Quick Intro

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FHIR Roundtable
Duke
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Building on SMART on FHIR

**Learn about** apps (SMART Gallery at [apps.fhir.org](http://apps.fhir.org))

**Install** SMART app within an EHR

Click to **launch** a SMART app embedded within the EHR session

**Security model** for authorization, authentication

Access **contextual data** (patient, user, encounter, ...)

Access **clinical data** (FHIR, Argonaut, US Core)
Workflow challenges with *click to launch*

What apps can I run?
What if I forget?
Which apps matter right now?
CDS Hooks aims at these challenges

Following SMART's model with open specification & reference implementation

Developing specification within the FHIR community

Collaborating with HL7's Clinical Decision Support Workgroup
Vocabulary lesson

Throughout interactions with a clinician end-user,

the **EHR** triggers **hooks** (i.e. specific events)

that notify external **CDS Services**

that return **Cards** (or **Decisions**).
An initial set of hooks

patient-view
When a patient’s chart is opened

medication-prescribe
When a medication is selected for prescription

order-review
Viewing pending orders for signing
CDS Service responsibilities

- Respond (in time) to an EHR request
- Obtain (via FHIR) any data needed for an automated decision
- Generate cards for display to the user
Cards are simple JSON

```json
{
    "cards": [
        {
            "summary": "Example card",
            "indicator": "info",
            "source": {
                "name": "Demo CDS Service"
            }
        }
    ]
}
```
Cards include an urgency indicator

- success
- info
- warning
- hard-stop
Basic card types

**Information** card (direct display to clinician / FYI)

**Suggestion** card (proposed action → workflow)

**App link** card (app or web site that's relevant right now)
Analytics → refined advice

Early connectathon experience ("how can we tell what happened?")

Each suggestion may contain a UUID

EHR to notify the CDS Service that the user interacted with their suggestion
CDS Hooks is very much "work in progress"

Argonaut projects for 2017 → EHR adoption
   Link to a SMART App vs. "generic" web URL
   Review of security model

HL7 Clinical Decision Support WG → alignment

New hook definitions and use cases

Performance assessment

Asynchronous delivery
Join an HL7 FHIR Connectathon!

**Jam-packed CDS Hooks track** at past four 4 connectathons ( + Madrid in May)

Examples from CDS Hooks track in Jan 2017

- [Track overview](#)
- [Participant list](#)
- [Track results + summary](#)
docs, demo, details

cds-hooks.org
demo.cds-hooks.org
github.com/cds-hooks/docs/wiki
CDS Services

1. EHR triggers a CDS hook

2. CDS Cards (displayed in EHR) & CDS Decisions (automatically applied)

3. User reads, runs apps, and decides.

4. decision

information card

- $200 per month (patient pays $30)

suggestion card

- Try HCTZ as first-line
- Switch to HCTZ

app link card

- Managing hypertension? Launch JNC 8 Rx Pro

EHR Med Order

RX Toprol XL 50 mg daily
Addendum

Sample content from CDS vendors developing on CDS Hooks
Healthwise helps people make better health decisions with CDS Hooks

**Review patient education at the moment in care**

**Patient Education**

*Source: Healthwise*

The following patient education resources were found.

**Conditions**

- Dementia associated with another disease (2008-08-08)
- Essential hypertension (2008-04-20)
- Other persistent mental disorders due to conditions classified elsewhere (2007-09-15)
  - Medical History and Physical Exam for Dementia or Alzheimer’s Disease,
  - Memory Problems: Tips for Helping the Person With Daily Tasks

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**Prevent medication interactions at the time of prescription**

**Drug Interactions**

*Source: Healthwise*

The following drug interactions were found.

**Interactions**

- ACE INHIBITORS; ARBS; ALISKIREN/POTASSIUM PREPARATIONS (moderate)
  - Lisinopril (bulk) and potassium acetate may interact based on the potential interaction between ACE INHIBITORS; ARBS; ALISKIREN and POTASSIUM PREPARATIONS.
  - **KEEP VITAMIN K CONTENT OF DIET CONSISTENT. (serious)**
  - The use of warfarin (bulk) may interact with food in that FOOD HIGH IN VITAMIN K MAY DECREASE EFFECT.
IDENTIFY.

PerfectChoice Notification: Based on new culture information and facility antibiogram, the following antinfectives have the highest likelihood (% susceptible) of effectively treating the infection.

Source:
Launch Premier TheraDoc for more details.

Know the priority patients with new microbiology results with automated surveillance that notifies clinicians in their workflow.

DECIDE.

PerfectChoice Notification: Based on new culture information and facility antibiogram, the following antinfectives have the highest likelihood (% susceptible) of effectively treating the infection.

Source:
Launch Premier TheraDoc for more details.

ACT.

Access the EMR to make the appropriate medication order decisions.

View the best antibiotic options based on facility antibiogram in context of the patient's relevant clinical data to reach the right decision.
Medication Management for Adherence (CDS Hooks)

Real-time medication adherence insights delivered directly into workflow during patient visits

Bi-directional communication to enable users to provide real-time feedback

Patient View

Daniel X. Adams
Birthday: 1930-10-22

Hello Daniel,
Source: Patient greeting service

Medication Management for Adherence
Source: MedisafeRx

The PDC (Proportion of Days Covered) is calculated by the Pharmacy Benefit Management (PBM) or Health Plan based on claim data. The PDC score is used to determine medication adherence and to recommend intervention.

Lower PDC score 47% as of 10/15/2016 12:17:38 AM

Medication Adherence Profile

- **47% Diabetes**
  - Medication: METFORMIN HCL - 30.0 MG
  - Date Filled: 9/25/2016
  - Supply: 30 days

- **85% Cholesterol**
  - Medication: LOVASTATIN - 90.0 MG
  - Date Filled: 9/25/2016
  - Supply: 90 days

Please respond:

Is adherence a confirmed issue?

- [ ] Yes

Why is adherence an issue?

- [ ] Patient has been educated on importance of adherence and plans to resume therapy
- [ ] Patient refuses drug due to cost
- [ ] Patient refuses drug due to side effects
- [ ] Patient refuses drug due to other reasons
- [ ] An unlisted reason

Medication Adherence

Received: 10/25/2016
Adams, Daniel - DOB: 12/23/1925

Health plan records show this patient may not be taking their diabetes medication as instructed. Please talk to your patient about adherence.
CDS Hooks Dose Calculator

Prevent ADEs with system-calculated, safe, patient-specific doses

Med ordering workflow: pediatric patient, sulfamethoxazole/trimethoprim

• See common orders for this patient based on their age and the ordered drug
• Smart logic knows this order should be dosed as trimethoprim
• Select from safe rounded admin amounts

Leverages FDB Cloud Connector web services
Calculations happen in real-time using current knowledge base
Mecucaion® provides patient-specific medication instructions & regimen summaries at 5-8 grade reading level & 21 languages to reduce errors & improve adherence.

Interact with Meducation PMI Viewer

Mecucaion Regimen Summary

Mecucaion® provides patient-specific medication instructions & regimen summaries at 5-8 grade reading level & 21 languages to reduce errors & improve adherence.

Interact with MeducationRS
Optimize pharmacy spend using actionable recommendations.

Improve outcomes through consistent prescribing.

Drive performance metrics (e.g., adherence) through prescribing behavior surveillance.
Precision Link at Boston Children’s: PGx Recommendations via CDS Hooks

Adjusting medication order based upon genomic data

An azathioprine prescription based upon a patient's expression of TPMT enzyme

**Normal metabolizer**

**PGX Recommendation**
Start with normal starting dose (e.g., 2-3 mg/kg/d) and adjust doses of azathioprine based on disease-specific guidelines. Allow 2 weeks to reach steady state after each dose adjustment.

**Intermediate metabolizer**

**PGX Recommendation**
If disease treatment normally starts at the "full dose", consider starting at 50-75% of target dose (e.g., 1.5 mg/kg/d), and titrate based on tolerance. Allow 2-4 weeks to reach steady state after each dose adjustment.

**Poor metabolizer**

**PGX Recommendation**
Consider alternative agents. If using azathioprine start with drastically reduced doses (reduce daily dose by 10-fold and dose thrice weekly instead of daily) and adjust doses of azathioprine based on degree of myelosuppression and disease-specific guidelines. Allow 4-6 weeks to reach steady state after each dose adjustment. Azathioprine is the likely cause of myelosuppression.
Stanson Health’s CDS Hooks service

- Real time, workflow integrated, patient specific, evidence based
- Reduces low-value and unnecessary care