

C-CDA on FHIR

Rick Geimer, Lantana Consulting Group



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Instructor

- Rick Geimer
 - Member:
 - HL7 CDA Management Group
 - FHIR Infrastructure Work Group
 - Structured Documents Work Group
 - Attachments Work Group
 - HL7 CDA R2 Certified Specialist, Certified FHIR Proficient
 - Co-Editor, CDA Consolidation and many other implementation guides
 - Lead: C-CDA on FHIR project
 - Day job: Lantana Chief Innovation Officer

Lantana Consulting Group

- Our Mission:
 - Improve healthcare through health information technology (IT)
 - Lead the industry through our consulting and volunteer practice
- Our Services:
 - Strategic advice for health IT planning, design, & purchasing
 - Development & implementation
 - Terminology, data governance, & education



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Outline

- Overview of Electronic Clinical Documents
- FHIR documents
- C-CDA on FHIR and US Core
- Converting, managing, and validating FHIR documents
- Current/Future Work and Resources

Clinical Documents

- This is a document
- and this
- and this
- and this
- and this

EVE BETTERHALF
PATIENT CHART SUMMARY

BACK TO TOP

DEMOGRAPHICS

AUTHORING DETAILS

CLINICAL SECTIONS

PROCEDURES


Community Health and Hospitals: History & Physical

Patient	Eve Betterhalf
Date of birth	May 1, 2009
Sex	Female
Race	Asian
Ethnicity	Not Hispanic or Latino
Contact info	Primary Home

CHART SUMMARY

CONTACT

Primary Home
2222 Home Street



1004 Healthcare Drive
Portland, OR
99123, US
Tel : +1(555)555-1004

Community Health H
Discharge Summary

Description: Acute cerebrova

Diagnostic Imaging Report

Clinical History
Colorectal carcinoma with right-sided chest and right upper abdominal pain.

Comparison
Chest x-ray from the same date.

Technique
The patient underwent initial ventilation imaging following the inhalation of DTPA aerosol.

Findings
There are new wedge-shaped pleural-based moderate-sized segmental defects identified within the bilateral upper lung zones compatible with high probability for pulmonary thromboembolism.

Impression
High probability for pulmonary thromboembolism

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Alert

right, 2) No evidence of carotid

HISTORY AND PHYSICAL: TI 15 years, untreated. The patient had a history of right-sided weakness of his arm and numbness on the dorsal side, relieved by EMS to emergency room. The patient was normal before he was given aspirin in the ER. The CT of the brain without contrast could not have a CT with contrast because the machine was broken. The MRI/MRA of the brain and neck, which showed infarct involving deep white matter of the left parietal lobe. Also, there is diffuse stenosis of the middle cerebral artery.

The patient was admitted to the MICU.

Key Characteristics

- **Persistence** – A clinical document continues to exist in an unaltered state, for a time period defined by local and regulatory requirements. Note: documents outlive the servers (and often the syntax) on which they are created.
- **Stewardship** – A clinical document is maintained by an organization entrusted with its care.
- **Potential for authentication** – A clinical document is an assemblage of information that is intended to be legally authenticated.
- **Context** – A clinical document establishes the default context for its contents.
- **Wholeness** – Authentication of a clinical document applies to the whole and does not apply to portions of the document without the full context of the document.
- **Human readability** – A clinical document is human readable.

Clinical Document Architecture (CDA)

- A **specification for exchange of clinical documents**, defining their structure and semantics
- **ANSI/ISO standard** developed by HL7's Structured Documents Work Group (SDWG)
- **Base standard** on which many Implementation Guides (IGs) are built:
 - Quality Reporting Document Architecture (QRDA)
 - Healthcare Associated Infection (HAI) Reports
 - Consolidated CDA (C-CDA)
 - ...and many others

Consolidated CDA (C-CDA)

- HL7 Consult Note
- HL7 Diagnostic Imaging Report
- HL7 Discharge Summary
- HL7 History and Physical
- HL7 Operative Note
- HL7 Procedure Note
- HL7 Unstructured Documents
- HL7 Progress Notes
- HL7 Continuity of Care Document
- HITSP/C84 Consult and History & Physical Note Document
- HITSP/C32 - Summary Documents Using HL7 CCD
- HITSP/C48 Referral and Discharge Summary Document constructs
- HITSP/C62 Scanned document



Consolidate and harmonize various standalone documents into one master implementation guide for the primary care use case.

Later versions added additional document types such as the Care Plan document type.

What can be improved?

- **Grahame's Law:**
 - You can hide complexity, or **make it worse**, but you can't make it go away.
- **HL7 V3 was more complex than necessary.**
 - Simple technical problems became road-blocks for many implementers.
- **CDA was the stable, simpler part of HL7 V3.**
 - But inherited much of the V3 complexity
 - Never had a viable API complement
- **FHIR makes many simple problems simple again.**
 - Lets implementers focus on solving the hard problems.
- **Many CDAs today are just EHR data dumps.**
 - FHIR Queries can serve the same purpose with more specificity.
 - The future: fewer data dump documents, more clinically relevant documents

The Acronym

- F – Fast (to design & to implement)
 - Relative – No technology can make integration as fast as we'd like
- H – Health
 - That's why we're here
- I – Interoperable
 - Ditto
- R – Resources
 - Building blocks – more on these to follow

FHIR, Over-Simplified

- FHIR is like Lego(™) for Healthcare
 - Resources = Blocks
 - Resources are discrete chunks of clinical information
 - Resources can be assembled into larger constructs
 - You operate on resources via FHIR's REST APIs - like programming Lego Mindstorms (™)



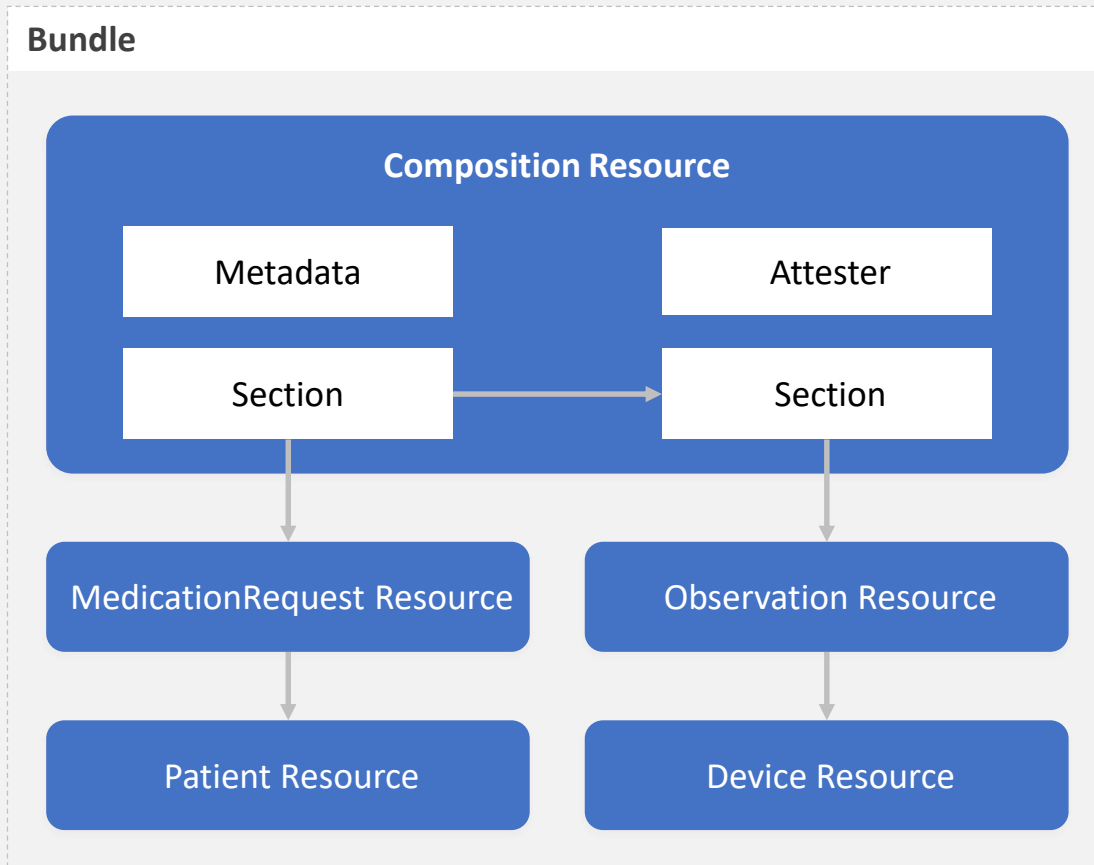
FHIR and CDA

- Similarities
 - Support profiling for specific use-cases
 - Human readability is minimum for interoperability
 - Validation tooling, profile tooling
- FHIR Differences
 - Can use out of the box – no templates required (but profiling still recommended)
 - Encompasses documents, resources, messages, and APIs (i.e. not just a document exchange format)
 - Implementer tooling generated with spec

FHIR Documents

- Address CDA use case for clinical documents
- Collection of resources bound together
 - Root is a Composition resource
 - Much like the CDA header + narrative
- Sent as a Bundle resource
- Can be signed, authenticated, etc.
- A FHIR document has the same basic obligations as a CDA document
- Full rules
 - <http://build.fhir.org/documents.html>

FHIR Documents: Bundles of Resources

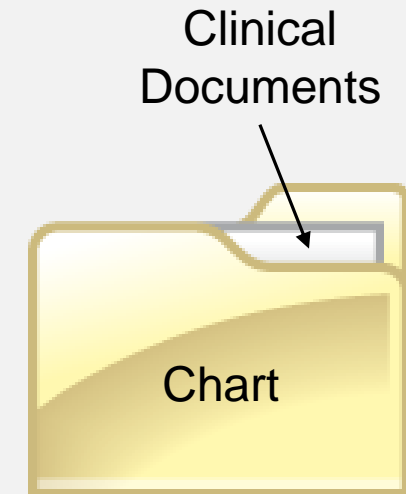


```

<Bundle>
  <entry>
    <Composition />
  </entry>
  <entry>
    <Observation />
  </entry>
  <entry>
    <Device />
  </entry>
  <entry>
    <MedicationRequest />
  </entry>
  <entry>
    <Patient />
  </entry>
</Bundle>
  
```

Composition Resource

- Contains
 - Patient
 - Author
 - Custodian
 - Type of document (e.g., Discharge summary)
 - Attested narrative of the document
- Sufficient for
 - Medical records management
 - Document management
 - Enable clinical document exchange across and within institutions
 - Human readable documents



Sections and Narrative

- Composition resources contain sections (which may be nested)
- The section narrative markup is XHTML
- The narrative contains the attested text of the document
- It is ok for sections to consist of only human readable text (i.e., no machine processable resources)

First: Human Readable

```

<section>
  <title value="Allergies and Intolerances"/>
  <code>
    <coding>
      <system value="http://loinc.org"/>
      <code value="48765-2"/>
      <display value="Allergies and adverse reactions"/>
    </coding>
  </code>
  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml">
      <ul>
        <li>Penicillin - Hives</li>
        ...
      </ul>
    </div>
  </text>
  ...
</section>
  
```

Allergies and Intolerances

- Penicillin - Hives

Next: Coded Data

```
<AllergyIntolerance xmlns="http://hl7.org/fhir">
  <clinicalStatus value="active"/>
  <verificationStatus value="confirmed"/>
  <category value="medication"/>
  <criticality value="high"/>
  <code>
    <coding>
      <system value="http://snomed.info/sct"/>
      <code value="418038007"/>
      <display value="allergy to penicillin"/>
    </coding>
  </code>
  <patient>
    <reference value="Patient/1"/>
    <display value="Henry Levin"/>
  </patient>
```

```
<assertedDate value="2000"/>
  <reaction>
    <manifestation>
      <coding>
        <system value="http://snomed.info/sct"/>
        <code value="247472004"/>
        <display value="hives"/>
      </coding>
    </manifestation>
    <severity value="mild"/>
  </reaction>
</AllergyIntolerance>
```

C-CDA on FHIR

- US Realm FHIR Implementation Guide
 - Goal:
 - FHIR profiles for the C-CDA use case
 - Scope
 - Represent C-CDA templates using FHIR profiles
 - Focus on C-CDA document-level profiles using the Composition Resource
 - Coded entries limited to US Core profiles via the 80/20 rule.

Home Documentation Modules Resources Profiles Extensions Operations Services

C-CDA on FHIR Implementation Guide

C-CDA on FHIR Implementation Guide (IG)

Summary

C-CDA is one of the most widely implemented implementation guides for CDA and covers a significant scope of clinical care. Its target of the 'common/essential' elements of healthcare is closely aligned with FHIR's focus on the '80%'. There is significant interest in industry and government in the ability to interoperate between CDA and FHIR and C-CDA is a logical starting point. Implementers and regulators have both expressed an interest in the ability to map between FHIR and C-CDA.

This Implementation Guide defines a series of FHIR profiles on the Composition resource to represent the various document types in C-CDA. This release does not directly map every C-CDA template to FHIR profiles, rather tries to accomplish the C-CDA use case using Composition resource profiles created under this project (the equivalent of Level 2 CDA documents), and linking to the profiles created under the Data Access Framework (DAF) project for any coded entries that would normally be included in C-CDA sections. The hope is that this results in a simpler, more streamlined standard that reuses existing work and focuses on the 80% that implementers actually need in production systems (the hope is that DAF represents that 80% needed for coded entries).

The Composition profiles in this IG do not require coded data in any section. This is a departure from C-CDA, which requires coded data for Problems, Results, Medications, etc. This departure is intentional, as the C-CDA requirement for coded one or more coded entries in these sections resulted in some very complicated workarounds using nullFlavors to handle the fact that sometimes a patient is not on any medications, or has no current problems. In general, FHIR takes the approach that if something is nullable, it should simply be optional to ease the burden on implementers, thus C-CDA on FHIR does not require any coded entries, but rather uses the "required if known" approach, meaning that if an implementer's system has data for a section that requires data under Meaningful Use, they need to send it, but if they have no data there is no need for a null entry.

We encourage feedback on these Composition profiles, and the general approach to the project as a whole. We also encourage implementers who wish to see more of the coded data from C-CDA mapped to FHIR to comment on the DAF project and make their requests known there. Once DAF creates new profiles, this project can reference them.

Scope

To represent Consolidated CDA Templates for Clinical Notes (C-CDA) 2.1 templates using FHIR profiles. This first stage of the project defines all the C-CDA document-level profiles on the Composition resource and contained sections.

Any coded data used by sections will be accomplished by referencing relevant U.S. Data Access Framework (DAF) FHIR profiles.

Resource Profiles














This guide defines the following profiles.

Profile Name	Description
--------------	-------------

Finding C-CDA on FHIR

- Published specification
 - <http://hl7.org/fhir/us/ccda/index.html>
- Current build
 - <http://build.fhir.org/ig/HL7/ccda-on-fhir/>

First time here? See the [executive summary](#), the [developer's introduction](#), [clinical introduction](#), or [architect's introduction](#), and then the [FHIR overview / roadmap](#). See also the [open license](#) (and don't miss the full [Table of Contents](#) or you can search this specification).

 Clinical Reasoning		Decision Support, Clinical Quality Measures		
 Clinical	 Diagnostics	 Medications	 Workflow	 Financial
Allergy, Problem, etc.	Observation, Report, Request, etc.	Order, Dispense, Administration, Statement, etc.	Task, Subscription, etc.	Claim, EligibilityRequest, etc.
 Administration		Patient, Practitioner, Device, Organization, Location, Healthcare Service		
 Implementer Support	 Security & Privacy	 Conformance	 Terminology	 Ontology
Downloads, Common Use Cases, Testing	Security, Consent	StructureDefn, CapabilityStatement, Profiling	CodeSystem, ValueSet, ConceptMap, Terminology Svc	RDF
 Foundation		Base Documentation, XML, JSON, REST API + Search, Data Types, Extensions		

External Links:

Implementation Guides
 Specifications based on the FHIR standard

- Published by HL7 Affiliates & FHIR Foundation [↗](#)
- Other IGs (FHIR Wiki) [↗](#)

FHIR Foundation [↗](#)
 Enabling health interoperability through FHIR

- Community Forum [↗](#) + FHIR Chat [↗](#)
- Public Test Servers & Software [↗](#)

Translations
 Note that translations are not always up to date

- Russian [↗](#)
- Chinese [↗](#)

US Core Framework

- Location
 - <http://hl7.org/fhir/us/core/index.html>
- FHIR Profiles for the Common Clinical Data Set (CCDS)
 - CCDS location:
 - https://www.healthit.gov/sites/default/files/2015Ed_CCG_CCDS.pdf
- [US Core AllergyIntolerance Profile](#)
- [US Core CareTeam Profile](#)
- [US Core Condition \(a.k.a Problem\) Profile](#)
- [US Core Device Profile](#)
- [US Core DiagnosticReport Profile](#)
- [US Core Goal Profile](#)
- [US Core Immunization Profile](#)
- [US Core Location Profile](#)
- [US Core Medication Profile](#)
- [US Core MedicationRequest Profile](#)
- [US Core MedicationStatement Profile](#)
- [US Core Practitioner Profile](#)
- [US Core Procedure Profile](#)
- [US Core Results Profile](#)
- [US Core Smoking Status Profile](#)
- [US Core CarePlan Profile](#)
- [US Core Organization Core Profile](#)
- [US Core Patient Profile](#)
- US Core adopts the [Vitals Signs Profile](#) from FHIR Core.

C-CDA on FHIR Demo

- Live walkthrough of the specification
- Composition profiles and US Core

Converting between C-CDA and C-CDA on FHIR

- Why?
 - Quick way to get a critical mass of FHIR documents
 - Continuity with existing practice, using better syntax and APIs
 - Creating FHIR documents and converting to CDA may be an easier way for developers to comply with today's regulations
 - Supports transitional strategies with mixed environments
- How?
 - Future:
 - C-CDA to FHIR mapping project
 - HL7 sanctioned mappings defined using FHIR Mapping Language
 - Project began in May 2018, completion planned for Sept 2019
 - Current
 - Various non-HL7 solutions (some proprietary, some open)
 - Example: ONC-HIP Pharmacist Care Plan transforms
<https://github.com/lantanagroup/PhCP-Public-Transforms>

Managing FHIR Documents

- Documents are persistent objects
- Thus they must be stored somewhere (or reproduced exactly on demand)
- Options:
 - FHIR server (/Bundle or /Binary endpoint)
 - Document management system
 - Clinical data repository
 - Database
 - File system
 - etc.
- **Important:** since clinical documents are a persistent part of the patient record, they should not be generated, transmitted, then disposed of like an message.

Validating FHIR Documents

- FHIR validation pack
 - Includes XML Schema and Schematron files
 - <http://build.fhir.org/fhir-all-xsd.zip>
 - FHIR Validator (Java Tool)
 - <http://build.fhir.org/validator.zip>
- FHIR server validation
 - Most servers do basic resource validation
 - Use the \$validate operation
 - Can validate profiles like C-CDA on FHIR
 - <http://build.fhir.org/operation-resource-validate.html>

Future Work

- Unstructured Documents (US Core DocumentReference profile)
- Section entry profiles not covered by US Core
- Other CDA IGs as driven by demand
- C-CDA to FHIR Mapping Project
 - C-CDA to FHIR Mappings using FHIR Mapping Language
 - Starting now, projected to end in Sept of 2019

Is your roadmap on FHIR?

- FHIR evaporates “V3 messaging”
- V2: if not broke... don't replace
- CDA
 - FHIR retains CDA document concepts
 - Improves text/data management
 - Unified model/syntax with messages/API
- C-CDA on FHIR
 - Ready for trial use
 - Limited production
 - Needs more testing/implementation

Exercise

- Use FHIR Connectathon materials for the Documents track
- http://wiki.hl7.org/index.php?title=201805_FHIR_Documents

Resources

- The FHIR spec:
 - Updated continuously
 - URLs
 - Latest balloted version: <http://hl7.org/fhir>
 - Continuous build: <http://build.fhir.org/>
- Lantana White Paper co-authored with Grahame Grieve:
 - FHIR CDA Position Statement and Roadmap
 - URL: <http://www.lantanagroup.com/resources/publications/>
- Rick:
 - Updated continuously, rebooted occasionally
 - rick.geimer@lantanagroup.com

Questions?