Public Health – EHR Vendors Collaboration Initiative
Webinar

EHR Integrated Decision Support

October 17, 2017
Public Health – EHR Vendors Collaboration Initiative

In Focus

Special Session # 7: Zika Virus Disease Update

Coming Up! Special Session # 7: Zika Virus Disease Update for Electronic Health Record (EHR) Vendors, Health Information Technology Developers, Public Health, and Clinical Healthcare Partners on Nov 2, 2016 1:00 PM-2:00 PM EDT

Please pre-register for the webinar by clicking the link below:
https://attendee.gotowebinar.com/register/3504905897385264131

Abstract

This webinar will be focused on the recommendations around Ask at Order Entry (AOE)* for pregnancy status in Zika virus (ZIKV) laboratory test orders with the possibility of a broader discussion on the capture of pregnancy status in electronic health records, per the clinical workflow and an update on the algorithm for ZIKV risk assessment in pregnant women, based on the latest Centers for Disease Control and Prevention (CDC) guidelines.

Terms explained-
* Ask at Order Entry (AOE)- Some tests, such as microbiology cultures and those that determine heavy metal ion concentration, require additional
Question and Answer Session
How to submit or ask questions for the panel members?

Submit or Ask Questions

• Submit your text question and comments using the Question Panel

• Please raise your hand to be unmuted for verbal questions.
EHR Integrated Decision Support

Kevin Shekleton and Bryn Rhodes
Oct 18, 2017
Clinical decision support (CDS) provides the right information, to the right person, at the right time.

96% of non-Federal acute care hospitals have a certified EHR in 2015. [ONC Data Brief 35](#)

Decision support should be integrated with the EHR to provide seamless user-experience.
Infobutton

HL7 Standard for Context Aware Knowledge Retrieval provides a standard mechanism to retrieve context-specific clinical knowledge from online resources.

Over 500 vendor products certified against Infobutton EHR requirements (ONC Certified Product List).

Dozens of Infobutton content and service providers (Open Infobutton HL7 Enabled Knowledge Resources).
SMART Platform

Provides a platform to build healthcare applications

Applications can run against any vendor implementing SMART

Generally web apps (though not a requirement)
FHIR

API specification for RESTful clinical resources

Applications portable against any vendor implementing FHIR services

Any application capable of making HTTPS calls can consume FHIR services
SMART Platform Benefits

- Defines how apps are launched
- Authorization (OAuth 2)
- Authentication (OpendID Connect)
- Context sharing between EHR and app
- Discover EHR FHIR service endpoint
The problem with SMART apps

**Bilirubin Chart**
Newborns < 120 hours old
Bilirubin results that are either:
- Not documented
- Outside of the accepted range

The user needs to know the app is **available**
The user needs to know the app is **relevant**
The user has to **find** the app and launch it
CDS Hooks
A vendor agnostic remote decision support specification

Created by the team behind SMART
Open source (Apache)
Emerging standard with active development and widespread participation from stakeholders
CDS Service

A service that is:
invoked by the EHR via a hook,
evaluates its own logic using FHIR data,
returns decision support via cards
Example 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 executes its own rules, leveraging FHIR data as needed.

1. EHR triggers a CDS hook and invokes a remote service.

2. CDS Services processes the request.

3. Returns CDS cards (rendered and displayed by EHR).

Managing hypertension? 
Launch JNC 8 Rx Pro

Try HCTZ as first-line
Switch to HCTZ

information card
$200 per month (patient pays $30)

suggestion card

smart app link card
POST https://example.com/cds-services/example-service

```
{
  "hook": "patient-view",
  "fhirServer": "https://fhir.example.com",
  "user": "Practitioner/789",
  "patient": "123",
  "encounter": "456",
  ...
}
```
POST https://example.com/ cds-services/example-service
POST https://example.com/cds-services/example-service

HTTP 1.1/ 200 OK

{  
  "cards": [  
    {  
      "summary": "Example card",
      "indicator": "info",
      "source": {  
        "name": "Demo CDS Service"
      }
    }
  ]
}
Cards

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

```json
{
    "cards": [
        {
            "summary": "Example card",
            "indicator": "info",
            "source": {
                "name": "Demo CDS Service"
            }
        }
    ]
}
```
Card Indicator

Informational  Warning  Hard Stop
**Common Card Examples**

**Information Only**
Textual information for the provider

**Suggestions**
Proposed actions encoded as FHIR resources

**App Links**
Proposed SMART app that should be used

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**Medication Information**
ADRA2A (C/C): The genotype of this patient suggests a reduced response to certain ADHD medications.

Source: RxCheck

**Medication Alert for lisinopril 5 mg tablet**
This medication is not recommended for Black or African American patients.

82% of providers selected this recommendation.

Switch to amiloride 5 mg-hydrochlorothiazide 50 mg tablet

Source: RxCheck

**ASCVD Risk Alert**
12% 10-year risk
69% lifetime risk

Source: Demo CDS Service
ASCVD Risk Calculator
Cards can contain any combination of information, suggestions, and links.
Capturing user behavior for analytics

• Since CDS Services return purely JSON, they don’t know how users interact with their suggestion
• Each suggestion *may* contain a **UUID**
• The UUID allows the EHR to notify the CDS Service that the user interacted with their suggestion

```plaintext
POST {cds-service}/analytics/{uuid}
```
Base https://example.com

CDS Service Provider

Discovery /cds-services

CDS Services

Service /cds-services/{id}
Discovery

GET https://example.com/cds-services
{
   "services": [ 
   {
      "hook": "patient-view",
      "name": "CDS Service Example",
      "description": "An example CDS service",
      "id": "example-service",
      "prefetch": {
         "patientToGreet": "Patient/{{Patient.id}}"
      }
   },
   {...}
   ]
}
CDS Service Invocation

```json
{
  "services": [ {
    "hook": "patient-view",
    "name": "CDS Service Example",
    "description": "An example CDS service",
    "id": "example-service",
    "prefetch": {
      "patientToGreet": "Patient/{{Patient.id}}"
    }
  }
}
```

POST https://example.com/cds-services/example-service
2017 Resolutions

Release a 1.0 specification

Launch production pilots
The EHR invokes a CDS service via a patient-view hook, resulting in a SMART app link card that the clinician uses to launch the SMART app.

Validate and implement the CDS Hooks security model.
What’s after 1.0?

- Performance: trigger guards, SLAs
- Event & time based hooks
- Specific use cases (ACR ordering guidelines, CDC opioid guidelines, etc)
Clinical Reasoning

**FHIR**

- Allows decision support content to be shared as FHIR resources

**Artifacts**

- Artifacts that define the structure of content including rules, order sets, protocols, and questionnaires

**Libraries**

- Libraries that describe the *behavior* using logic in Clinical Quality Language (CQL)
Recommendations for primary care clinicians who are prescribing opioids for chronic pain outside of active cancer treatment, palliative care, and end-of-life care (CDC guideline for prescribing opioids for chronic pain)

Provides FHIR Clinical Reasoning artifacts to define the workflows and behaviors recommended by the guideline

Describes how to use CDS Hooks to implement the behavior within a supporting EHR
References

Specification & documentation
http://cds-hooks.org

Demo sandbox
http://sandbox.cds-hooks.org

Source code
https://github.com/cds-hooks
Thanks!
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: Wandering,
- Memory Problems: Tips for Helping the Person With Daily Tasks

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)
ilisinopril (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.
PerfectChoice™
Helping physicians make the perfect antibiotic choices.

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.

View the best antibiotic options based on facility antibiogram in context of the patient’s relevant clinical data to reach the right decision.

Access the EMR to make the appropriate medication order decisions.

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

**Medication Management for Adherence (CDS Hooks)**

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

**Patient View**

**Daniel X. Adams**

- **Birthdate:** 1950-10-22
- **Source:** Patient greeting service

**Medication Management for Adherence**

- **Diabetes**
  - **Medication:** METFORMIN HCL - 30.0 MG
  - **NDC:** 68382075810
  - **PPO score:** 47%
  - **Date filled:** 9/25/2016
  - **Supply:** 30 days

- **Cholesterol**
  - **Medication:** LOVASTATIN - 90.0 MG
  - **NDC:** 68180046803
  - **Date filled:** 9/25/2016
  - **Supply:** 90 days

**Medication Adherence Profile**

**Medication Adherence**

- **Date received:** 10/25/2016

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

**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
Stanson Health’s CDS Hooks service

Real time, workflow integrated, patient specific, evidence based

Reduces low-value and unnecessary care
Build custom differentials from patient information

Differential Diagnosis of a 80+ year old Male

with • Lisinopril • Rash • Reaction 0 to 3 Days After Drug • Smooth Plaque

ADD OR REMOVE FINDINGS

Urticaria

VERY COMMON OR IMPORTANT DIAGNOSIS

Raised, erythematous wheals caused by the release of histamine and other vasoactive substances from mast cells. Urticaria can be triggered by a variety of mechanisms, both allergic and nonallergic. Pruritus, pricking, and stinging sensations, or pain may occur with urticaria. Usually resolve within 24 hours without skin sequelae.

Other Resources:

• UpToDate • Published

Matches 4 of 4 findings: Edit findings

Update record with new diagnoses and findings

Find patient handouts

Recently viewed Diagnoses from VisualDx

Add new Conditions to the problem list

• Urticaria • Crohn's Disease • AIDS

Dx of Medications Reactions in VisualDx

• Lisinopril • Prochlorperazine

Build a Custom Differential in VisualDx

Select a finding to be the Chief Complaint

• Hypertension

Find diagnosis summaries and textbook differentials

Differential Diagnosis & Pitfalls

• Drug toxicity
• Chronic ethanol consumption (e.g., alcohol use disorder)
• Lead poisoning
• Carbon monoxide poisoning
• Multi-infarct dementia
• Depression
• Complex partial seizures
• Autoimmune encephalopathy
• Creutzfeldt-Jakob disease
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

[Image of a patient profile and OrderKnowledge Sigs]

- [5 mg/kg] 9 mL by mouth every 12 hours
- [150 mg/m^2] 6 mL by mouth every day; administer 3 consecutive days per week

[Image of Dosage Calculation: sulfamethoxazole 200 mg trimethoprim 40 mg/5 mL oral suspension]

- Calculated Dosage Amount: 68 mg
- Rounded Dosage Amount: 72.0 mg
Mucedation Personalized Medication Information

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

Interact with Mucedation PMI Viewer

Mucedation Regimen Summary

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

Interact with MucedationRS
Optimize pharmacy spend using **actionable recommendations**.

![Table showing cost and adherence for hypertension and Seasonal Affective Disorder medications.]

Improve outcomes through **consistent prescribing**.

![Table showing prescribing compliance and potential savings for different patients.]

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 30-70% of target dose (e.g., 1.5 mg/kg/d) and titrate based on tolerability. 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 4-8 weeks to reach steady state after each dose adjustment. Azathioprine is the likely cause of myelosuppression.