Public Health on FHIR—Fast Healthcare Interoperability Resources

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CDC Health Information Innovation Consortium (CHIIC) Forum

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Vision . . .

Make public health data available

- In a coordinated, consistent, and secure way
- Across jurisdictional boundaries
- With the ability to link to other data to provide greater value
- Without workflow disruption to data providers or data users
Background
Learning Health System

Adoption  Interoperability  Analytics

Learning Health System
Ubiquity of Electronic Health Records

Possession of Certified EHR Among Office-Based Physicians and Hospitals in 2015

78% Physicians

96% Hospitals

Interoperability
Transitions of Care

“An estimated 80 percent of serious medical errors involve miscommunication between caregivers when responsibility for patients is transferred or handed-off, according to the Joint Commission.” --- Health IT News 10/22/10

Population Health Data Challenges

Healthcare data are not semantically consistent

To aggregate or analyze data meaningfully, need:

• standardization at more granular level and
• buy-in from EMR system developers to implement standards consistently
Opportunities to leverage clinical care data in new ways
Evolution of Health Level Seven (HL7)
Interoperability: HL7’s Mission

“a not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services”
Fresh Look in 2011

- **V2**: 1987
- **Start V3**: 1995
- **V3 CDA**: 2005
- **Fresh FHIR Look**: 2011
  - **DSTU**: 2014

Timeline:
- 1980
- 1990
- 2000
- 2010
- 2020

- 10 years
- 3 years
A Closer Look at FHIR—Fast Healthcare Interoperability Resources
FHIR: Fast Healthcare Interoperability Resources

- **Content**: Focus on simplicity (80/20) – bite-sized v. monolithic
- **Technology**: Use cross-industry internet technologies ideal for mobile and web platforms
- **Community**: Develop standards incrementally with early input from implementers through real-world projects with committed and ongoing involvement
- **Privacy & Security**: Adopt best practices, don’t re-invent the wheel
Laying the Conditions for Broad Interoperability
FHIR Clinical Resources

General
- Allergy\Intolerance
- Condition (Problem)
- Procedure
- ClinicalImpression
- Family\MemberHistory
- Risk\Assessment
- Detected\Issue

Care Provision
- CarePlan
- Goal
- Referral\Request
- Procedure\Request
- Nutrition\Order
- Vision\Prescription

Medication & Immunization
- Medication
- Medication\Order
- Medication\Administration
- Medication\Dispense
- Medication\Statement
- Immunization
- Immunization\Recommendation

Diagnostics
- Observation
- Diagnostic\Report
- Diagnostic\Order
- Specimen
- Body\Site
- Imaging\Study
Patient Resource

```xml
<Patient xmlns="http://hl7.org/fhir">
  <id value="glossy"/>
  <meta>
    <lastUpdated value="2014-11-13T11:41:00+11:00"/>
  </meta>
  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml">
      <p>Henry Levin the 7th</p>
      <p>MRN: 123456. Male. 24 Sept 1932</p>
    </div>
  </text>
  <extension url="http://example.org/consent#trials">
    <valueCode value="renal"/>
  </extension>
  <identifier>
    <use value="usual"/>
    <type>
      <coding>
        <system value="http://hl7.org/fhir/x2/0203"/>
        <code value="MRN"/>
      </coding>
    </type>
    <system value="http://www.goodhealth.org/identifiers/nnn"/>
    <value value="123456"/>
  </identifier>
  <name>
    <family value="Levin"/>
    <given value="Henry"/>
    <suffix value="The 7th"/>
  </name>
  <gender value="male"/>
  <birthDate value="1932-09-24"/>
  <careProvider>
    <reference value="Organization/2">
      <display value="Good Health Clinic"/>
    </reference>
  </careProvider>
  <active value="true"/>
</Patient>
```
Observation Resource

Incorporates existing data standards

IDs unique to each FHIR server
## REST API

### Interaction

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>read</td>
<td>/{type}/1{id}</td>
</tr>
<tr>
<td>vread</td>
<td>/{type}/1{id}/_history/1{id}</td>
</tr>
<tr>
<td>update</td>
<td>PUT /{type}/1{id}</td>
</tr>
<tr>
<td>delete</td>
<td>DELETE /{type}/1{id}</td>
</tr>
<tr>
<td>create</td>
<td>POST /{type}</td>
</tr>
<tr>
<td>search</td>
<td>GET /{type}?_search=</td>
</tr>
<tr>
<td>search-all</td>
<td>GET /{type}/_search?</td>
</tr>
<tr>
<td>transaction</td>
<td>POST /conformance / or /metadata</td>
</tr>
<tr>
<td>history</td>
<td>POST /{type}/1{id}/_history</td>
</tr>
<tr>
<td>history-type</td>
<td>POST /{type}/1{id}/_history/1{type}</td>
</tr>
<tr>
<td>history-all</td>
<td>POST /{type}/1{id}/_history/1{type}/1{type}</td>
</tr>
<tr>
<td>(operation)</td>
<td>POST /{type}/1{id}/1{type}/1{type} or /{type}/1{id}/1{type}/1{type}</td>
</tr>
</tbody>
</table>

### Request

<table>
<thead>
<tr>
<th>Verb</th>
<th>Content-Type</th>
<th>Body</th>
<th>Prefer</th>
<th>Conditional</th>
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<tbody>
<tr>
<td>GET</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>O: If-Match, If-Modified-Since, If-none-match</td>
</tr>
<tr>
<td>PUT</td>
<td>R</td>
<td>Resource</td>
<td>O: O: If-Match</td>
<td></td>
</tr>
<tr>
<td>DELETE</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>POST</td>
<td>R</td>
<td>Resource</td>
<td>O: O: If-None-List</td>
<td></td>
</tr>
<tr>
<td>GET</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>POST</td>
<td>application/x-www-form-urlencoded form data</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>GET</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
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<td>of GET</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>POST</td>
<td>R</td>
<td>Bundle</td>
<td>O</td>
<td>N/A</td>
</tr>
<tr>
<td>GET</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>POST</td>
<td>R</td>
<td>Parameters</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>POST</td>
<td>application/x-www-form-urlencoded form data</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

### Endpoints

- **Resource Type**: `http://server.org/fhir/Patient/1`
- **Identifier**
API Example

GET [base]/Observation?_query=obs.stats&code=8480-6&03/03/2016/07:00:00&03/03/2016/12:00:00
GET [base]/Observation?_query=obs.stats&code=8462-4&03/03/2016/07:00:00&03/03/2016/12:00:00
FHIR Profiles and Extensions
Content & Format Always the Same
Substitutable Medical Applications and Reusable Technologies (SMART)-on-FHIR

Learn More: https://smarthealthit.org/ and https://www.youtube.com/watch?v=Lo9ETDImwes
SMART Apps Integrated Into EHR
Harvard Medical School
Duke University Medical System
Intermountain Healthcare
Hackensack University Medical Center (Epic)

Patient Demographic Update

Patient Appointment

Open Scheduling
SMART-on-FHIR Public Health App: “Death Worm”
Solution: Powerful & Flexible Tool to Help Physicians Determine Chain of Events that Led to Death

+ **Integrate Into Physicians’ Workflow**: Certify Deaths in the EHR & Send Electronically to State
+ **Save Time**: Provide Medical History & Pre-Populate Demographic/Basic Health Information
+ **Improve Accuracy**: Use Advanced Computing to Help Determine Cause-of-Death Sequence
+ **Advance Medical Research & Improve Care**: Send Coded Data Back to EHR
Johnston, Jonathan -- ID 100001

Patient Details
Name: Jonathan James Johnston
Age at death: 68.5 years
Residence: Everett, USA 98209

Patient History
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Suspendisse hendrerit, enim vel dictum
duplulas, tellus massa duis nibh, in ascor felis felis at nisl. Nam sit amet lorem dui. Sed
ullamcorper magna eget enim semper, eu maximus nisl porta. Proin congue et quam, ac rhoncus ipsum
hendrerit amin. Proin sed rutrum diam vel diam semper ac nata felis consectetur. Nulla tincidunt, risus

Cause of Death:
- Rupture of heart
- Acute myocardial infarction
- Diffuse disease of coronary artery

Onset to Death:
- 13 minutes
- 3 days
- 39 years

Other Significant Conditions

Logged in as: unknown
Automatically extract patient data from EHR

Patient history information

Scaled timeline of health conditions

Recommend possible sequences

Familiar interface for cause-of-death documentation

Bundle results in FHIR format
CDC Partnership With Georgia Tech

OMS Wins Top Award in Program Effectiveness

Learn More

Online Master of Science in Computer Science

Are you ready to earn your master’s in computer science but not ready to stop working? Do you want a top-ranked degree without the top-ranked price tag?

If so, Georgia Tech has the answer.
- Healthy Communities
  - Childhood Obesity
  - Group B Step
  - Cancer Reporting
  - Health Surveys
- Public Health Surveillance
  - Medication Adherence
  - STD Reporting
  - Interoperability Among Existing Systems
- Clinical Decision Support
  - Social Service Referral
  - Electronic Case Reporting
- Population Health Frameworks
  - Stroke Discharge
  - Interoperability Among Existing Systems
Improve Medical Examiner Access to Controlled Substances Database

Develop a FHIR interface for the Utah Controlled Substances Database to enable users to access prescription history from within the Office of the Medical Examiner's case management system.
Provide Prescription Drug History Within Medical Examiner’s Workflow
Scalable Solution
Now Accepting App Ideas for Fall 2017

Contact Paula Braun: pax1@cdc.gov
Topics for Consideration
Considerations for public health based on lessons learned from FHIR

- What are the most important things that need to be done?
- How can we work together to promote as much coordination and consistency as early as possible in the process?
- What do vendor products currently have the capacity to do? What functionality needs to be added to core products? What options do we have to bridge any gaps?
- How can public health data collection better fit within data providers’ workflow?
- Don’t try to solve every problem. Focus on the common 80%, set priorities, and build strong collaborations.
Questions?

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