

Leveraging the HL7[®] FHIR[®] Standard to Drive Improvement in Clinical Care

November 14, 2018

Agenda

- Welcome
 - Jennifer Covich Bordenick, CEO, eHealth Initiative and Foundation
- Discussion & Comments
 - Russell B. Leftwich, MD, Senior Clinical Advisor, Interoperability, InterSystems
 - Dan Gottlieb, Product Specialist, InterSystems
 - Laura Heermann Langford, PhD, RN, Nurse Informaticist, Homer Warner Center for Informatics Research, Intermountain Healthcare; COO, Healthcare Services Platform Consortium
- Q & A



Housekeeping Issues

All participants are muted

 To ask a question or make a comment, please submit via the Q&A feature and we will address as many as possible after the presentations

• Technical difficulties:

Use the chat box and we will respond as soon as possible

Questions:

• Use Q&A feature

 Today's slides will be available for download on eHI's Resource page www.ehidc.org/resources



Our Mission

eHealth Initiative's mission is to serve as the industry leader convening executives from multi-stakeholder groups to identify best practices to transform healthcare through use of technology and innovation. eHI conducts, research, education and advocacy activities to support the transformation of healthcare.



Multi-stakeholder Leaders in Every Sector of Healthcare





Current Initiatives and Member Meetings

Convening Healthcare Executives to Conduct Research & Identify Best Practices

- Technology and Analytics to Improve Patient Care
- Workflow for Quality Improvement
- Data Governance: A Framework for Value-Based Care
- Addressing Privacy in Non-HIPAA Covered Entities
- Effects of Prior Authorization in Healthcare
- Sharing Behavioral Health Information in Light of the Opioid Epidemic
- Clinical Data Drives Success in VBC for Medicaid MCO
- Leveraging Patient Data to Improve Outcomes and Reduce Costs
- Influence of Artificial Intelligence on Healthcare
- Improving Pop Health by Addressing SDOH With A Multi-Stakeholder Approach
- Electronic Medication Adherence and Patient Safety



eHealth Resource Center Available With Best Practices & Findings

Best Practice Committees contribute to the eHealth Resource Center www.ehidc.org/resources which provides assistance, education and information to organizations transforming healthcare through the use of information, technology and innovation. The Resource Center is a compilation of reports, presentations, survey results, best practices and case studies from the last 16 years.



This webinar was made possible through the generosity and support of

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Leveraging the HL7® FHIR® Standard to Drive Improvement in Clinical Care

Russell B Leftwich, MD

Senior Clinical Advisor, Interoperability – InterSystems Webinar – November 14, 2018 2:00 PM















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InterSystems[®]



Leveraging HL7 FHIR to Drive Improvement in Clinical Care

Dan Gottlieb Product Specialist





CDS HÖOKS



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FHIR for Apps



SMART on FHIR

Extends the FHIR standard to support the development of web and mobile apps that can plug-and-play across clinical systems

Layers on support for

- User Authorization via "scopes" (OAuth 2.0)
- Single Sign On (OpenID Connect)
- Context passing on app launch (current patient, encounter, etc.)



Common Clinical Dataset

- Patient demographics (name, birthdate, race, ethnicity, ...)
- Allergies and intolerances
- Immunizations
- Lab results
- Medications (administrations, dispensations, orders, statements)
- Patient documents (*)
- Problems
- Procedures
- Smoking status
- Vital signs

Patient Facing Apps

SMART Patient App Flow



Apple Health

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National Institutes of Health (NIH)



CMS - SMART on FHIR Data Provider

API Blue Button 2.0	
A developer-friendly, standards-based API that enables Medicare beneficiaries applications, services and research programs they trust. View the documentation \rightarrow Sign up for the Developer Sandbox \rightarrow	ies to connect their claims data to the

Provider Facing Apps

"... we had this wonderful population health tool, but we couldn't get the [EHR] system to interface with it, so we had to enter information by hand. We just had to give up on that because we couldn't physically keep up."

Physician, Interview with KLAS Research, 2017

SMART EHR App Flow



SMART App Gallery (apps.smarthealthit.org)



SMART App Gallery (apps.smarthealthit.org)



First Databank - Meducation



Duke Medicine - Pillbox

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Prototype - Joint Tenderness (ClinDat)



FHIR for Clinical Decision Support

CDS HOOKS

CDS Hooks (cds-hooks.org)

Make it easy to incorporate external advice into clinical workflows

- Uses FHIR and SMART defined API ("hooks")
- Response types ("CDS Cards")
 - Information (display to clinician)
 - Suggestion (proposed action to impact clinical workflow)
 - App Link (SMART app that's relevant to the task)
- Next
 - Official version 1.0 balloted through HL7
 - Pilots and roll-out
 - New hook definitions and use cases

CDS HÖOKS

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CDS Hooks Flow



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CDS Hooks Prototype - Pharmacogenomics

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Alert on **Azathioprine** prescription based on patient's expression of **TMPT 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., 1-1.5 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.

FHIR for Population Level Data



Use Cases for Transferring Population Data

Large AMC syncing progress notes from a third party clinic into EHR

Integrating population health system with EHR system

Machine learning startup obtaining training data from cloud EHR

Payer database to assess care quality

Claims in EHR to provide comprehensive view

Internal clinical data warehouse for study cohort identification

Reportable disease submission or other registry

Many more!

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FHIR for Population Level Data

Draft "bulk data" extension to FHIR to support efficient access to data on large groups of individuals

- Leverage FHIR to eliminate the manual and repetitive work involved with proprietary APIs and custom data mapping
- Standard FHIR data model, Standard FHIR Operation API, Standard SMART security model
- Queries return data on all patients that the client's account has access to, all patients in a nominated group, or all data in the system since the starting date time provided
- Can restrict to specific FHIR data models (resource types)



Bulk Data Flow



Google BigQuery Example

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Google BigQuery Example

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HL7 FHIR	hl7.org/fhir
SMART on FHIR	dev.smarthealthit.org
SMART App Gallery	apps.smarthealthit.org
CDS Hooks	cds-hooks.org
FHIR Bulk Data	github.com/smart-on-fhir/fhir-bulk-data-docs



Laura Heermann Langford PhD, RN

Laura.Heermann@imail.org

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Why do we care about all of this?

To help people live the healthiest lives possible



Core Challenges and Value Proposition

- Healthcare faces many critical challenges
 - Patients receive only ~55% of recommended care¹
 - As many as 440,000 patients die each year from preventable medical errors²
 - US healthcare costs are the highest in the world by far,³ and not sustainable
 - Physicians spend up to 2 hrs on administrative tasks (including EHR use) per 1 hr spent in direct patient care, leading to high burnout⁴
- Interoperable apps and services could enable innovative solutions to be widely scaled across EHRs to address these challenges
 - While early, rapidly becoming a viable strategy for improving patient care
- 1. McGlynn EA et al. *N Engl J Med*. 2003. 348:2635-2645.
- 2. James JT. J Patient Saf. 2013. 9:122-128.
- 3. Papanicolas I et al. JAMA. 2018. 319:1024-1039.
- 4. Shanafelt TD et al. JAMA. 2017. 317:901-902.

This is today....



Tomorrow: Plug and Play Interoperability







Decision Support Modules

Antibiotic Assistant Ventilator weaning ARDS protocols

Nosocomial infection monitoring

MRSA monitoring and control

Prevention of Deep Venous Thrombosis

Infectious disease reporting to public health

Patient worksheets

Diabetic care Pre-op antibiotics ICU glucose protocols Ventilator disconnect Infusion pumperrors Lab alerts **Blood ordering** Order sets Post MI discharge meds





At Intermountain

- We have ~150 decision support rules or modules
- We have picked the low hanging fruit
- There is a need to have 5,000+ decision support rules or modules
- There is no path from 150 to get to 5,000+

We have to fundamentally change the ecosystem



Intermountain Healthcare

Integrated Health Delivery Organization

- HQ in Salt Lake City, UT
- Spans all of Utah and Southern Idaho

23 Hospitals, 185+ clinics

Strong Hx of Informatics Innovation (homegrown solutions) Recent implementation of Cerner EMR



A New Direction for Health IT



Intermountain[®] Healthcare Coincidentally...



- DSTU 1 published by HL7 in Feb 2014
- Intermountain & Cerner agree on FHIR as API standard



- Intermountain & Cerner agree on SMART as app interop standard
- Joint support for SMART on FHIR
- Participation (w/ other vendors) at HIMSS 2014, demonstrating interoperable SMART on FHIR apps



ntermountain

Accomplishments

- FHIR DSTU 2 dev & production servers
- OAuth support
- SMART app integration in iCentra
- Production release of 3 SMART on FHIR apps
 - PE Diagnostic/Treatment app in development
- Sharing of app enhancements across orgs/EHRs
- Use of FHIR resources for HIE, Telehealth, PH reporting
- Implementation of Publish/Subscribe services*
- SMART on FHIR sandbox development environment



Example: Pediatric Growth Chart App

First developed by Boston Children's

Target users: NICUs and Peds Clinics, as well as Parents

• Direct patient care

Provides visual display of patient's growth (development) data against an appropriate cohort



Growth Chart App Description

SMART on FHIR App

- Open Source
- Stand-alone or Integrated

Uses FHIR resources to access growth data from EMR

- Height/Length, Weight, Head Circumference, BMI
- DOB, EDD/Gestational Age, Sex

Current State: In Clinical Use in NICUs and Peds Clinics

• Replaces Cerner module & in-house developed app



Growth Chart



Concise, interactive view of a child's growth over time Interactive Graphs, Data Table, Parent View Percentile/bone-age/mid-parental height estimates CDC/WHO/Fenton charts (expandable)

Support for Ambulatory and NICU uses with:

- Gestation corrections
- Bone Age presentation
- Growth point comparison with velocity
- Print-out formats for Graphs, Data Table, and Parent View




Lessons Learned I

EMR Vendor provides a fairly extensive set of FHIR resources...

...Vendors are cautious & conservative at this point ...Need support for additional use cases and Write capability



Lessons Learned II

Still need some expertise on vendor data Data are not always where you think they are, and they don't always come back as expected



Lessons Learned III

Lack of specificity in FHIR Resources

- US Core FHIR Profiles not enough
- Need true semantic interoperability (FHIR Profiles)
- FHIR supports single patient/subject queries
- Working on population-based queries and formats (FHIR Bulk Data)
- Registries and Research-related efforts?



Lessons Learned IV

Differences in Vendor implementations of FHIR

- Data Models
- Search parameters and approaches

Differences in terminology support

• Local term mapping probably needed



IsoSemantic Models – Example of Problem

(based on example from Dr.Linda Bird)

e.g. "Suspected Lung Cancer"



Polyclinic 🛛		
Problem/Diagnosis		
Prob/Dx Name:		
Suspected cancer		
Body Site:		
Lung 🔽		
OK Cancel		
EHR Vendor 123		

Restructured Hospital 🗵	
Diagnosis	
Name:	
Suspected lung cancer	
OK Cancel	

EHR Vendor XYZ

Intermountain[®] Healthcare

University of Utah Exemplar Apps and Services



Neonatal Bilirubin App	 Pulls in baby and mother's EHR data Near universal use in inpatient setting; estimated to save >300 MD hrs/year 	
Procedure Capacity Management App	 Calendar visualization of capacity vs. scheduled procedures Capacity based on business rules and any over-rides Facilitates efficient capacity management 	
Surgical Referral Dashboard App	 Support post-surgical care transition ONC High Impact Pilot project (PIs: Brooke, Del Fiol) Desire for enhanced data interchange with existing documentation 	Image: second
Diabetes Rx Outcome Prediction App	 Collaboration with Hitachi Data-driven Rx guidance (predictive model, AUC 0.87) Accounts for insurance for cost info In pilot clinical use 	
Opioid Decision Support	 Goal: provide point-of-care s upport for CDC Guideline for Prescribing Opioids for Chronic Pain CDC-s ponsored effort. Contributors: ONC, AHRQ, Yale, SRS, ESAC, Epic, and many others. CDS Hooks services and SMART on FHIR app 	Constrained and a second a
MDCalc Integration	 MDCalc: leading calculation tool; > 1 million monthly users; 79% of residents Top 20 priority calculators in production use Auto-population using EHR data 1-click integration with dot phrase Next: many more calculators, CDS Hooks integration 	Here the second

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The Vision

- Imagine as a clinician...
 - It is a joy to use the EHR



- The EHR is constantly saving you time, leaving you more time for your patients and your family
- There is no need to hunt through the record everything you need is right there
- It is easy to do the right thing, every time
- When you imagine how the EHR *should* work, it soon becomes how it *does* work



Key Challenges and Potential Solutions

Challenge	Potential Solutions
Need for additional FHIR APIs	Top-down (e.g., expand US Core FHIR profiles)
(e.g., gestational age, detailed	Bottom-up (e.g., develop and share FHIR profiles
smoking history)	as well as their implementations)
Differences in vendor	Tighten standards
implementations of standards	Improve conformance testing
Ever-evolving standards	Define core logical data model (e.g., CIMI) and
(e.g., FHIR STU 2/3/4, profiles)	map to different flavors of FHIR, other models
Healthcare organizations are innately inward-looking	External funding to promote collaboration and sharing Commercialization



Rationale for FHIR-based Innovations

- Enables tackling important problems for which native EHR functionality is inadequate
 - Provides an alternate strategy to "ask and hope"
- *Feasible to accomplish* as a part of a holistic EHR optimization strategy
 - Epic, Cerner, and other major EHR vendors are supportive
- Can harness the innovation of others
 - Local stakeholders, other institutions, vendors
- Could *potentially commercialize* solutions
- Powerful enabler for *externally funded R&D*



More Reasons to Pursue

Efficient software development

- Widely distributed
- Directed daily by front line clinicians
- Increased usability of software, creativity, innovation

Increased choice in software

- Thousands of independent developers
- Centrally planned economy vs free market
- Think "app store for healthcare" or of innovations like Uber

The start of a Learning Healthcare System is accurate, computable, data.

Healthcare



- Interoperability of apps still in early stages
- Models and profiles will be different and limit interoperability without specific attention
- Open source apps are NOT free
- Prioritization and Governance are key
- The prospect of a new ecosystem to support the vision of information systems contributing to providing the best healthcare widely is REAL and is worthy of investment

To help people live the healthiest lives possible



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Russell B. Leftwich, MD

Dan Gottlieb

Laura Heermann Langford, PhD, RN



To learn more about how InterSystems technology supports SMART on FHIR contact Russ or Dan or visit their FHIR microsite <u>www.intersystems.com/fhir</u>

Russ Leftwich: <u>russell.leftwich@intersystems.com</u>
Dan Gottlieb: <u>daniel.gottlieb@intersystems.com</u>



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