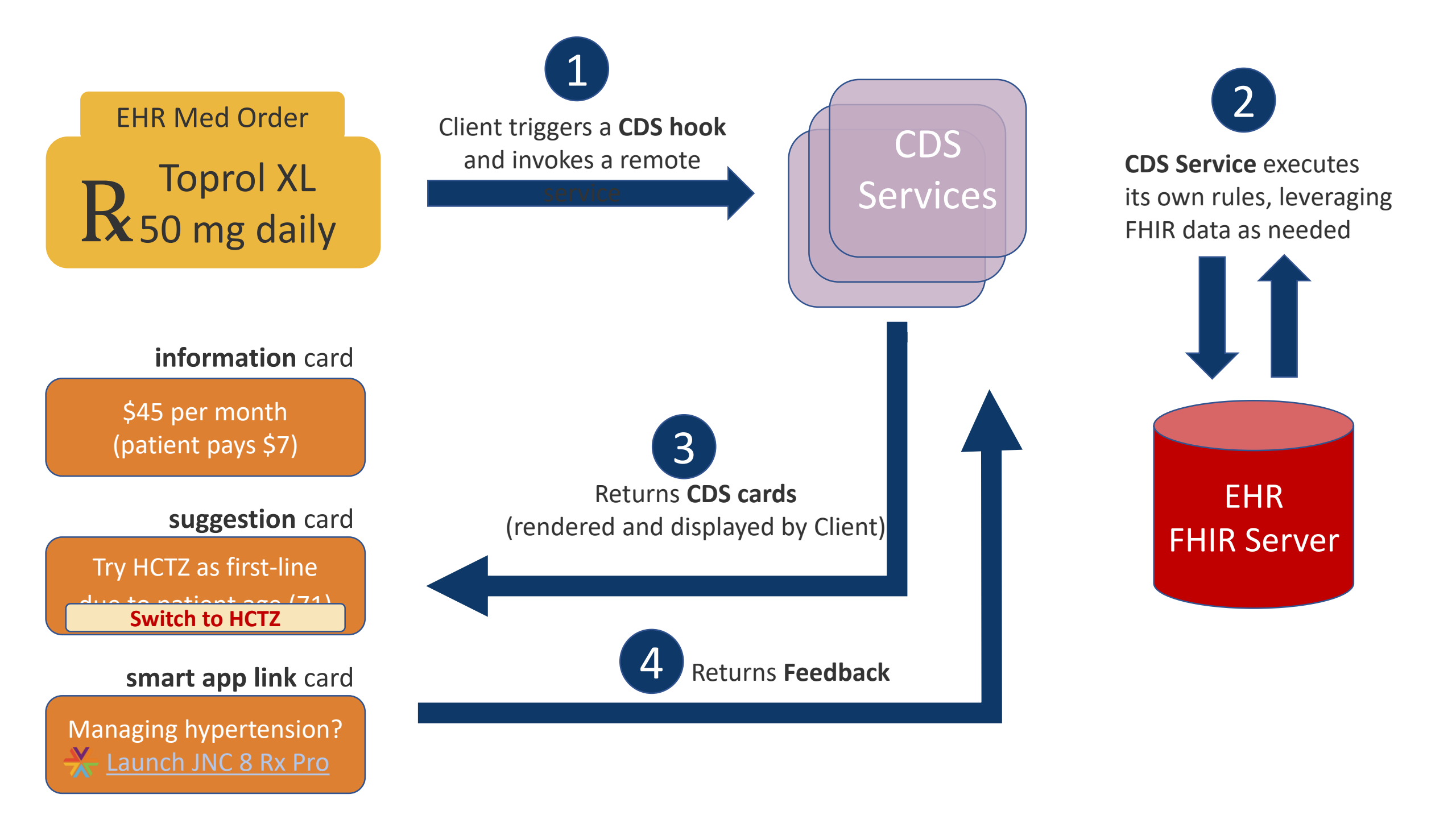
may provide SMART authorization and **FHIR server**

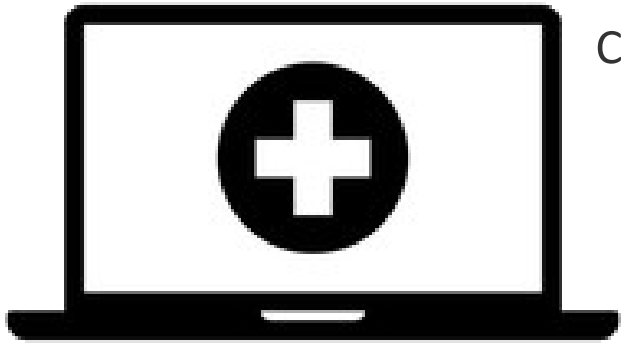


The `patient-view` hook fires when a patient's chart is opened, optionally within the context of an encounter.

The `order-select` hook fires when a clinician selects one or more orders to place for a patient.

The `order-sign` hook fires when a clinician is ready to sign one or more orders for a patient.


EHR Med Order
Rx Toprol XL
50 mg daily
1
Client triggers a **CDS hook** and invokes a remote service
CDS Services
2
CDS Service executes its own rules, leveraging FHIR data as needed
EHR FHIR Server
3
Returns **CDS cards**
(rendered and displayed by Client)
4
Returns **Feedback**
information card
$45 per month
(patient pays $7)
suggestion card
Try HCTZ as first-line
Switch to HCTZ
smart app link card
Managing hypertension?
Launch JNC 8 Rx Pro

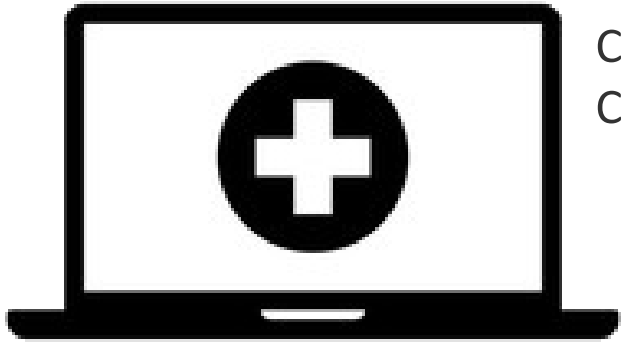


CDS Client

CDS Service

POST https://example.com/cds-services/example-service

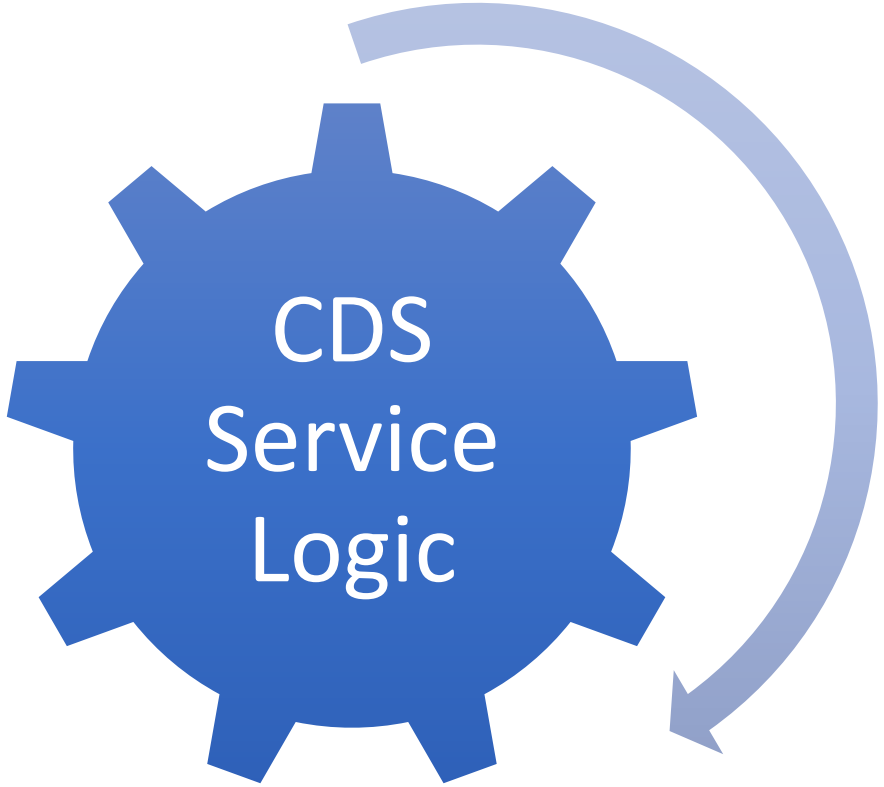
```
{
  "hook": "patient-view”,
  "fhirServer": "https://fhir.example.com",
  "context": {
    "userId": "Practitioner/789"
    "patientId": "123",
    "encounterId": "456",
  },
  ...
}
```

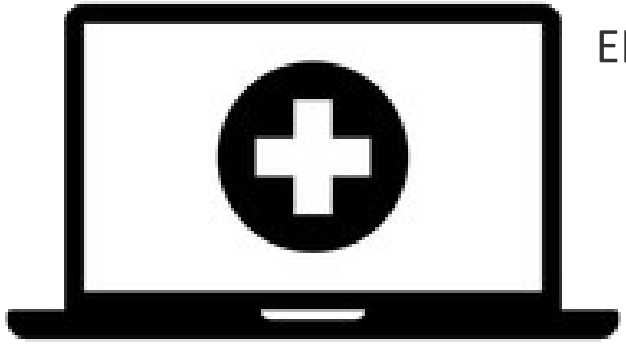


CDS
Client

CDS Service

POST https://example.com/cds-services/example-service





EHR

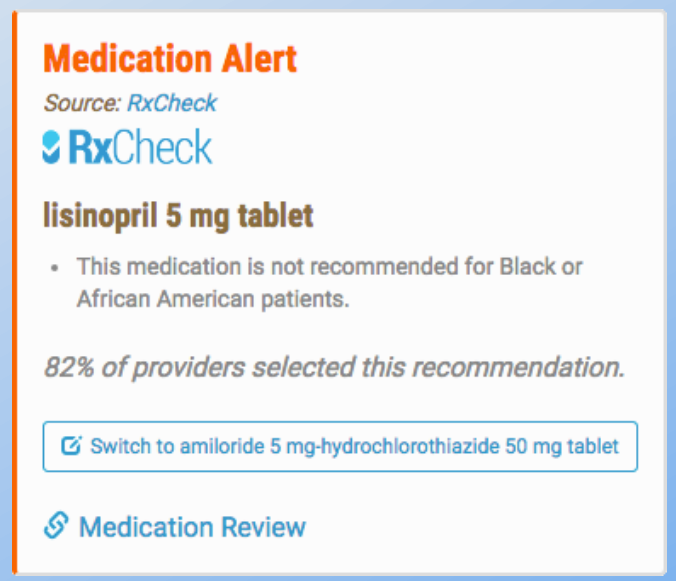
CDS Service

POST https://example.com/cds-services/example-service

HTTP 1.1/ 200 OK

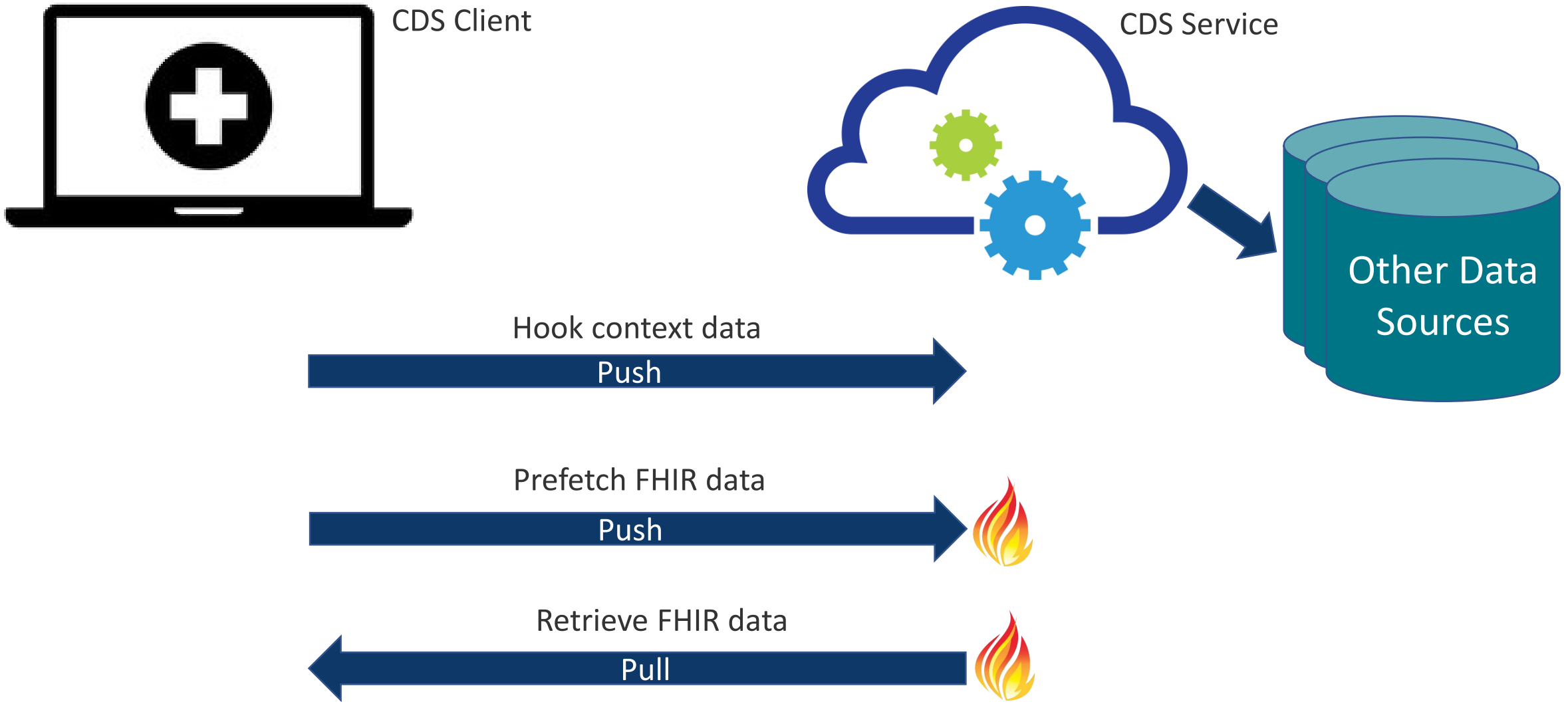
```
{
  "cards": [
    {
      "summary": "Example card",
      "indicator": "info",
      "source": {
        "label": "Demo CDS Service”
}}]}
```

Cards



any combination of information, suggestions, and links

- A CDS Service can return any number of cards
- The Client renders each card as it sees fit
- Each card must have:
  - A concise summary (140 characters)
  - Importance indicator
  - Information on the organization or data set that is the source of the card's data


CDS Client
CDS Service
Other Data Sources
Hook context data
Push
Prefetch FHIR data
Push
Retrieve FHIR data
Pull

- Data specific to a hook
- Data that all CDS Services using that hook would use
- Can be FHIR data (or references to FHIR data) but not always
- Every hook defines its own context

Example: patient-view hook

Field	Optionality	Prefetch Token?	Type	Description
userId	REQUIRED	Yes	string	The FHIR resource type + id of the current user eg: `Practitioner/1` or `Patient/2`
patientId	REQUIRED	Yes	string	The FHIR Patient.id of the current patient in context
encounterId	OPTIONAL	Yes	string	The FHIR Encounter.id of the current encounter in context

- Always FHIR data
- Data specific to a given CDS Service
- Clients are not required to honor prefetch requests from CDS Services
- Expressed as FHIR read/search queries

Example prefetch templates

Prefetch Template	Description
`Patient/{{context.patientId}}`	The current FHIR Patient
`metadata`	The FHIR server's CapabilityStatement

Why Prefetch?

Required Your CDS Service always needs a set of data

Efficiency EHRs may be able to consolidate duplicate prefetch requests into less/optimal requests

Performance EHRs may be able to retrieve the data in a more performant manner (in-memory, cached, less latency)

CDS Hooks Roadmap

- Hook Maturity
- Update to FHIR IG Look and Feel
- Normative

Hook Maturity Model

The intent of the CDS Hooks Maturity Model is to attain broad community engagement and consensus, before a hook is labeled as mature, that the hook is necessary, implementable, and worthwhile to the CDS Services and CDS Clients that would reasonably be expected to use it. Implementer feedback should drive the maturity of new hooks. Diverse participation in open developer forums and events, such as HL7 FHIR Connectathons, is necessary to achieve significant implementer feedback. The below criteria will be evaluated with these goals in mind.

September 2023 Hook Maturity Ballot

> **Info**
>
> For this ballot, only the hooks are under revision. Feedback is specifically solicited on the proposed maturities of the CDS Hooks hooks, per the CDS Hooks Maturity Model.

The September 2023 ballot period is open from August 4th, 2023 through September 4th, 2023. The September 2023 ballot includes the library of CDS Hooks, most of which have never before been balloted. Specifically:

- `order-sign` initial ballot at Trial Use, maturity level 5
- `order-select` intial ballot at Trial Use, maturity level 4
- `appointment-book` intitial ballot at Trial Use, maturity level 3
- `encounter-discharge` intial ballot at Trial Use, maturity level 3
- `order-dispatch` ballot at Trial Use
- `encounter-start` initial ballot at Trial Use, maturity level 1

Maturity Level	Maturity title	Requirements
0	Draft	Hook is defined according to the hook definition format.
1	Submitted	*The above, and* ... Hook definition is written up as a github pull request using the Hook template and community feedback is solicited on the zulip CDS Hooks stream.
2	Tested	*The above, and* ... The hook has been tested and successfully supports interoperability among at least one CDS Client and two independent CDS Services using semi-realistic data and scenarios (e.g. at a FHIR Connectathon). The github pull request defining the hook is approved and published by the CDS Hooks Project Management Committee.
3	Considered	*The above, and* ... At least 3 distinct organizations recorded ten distinct implementer comments (including a github issue, tracker item, or comment on the hook definition page), including at least two CDS Clients and three independent CDS Services. The hook has been tested at two Connectathons.
4	Documented	*The above, and* ... The author agrees that the artifact is sufficiently stable to require implementer consultation for subsequent non-backward compatible changes. The hook is implemented in the standard CDS Hooks sandbox and multiple prototype projects. The Hook specification SHALL: Identify a broad set of example contexts in which the hook may be used with a minimum of three, but as many as 8-10. Clearly differentiate the hook from similar hooks or other standards to help an implementer determine if the hook is correct for their scenario. Explicitly document example scenarios when the hook should not be used.
5	Mature	*The above, and* ... The hook has been implemented in production in at least two CDS Clients and three independent CDS Services. An HL7 working group ballots the hook and the hook has passed HL7 STU ballot.
6	Normative	*The above, and* ... the responsible HL7 working group and the CDS working group agree the material is ready to lock down and the hook has passed HL7 normative ballot

CDS Hooks, published by Clinical Decision Support WG. This is not an authorized publication; it is the continuous build for version 2.0.0). This version is based on the current content of https://github.com/cds-hooks/docs/ and changes regularly. See the Directory of published versions

1 Home

Official URL: **https://cds-hooks.hl7.org/ImplementationGuide/hl7.other.uv.cds-hooks**	*Version*: **2.0.0**
Draft as of 2023-08-16	*Computable Name*: CDSHooks

Continuous Improvement Build
This is the continuous integration, community release of the CDS Hooks specification. All stable releases are available at https://cds-hooks.hl7.org.

1.1 Overview

This specification describes a "hook"-based pattern for invoking decision support from within a clinician's workflow. The API supports:

- Synchronous, workflow-triggered CDS calls returning information and suggestions
- Launching a user-facing SMART app when CDS requires additional interaction

1.2 CDS Hooks Anatomy

This specification describes a "hook"-based pattern for invoking decision support from within a clinician's workflow. The API supports:

- Synchronous, workflow-triggered CDS calls returning information and suggestions
- Launching a web page to provide additional information to the user
- Launching a user-facing SMART app when CDS requires additional interaction

The main concepts of the specification are Services, CDS Clients, and Cards.

1.2.1 CDS Services

A *CDS Service* is a service that provides recommendations and guidance through the RESTful APIs described by this specification. The primary APIs are Discovery, which allows a CDS Developer to publish the types of CDS Services it provides. The Service API that CDS Clients use to request decision support. The Feedback API through which services learn the outcomes of their recommendations and guidance.

1.2.2 CDS Clients

A *CDS Client* is an Electronic Health Record (EHR), or other clinical information system that uses decision support by calling CDS Services at specific points in the application's

https://www.hl7.org/fhir/versions.html#normative

2.1.7.0.1 The Standards Development Process

FHIR is a standard. In order to be useful, standards need to evolve. At the same time, the evolution of standards needs to be predictable and manageable for the implementation community. This section describes how HL7 develops a standard so that implementers know what to expect as the standard evolves.

HL7 has five descriptive terms that describe the level of stability and implementation readiness associated with different aspects of the specification. They are as follows:

Standard Level	Description
Normative	This content was approved by the ANSI standards process in a previous version (see Normative status note). It has been subject to review and production implementation in a wide variety of environments. The content is considered to be stable and has been 'locked', subjecting it to FHIR Inter-version Compatibility Rules. While changes are possible, they are expected to be infrequent and are tightly constrained. Note that this version of the specification **has NOT** been submitted to ANSI for consideration as a normative standard.
Trial Use	This content has been well reviewed and is considered by the authors to be ready for use in production systems. It has been subjected to ballot and approved as an official standard. However, it has not yet seen widespread use in production across the full spectrum of environments it is intended to be used in. In some cases, there may be documented known issues that require implementation experience to determine appropriate resolutions for. **Future versions of FHIR may make significant changes to *Trial Use* content that are not compatible with previously published content.**

CDS Hooks Timeline

- Hook Maturity Ballot
  - July 23 - November 23
- STU Update - Move to FHIR IG format
  - November 23 - February 24
- Ballot CDS Hooks as mixed Normative
  - April 24 - November 24

CDS Hooks & SMART Apps

- CDS Hooks Intro & Roadmap
- **Nuts & Bolts of SMART on FHIR**

What is SMART?

HL7®
International

SMART

Defines how apps are launched

Authorization (OAuth 2.0)

Authentication (OpenID Connect)

Context sharing between EHR and app

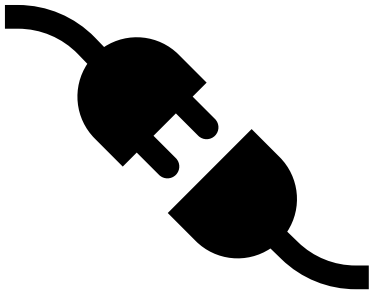
- FHIR Implementation Guide:
    1. Patient / Member
    2. Provider
    3. Backend system

http://hl7.org/fhir/smart-app-launch/STU2/

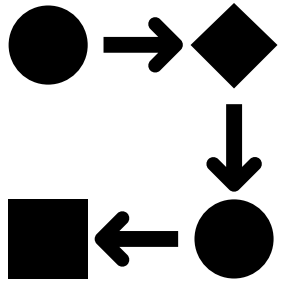
Why SMART?

Security

EHRs, Payers



Workflow



SMART on FHIR Steps

1. Registration (one-time)
2. Launch (stand-alone or embedded)
3. Authorization
4. Access Token

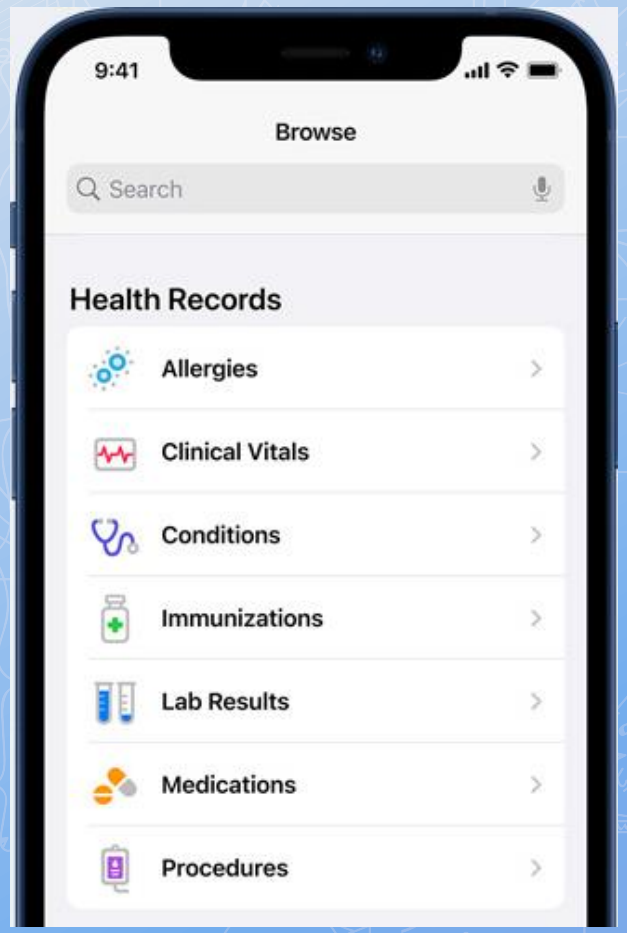
App Registration:
EHR, Payer

- Provide: authorization redirect URL, APIs, credentials, info about the app
- Receive: client id, endpoints

Launch types

Standalone: patient or provider

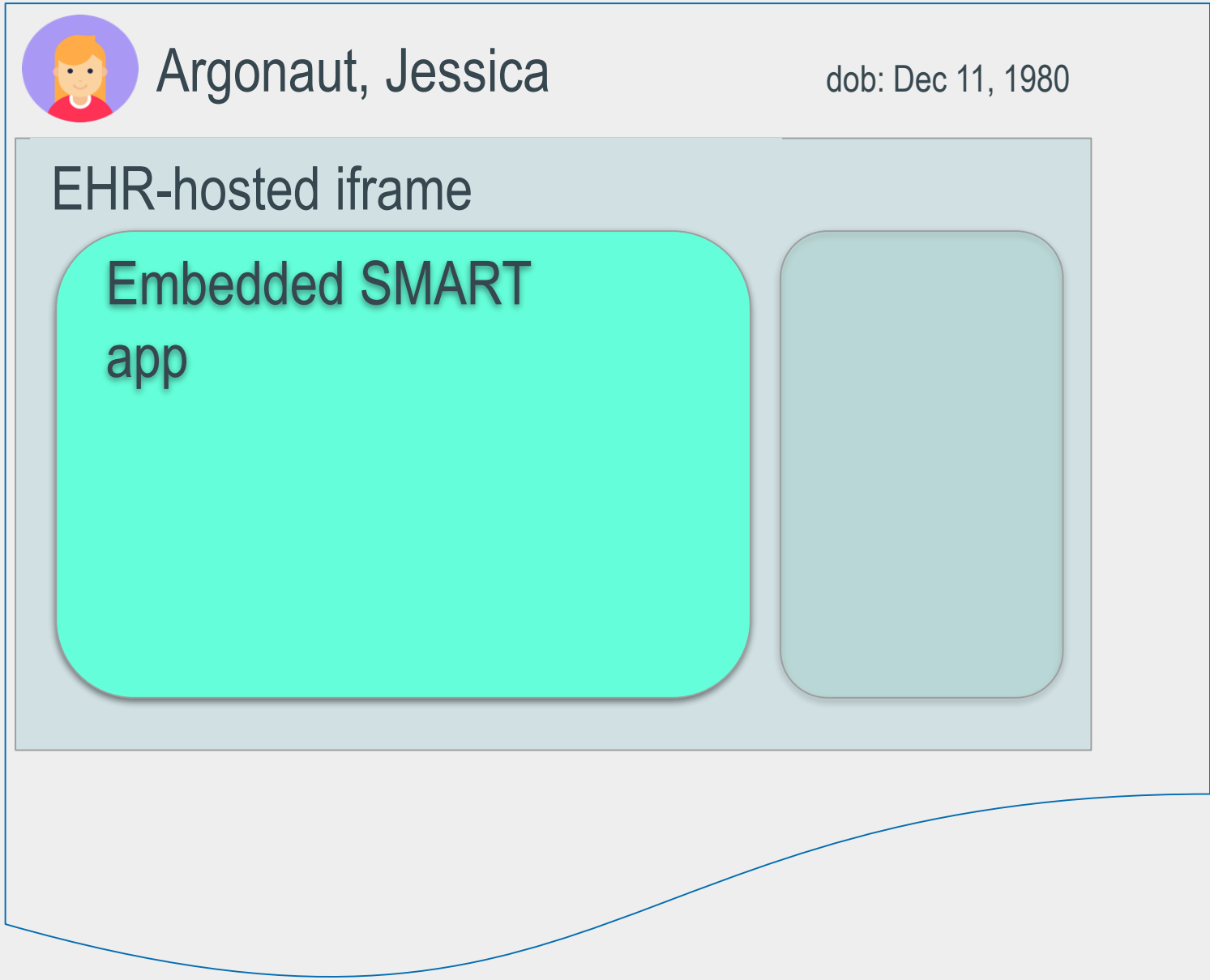
Embedded: patient portal or EHR



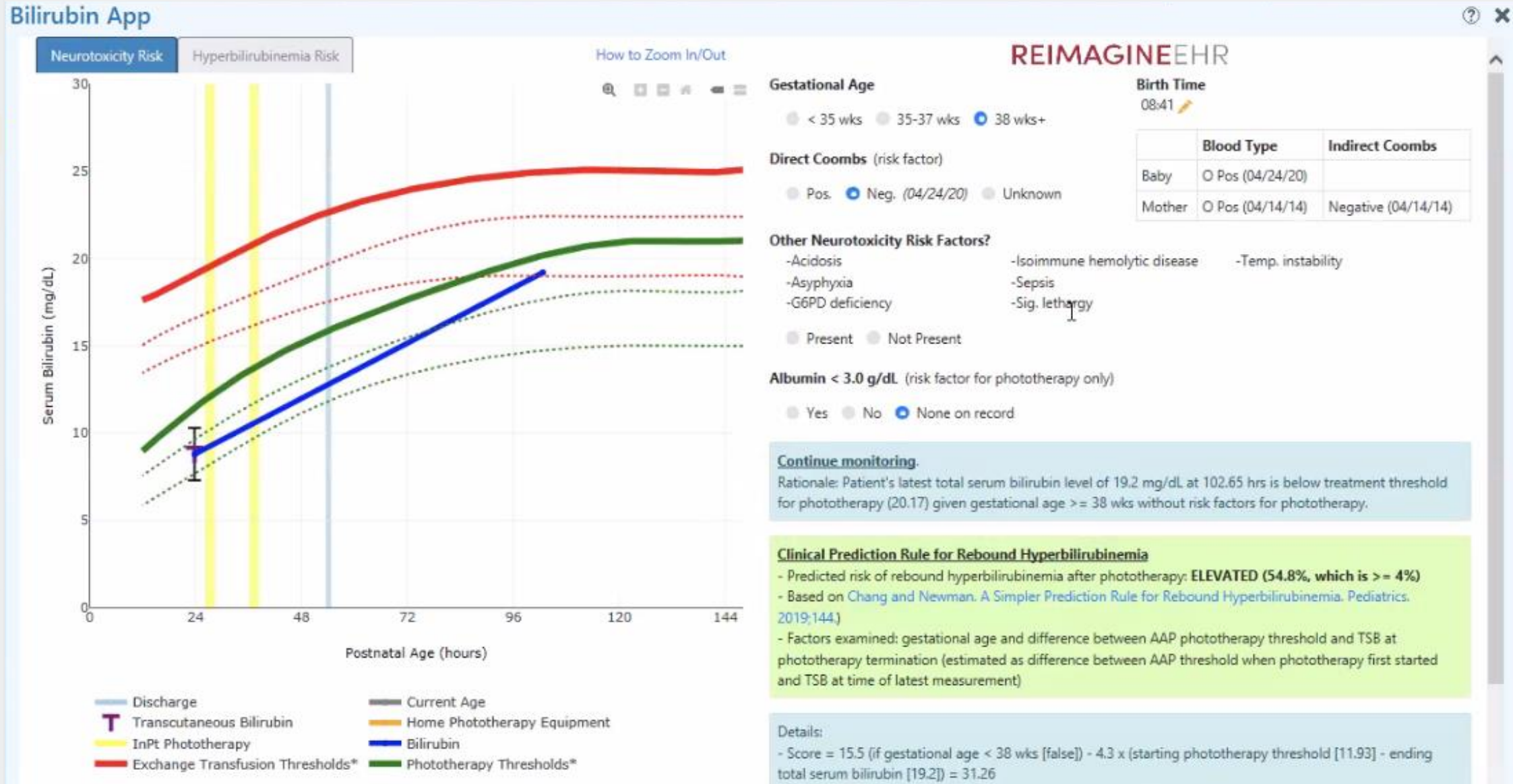
Standalone Patient App

Embedded in EHR

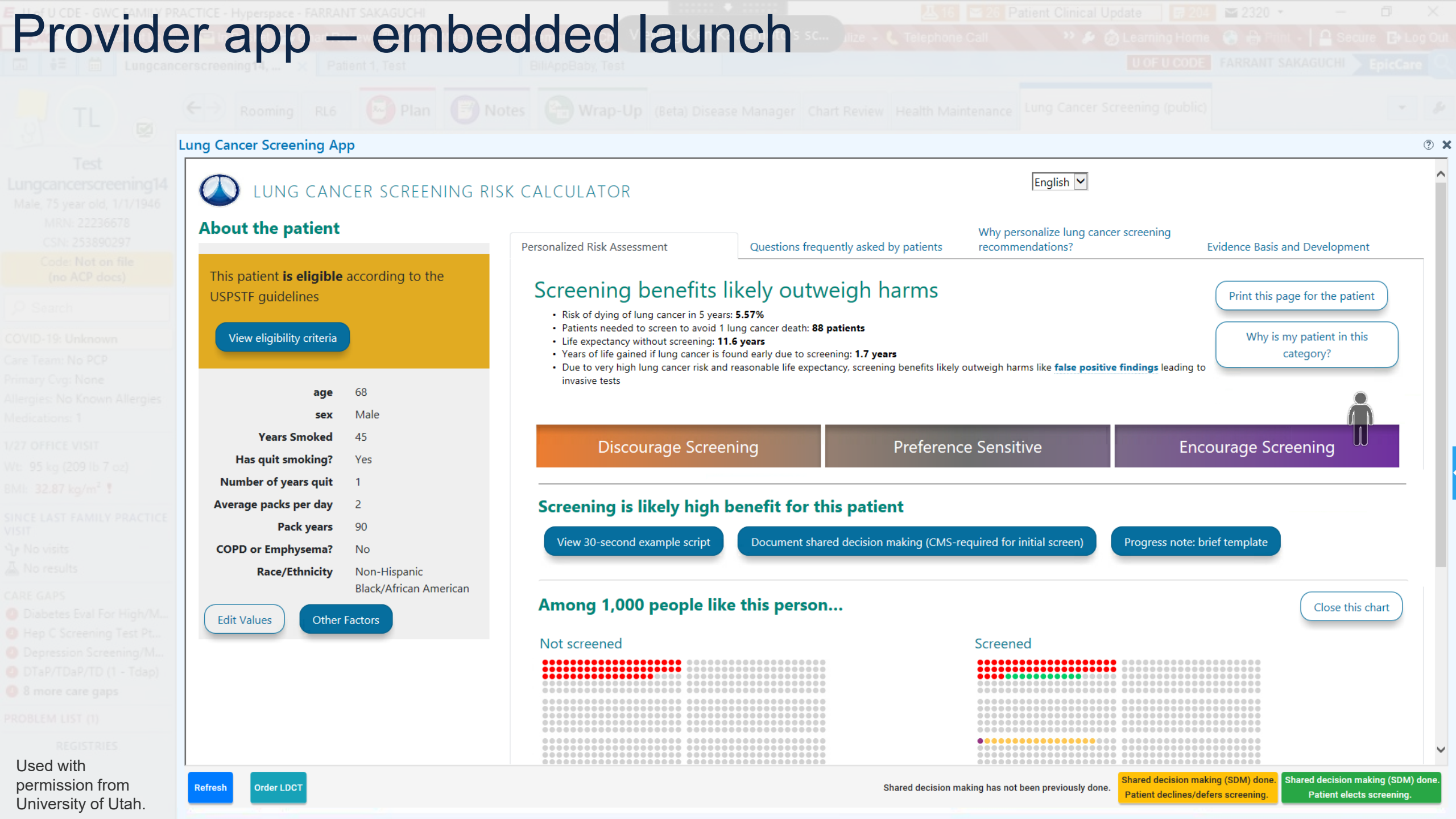
Embedded in EHR



Provider app – embedded launch



Provider app – embedded launch



Used with permission from University of Utah.

What questions do you have?

CDS Connect

Mario Terán, AHRQ
Matt Coarr and Julia Afeltra, MITRE



AGENCY FOR HEALTHCARE RESEARCH AND QUALITY

AHRQ

AHRQ's CDS Connect Project

Office of the National Coordinator Tech Forum:

The Future of Clinical Decision Support

September 27th, 2023

Presenters

Mario Terán, M.D., MSc,
Physician—Clinical Informatics
Government Task Lead CDS Connect Project
Division of Digital Healthcare Research

Matt Coarr
NLP Healthcare Developer and Data Scientist
Technical Lead - CDS Connect Project
The MITRE Corporation

Julia Afeltra
Software Engineer
Technical Support – CDS Connect Project
The MITRE Corporation
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Overview

1). Introduction and Background
2). CDS Connect Overview
3). Repository Demonstration
4). Authoring Tool Demonstration
5). Artifact Publishing Demonstration
5). Demonstration Questions
6). Sustainability Efforts

AHRQ CDS Initiative

Advancing evidence into practice through CDS
Make CDS more shareable, standards-based and publicly-available

1. Engaging a stakeholder community
2. Creating prototype infrastructure for sharing CDS and developing CDS
3. Advancing CDS through grant-funded research
4. Evaluating the overall initiative

https://cds.ahrq.gov

CDS Connect

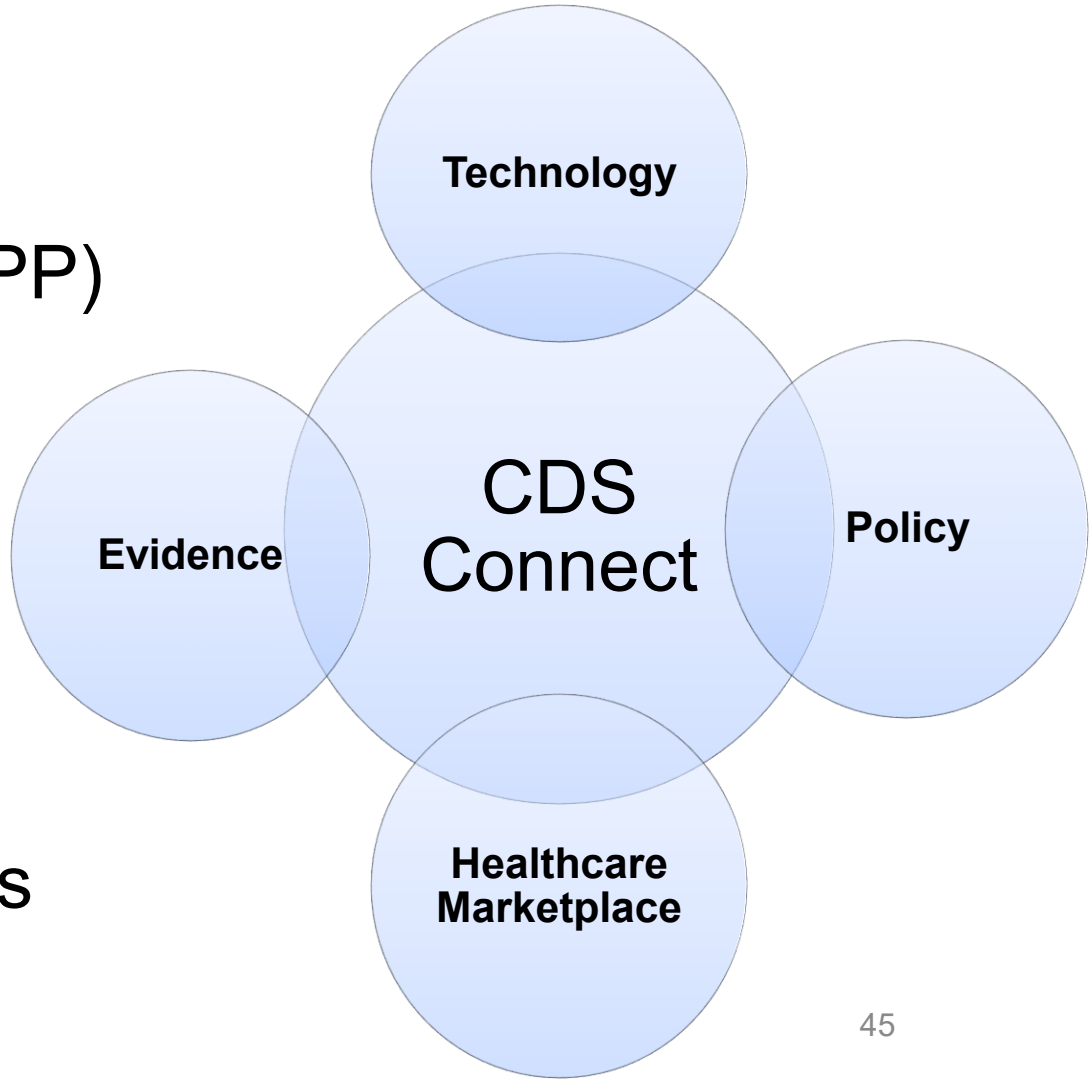
- **CDS Connect**
  - **Freely available** web-based platform to author, test, and share **interoperable CDS**

- **Goal**: Enable CDS Community to identify **evidence-based** care, **translate and codify** information into an **interoperable** health IT standard, and leverage tooling to promote a **collaborative model** of CDS development

https://cds.ahrq.gov/cdsconnect

Sustainability and the Future of CDS Connect

- **Sustaining and growing** CDS Connect outside of AHRQ
- Identified **Public-Private Partnership** (PPP) as best sustainment model
- Partnered with MITRE in 2023 to begin exploring PPP
- **Robust public engagement** to best paths forward



Challenge Competition: Designing the Future of CDS Connect

- Challenge Competition Launched 9/19/2023
- Seeking innovative input on the future state of CDS Connect
- Specifically:
  - Improving the functionality, value, and accessibility of CDS Connect
  - Understanding the potential role CDS Connect can have in quality improvement, based on emerging marketplaces of shareable, interoperable clinical decision support
  - How CDS Connect can best continue to disseminate and promote standards-based CDS
  - Methods by which industry, government, and nonprofit entities can collaborate to achieve this goal

Challenge Competition: Designing the Future of CDS Connect

- Phase 1 – Design Proposal
  - 25-page white paper describing a design for a future state of CDS Connect supported by a collaboration between AHRQ and private industry
    - **Deadline – November 22nd, 2023, 11:59PM EST**
- Phase 2 – Presentation
  - Winners of Phase 1 will be invited to participate in Phase 2
  - Live presentation to explain the strengths of Phase 1 submission
- Total Cash Prizes - $100,000
  - Four winning submissions will be selected and awarded $25,000
- How to Apply: Challenge.gov
  - https://www.challenge.gov/?challenge=ahrq-challenge-designing-the-optimal-future-state-of-cds-connect
  - https://www.ahrq.gov/challenges/cds-connect/index.html
- For Further Information, contact: ahrqchallenge@ahrq.hhs.gov.

Questions

Office of the National Coordinator for Health Information Technology

Contact ONC

Alison Kemp alison.kemp@hhs.gov

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