FHIR – The Future of Interoperability. Now
CDS Hooks: Integrating Decision Support at the Point of Care (Part 1)

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HL7 DCSIO
Agenda – April 18 - 10:25 - 10:50 am

- Session Structure
- Part 1
  - The FHIR Toolbox: FHIR Core Spec & IGs + …
  - Scenarios for the FHIR Toolbox
  - Individual Patient: CDS-hooks / Smart-on-FHIR
  - Intro to CDS Hooks
- Part 2
  - Discussion Zone: Example Scenarios
  - Recommended Tools / Reading
  - Questions/Answers
FHIR Tool Box

- FHIR Core Spec
- Implementation Guides
- SMART-on-FHIR
- CDS-HOOKS
- Bulk FHIR

Domain/Country Specific Content, Behavior and Terminology: example: US CORE

Syntax Structure API Methods

Today

April 20 8-8:45 am, here
The FHIR Toolbox

The stack of FHIR family tools from HL7 supporting a learning health care system

- HL7 FHIR Core Spec
- HL7 FHIR Base IGs
- HL7 FHIR IGs
- Smart-on-FHIR
- CDS-Hooks
- Bulk FHIR Data Access
- CQL
FHIR Tool Box: Knowledge

How can we apply medical knowledge in daily practice?
How can we overcome limitations of our EHRs and use/integrate other apps or services?
Which are the different scenarios?
Which FHIR tools apply?
**Scenarios**

**Individual Patient**

(We are attending a patient, or the patient is using a patient portal)

➔ **Independent Knowledge (CDS) Service**

We want to provide any EHR with a service: given context and data, apply knowledge and recommend an action course

➔ **Embedded/Shared User Interface**

We want to show information in a different way, integrated with the EHR/Patient Portal
Scenarios

Population Health

We want to analyze data from a (big) set of patients

➔ Data Extraction
   We want to extract data from the EHR for research, or apply discovery algorithms, or to calculate quality / clinical / epidemiological measures

➔ Population Health Measures
   We want to use a service to calculate measures on a given population -> (numerator / denominator)

FHIR BULK DATA
I ask for the data, and then process it

Extractor → EHR Data Server
Request
Bulk data

Requestor → Measure Server
Measure Definition + Parameters
Actual Measures

(I ask a FHIR Server to calculate)
What do we need?

Who is interested?
- EHR/LIS/RIS Vendors involving CDS
- CDS Providers

Problem?

- Different API for each CDS service
- A different API to access data for each EHR

Service 1: "Easy call my API: http://mycds.com/api1 y le devuelvo la recomendación"

Service 2: "Piece of cake: http://miothercds.com/api2 y le devuelvo la recomendación"

Service 3: "1-2-3: Call my service with this API: http://miootherothercds.com/api3method and it will return the recommendation"

EHR 1: "Easy!: Call my server with http://myehr.com/api1 le devuelvo la recomendación"

EHR 2: "Simple!: Call my server data http://miotrocds.com/api2 y le devuelvo la recomendación"

EHR 3: Easy: Call my service with this API: http://myehr/ProprietaryAPI/GetData?PatientId=200 and you can get the patient information!"
What do we need: **The same API!**

*Remember that FHIR is leveraged to create...Standardized APIs!*

→ A way to **discover/register services**

→ A framework for **authorization/authentication**

→ A way to **describe the context** *(What I am doing in my EHR that requires this service?)*

→ A way to **exchange clinical patient data** *(medication, labs, vital signs, etc.)*

→ A way to **call the services**

→ A way to **return the recommendations**

>Note: it does not matter how the service implements 'knowledge'/‐'algorithms' This API connects us to any service and allow us to leverage it*
## CDS Hooks

### HL7 Standard 1.0 (2019)

STU2 (08-23-2022)

[https://cds-hooks.hl7.org/2.0/](https://cds-hooks.hl7.org/2.0/)

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register/Discover Services</td>
<td><code>{cds_endpoint}/cds-services</code></td>
</tr>
<tr>
<td>Describe the context</td>
<td>hook (&quot;Which part of the clinical workflow?&quot;) patientId userId</td>
</tr>
<tr>
<td>Authenticate/Authorize</td>
<td>1- TLS <code>cds_endpoint</code> / 2- Signed JWT 3- Data Access Token</td>
</tr>
<tr>
<td>Clinical Data Exchange</td>
<td>Access to FHIR Resources + &quot;Prefetch&quot;</td>
</tr>
<tr>
<td>Return Recommendations</td>
<td>cards</td>
</tr>
</tbody>
</table>
**CDS-Hooks in a nutshell**

**hook**
What is the user doing in the EHR

**cds request**
Which user, which patient
Which service
Additional clinical or demographic data
FHIR data server and authentication parameters

**cds response**: Set of cards
**cards**: source, information, recommendation (actions), smart app link

**data request / response**
FHIR resources required for service

**feedback**
whether actions were accepted by user
reasons for override
CDS HOOKS

1. Service Registration `{cds_endpoint}`

Register the 'discovery endpoint' for the service in the EHR or sandbox https://sandbox.cds-hooks.org/

More details on Server Registration https://cds-hooks.hl7.org/2.0/#discovery

Example: https://my-cds-company.com/cds-services
2. Describe the service /cds-services

The /cds-services method returns for each service the description, id, and parameters. optional: "prefetch" : a list of required resources so we do not need to get them from the FHIR Server

[id]: the service identifier {service.id}...and hook...?

Example prefetch

```
"prefetch": { "patient": "Patient/{{context.patientId}}", "observations": "Observation?patient={{context.patientId}}" }
```
3. Which part of the workflow: hook

hook
When can I invoke this service from the EHR? What is the practitioner doing?

There is no 'closed' hook list
They are part of the community consensus, and have a life cycle. There is a process, language and structure for their definition.

List in CDS Hooks 1.0
• patient-view
• medication-prescribe
• order-review
• order-select
• order-sign
• appointment-book
• encounter-start
• encounter-discharge
4. How to call the service?

POST to URL: `{cds_endpoint}/cds-services/{service.id}`

In the request body:

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>REQUIRED</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>hook</td>
<td>YES</td>
<td>string</td>
</tr>
<tr>
<td>hookInstance</td>
<td>YES</td>
<td>string</td>
</tr>
<tr>
<td>context</td>
<td>YES</td>
<td>object</td>
</tr>
<tr>
<td>fhirServer</td>
<td>NO</td>
<td>URL</td>
</tr>
<tr>
<td>fhirAuthorization</td>
<td>NO</td>
<td>object</td>
</tr>
<tr>
<td>prefetch</td>
<td>NO</td>
<td>object</td>
</tr>
</tbody>
</table>

```json
{
  "hookInstance" : "d1577c69 - dfbe - 44ad - ba6d - 3e05e953b2ea",
  "fhirServer" : "http://myserver-fhir.org",
  "hook" : "patient-view",
  "fhirAuthorization" : {
    "access_token" : "my-token",
    "token_type" : "Bearer",
    "expires_in" : 300,
    "scope" : "patient/Patient.read patient/Observation.read",
    "subject" : "service client_id"
  },
  "context" : {
    "userId" : "Practitioner/12821",
    "patientId" : "1288992"
  }
}
```
5. Recommendation Type: cards

The service may return **one or more** cards. They can be purely informational, or suggest actions on FHIR resources, or even a link for a SMART app.

They include a criticality **indicator**.
6. FHIR resources

(But not just ANY FHIR resource: constrained!)

**Structure: FHIR Resources**
Specific profile so we know what to expect on content/terminology

**Which resources?** Depends on what question you are asking and the needs of the CDS algorithm

**Which content?** It should be ‘our’ FHIR resources.
Example: “US CORE”

<table>
<thead>
<tr>
<th>FHIR core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient.identifier: 0..*</td>
</tr>
<tr>
<td>Patient.name: 0..*</td>
</tr>
<tr>
<td>Patient.gender: 0..1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>'Our' FHIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient.identifier: 1..*</td>
</tr>
<tr>
<td>Patient.name: 1..*</td>
</tr>
<tr>
<td>Patient.gender: 1..*</td>
</tr>
<tr>
<td>Observation.code.system = LOINC</td>
</tr>
</tbody>
</table>
Nice…but is it used?
Let's go to Part 2!

• Discussion of Clinical Decision Support use cases with CDS-HOOKS