CDA and CCD for Patient Summaries

Calvin E. Beebe
Mayo Clinic
Co-chair SDWG
HL7 Board Treasurer
What is the CDA?

- The CDA is a document markup standard for the structure and semantics of an exchanged "clinical document".

- A clinical document is a documentation of observations and other services with the following characteristics:
  - Persistence
  - Stewardship
  - Potential for authentication
  - Context
  - Wholeness
  - Human readability

- A CDA document is a defined and complete information object that can exist outside of a message, and can include text, images, sounds, and other multimedia content.
CDA Business Case

- **CDA hits the “sweet spot”** – CDA encompasses all of clinical documents. A single standard for the entire EHR is too broad. Multiple standards and/or messages for each EHR function may be difficult to implement. CDA is “just right”.

- **Implementation experience** - CDA has been a normative standard since 2000, and has been balloted through HL7's consensus process. CDA is widely implemented.

- **Gentle on-ramp to information exchange** - CDA is straight-forward to implement, and provides a mechanism for incremental semantic interoperability.

- **Improved patient care** - CDA provides a mechanism for inserting evidence-based medicine directly into the process of care (via templates), making it easier to do the right thing.

- **Lower costs** – CDA's top down strategy let’s you implement once, and reuse many times for new scenarios.
CDA provides a gentle on-ramp to information exchange

A minimally conformant CDA document:

```xml
<ClinicalDocument>
  <typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>
  <id root="2.16.840.1.113883.19.4"/>
  <code code="11488-4" codeSystem="2.16.840.1.113883.6.1"/>
  <effectiveTime value="20000407"/>
  <confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25"/>
  <recordTarget>
    <patientRole><id root="2.16.840.1.113883.19.5"/></patientRole>
  </recordTarget>
  <author>
    <time value="2000040714"/>
    <assignedAuthor><id root="2.16.840.1.113883.19.5"/></assignedAuthor>
  </author>
  <custodian>
    <assignedCustodian>
      <representedCustodianOrganization>
        <id root="2.16.840.1.113883.19.5"/>
      </representedCustodianOrganization>
    </assignedCustodian>
  </custodian>
  <legalAuthenticator>
    <time value="20000408"/>
    <signatureCode code="S"/>
    <assignedEntity><id root="2.16.840.1.113883.19.5"/></assignedEntity>
  </legalAuthenticator>
  <component>
    <nonXMLBody>
      <text mediaType="text/plain"><reference value="1598765.txt"/></text>
    </nonXMLBody>
  </component>
</ClinicalDocument>
```

CDA provides a gentle on-ramp to information exchange

- A minimally conformant CDA document:
Key aspects of the CDA

- CDA documents are encoded in Extensible Markup Language (XML).
- CDA is derived from HL7's central Reference Information Model (RIM), thereby enabling data reusability - with lab or pharmacy messages, with claims attachments, clinical trials, etc.
- The CDA specification is richly expressive and flexible. Templates, conformance profiles, and implementation guides can be used to constrain the generic CDA specification.
CDA Guiding Principles

- Give priority to documents generated by clinicians involved in direct patient care.
- Minimize the technical barriers needed to implement the Standard.
- Promote longevity of all information encoded according to this architecture.
- Promote exchange that is independent of the underlying transfer or storage mechanism.
- Enable policy-makers to control their own information requirements without extension to this specification.
Major Components of a CDA Document

```xml
<ClinicalDocument>
  ...
  <structuredBody>
    <section>
      <text>...</text>
      <observation>...</observation>
      <substanceAdministration>
        <supply>...</supply>
      </substanceAdministration>
      <observation>
        <externalObservation>
          ...
        </externalObservation>
      </observation>
    </section>
    <section>...</section>
  </structuredBody>
</ClinicalDocument>
```
Allergies and Adverse Reactions

- Penicillin - Hives
- Aspirin - Wheezing
- Codeine – Itching and nausea
<section>
  <code code="48765-2" codeSystem="2.16.840.1.113883.6.1"
codeSystemName="LOINC"/>
  <title>Allergies and Adverse Reactions</title>
  <text>
    <list>
      <item><content ID="A1">Penicillin - Hives</content></item>
      <item>Aspirin - Wheezing</item>
      <item>Codeine - Itching and nausea</item>
    </list>
  </text>
  <entry>
    <observation classCode="OBS" moodCode="EVN">
      <code code="247472004" codeSystem="2.16.840.1.113883.6.96"
codeSystemName="SNOMED CT" displayName="Hives">
        <originalText><reference value="#A1"/></originalText>
      </code>
      <entryRelationship typeCode="MFST">
        <observation classCode="OBS" moodCode="EVN">
          <code code="91936005" codeSystem="2.16.840.1.113883.6.96"
codeSystemName="SNOMED CT" displayNames="Allergy to penicillin"/>
        </observation>
      </entryRelationship>
    </observation>
  </entry>
</section>
CDA is based on a principle of **Incremental Interoperability**

- **Incremental Interoperability** means that an implementer can begin with a simple CDA, and then add structured data elements over time.

- CDA R2 consists of a single CDA XML Schema, and the “architecture” arises from the ability to apply one or more “templates” which serve to constrain the richness and flexibility of CDA.

- Professional society recommendations, national clinical practice guidelines, standardized data sets can be expressed as CDA templates.

- There are many kinds of templates that might be created. Three are particularly relevant for documents:
  - Document level templates
  - Section level templates
  - Entry level templates
ASTM CCR vs. HL7 CDA

- What if you could have both?!? (or, what if you could have your data elements, and send them in a common exchange framework too?)
The primary use case for the ASTM CCR is to provide a snapshot in time containing a summary of the pertinent clinical, demographic, and administrative data for a specific patient.

From the perspective of CDA, the ASTM CCR is a standardized data set that can be used to constrain CDA specifically for summary documents.

The resulting specification is known as the Continuity of Care Document (CCD).
Continuity of Care Document (CCD)

- CCD maps the CCR elements into a CDA representation.

```xml
<Results>
  <Result>
    <CCRDataObjectID>2.16.840.1.113883.19.1</CCRDataObjectID>
    <DateTime>
      <Type>
        <Text>Assessment Time</Text>
      </Type>
      <ExactDateTime>200004071430</ExactDateTime>
    </DateTime>
    <Type>
      <Text>Hematology</Text>
    </Type>
    <Description>
      <Text>CBC WO DIFFERENTIAL</Text>
    </Description>
    <Code>
      <Value>43789009</Value>
      <CodingSystem>SNOMED CT</CodingSystem>
    </Code>
    <Status><Text>Final Results</Text></Status>
  </Result>
</Results>

<section>
  <templateId root="2.16.840.1.113883.10.20.1.14"
    code "30954-2"
    codeSystem="2.16.840.1.113883.6.1"
    codeSystemName="LOINC"/>
  <title>Laboratory results</title>
  <text>
    CBC (04/07/2000): HGB 13.2; WBC 6.7; PLT 123*
  </text>
</section>
```
Continuity of Care Document

CCD sections:
- Payers
- Advance Directives
- Support
- Functional Status
- Problems
- Family History
- Social History
- Allergies
- Medications
- Medical Equipment
- Immunizations
- Vital Signs
- Results
- Procedures
- Encounters
- Plan of Care
CCD Implementation challenge

- Creation of an instance conforming to a particular CDA Implementation Guide may require knowledge of:
  - CDA R2 base specification;
  - HL7 Version 3 data type specification;
  - CDA templates defined in the particular IG;
  - CDA templates referenced by the particular IG;
  - Terminology code lists defined/referenced by the particular IG;

- Validation of an instance conforming to a particular CDA IG may require:
  - W3C Schema validation;
  - Schematron validation;
One solution = Consolidate!

- Consolidated library of reusable CDA templates and common document types:
  - CCD
  - Consultation Note
  - Diagnostic Imaging Report
  - Discharge Summary
  - H&P
  - Operative Note
  - Procedure Note
  - Progress Note
  - Unstructured Document
Another Solution - greenCDA

- Create an “authoring schema” that simplifies the creation and processing of a particular CDA IG:
  - Clinically meaningful XML element and attribute names;
  - 100% transformable into conformant CDA IG;
  - Hides certain CDA complexities (such as moodCodes, fixed attributes, etc).

- We call this strategy: greenCDA
  - greenCDA schemas are modular, corresponding to CDA templates.
An example – build the **greenCDA** module

### Requirements

<table>
<thead>
<tr>
<th>CDA Data Location</th>
<th>HITSP Data Element Identifier and Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>cda:observation[cda:templateId/@root = '2.16.840.1.113883.10.20.1.31']</td>
<td>Result Event Entry</td>
</tr>
<tr>
<td>cda:id</td>
<td>15.01 - Result ID</td>
</tr>
<tr>
<td>cda:effectiveTime</td>
<td>15.02 - Result Date/Time</td>
</tr>
<tr>
<td>cda:code/@code</td>
<td>15.03 - Result Type</td>
</tr>
<tr>
<td>cda:statusCode</td>
<td>15.04 - Result Status</td>
</tr>
<tr>
<td>cda:value</td>
<td>15.05 - Result Value</td>
</tr>
<tr>
<td>cda:interpretationCode/@code</td>
<td>15.06 - Result Interpretation</td>
</tr>
<tr>
<td>cda:referenceRange</td>
<td>15.07 - Result Reference Range</td>
</tr>
</tbody>
</table>

**greenCDA** schema

```
<result>
  <resultID/>
  <resultDateTime/>
  <resultType/>
  <resultStatus/>
  <resultValue/>
  <resultInterpretation/>
  <resultReferenceRange/>
</result>
```
An example – create a conformant instance

**greenCDA instance**

```xml
<result>
  <resultID>
  <resultDateTime>
  <resultType>
  <resultStatus>
  <resultValue>
  <resultInterpretation>
  <resultReferenceRange>
</result>
```

Conformant CDA instance

```xml
<!-- These examples assume the default namespace is 'urn:hl7-org:v3' -->
<observation classCode='OBS' moodCode='EVN'>
  <templateId root='2.16.840.1.113883.10.20.1.31'/>
  <templateId root='2.16.840.1.113883.3.88.11.83.15'/>
  <templateId root='1.3.6.1.4.1.19376.1.5.3.1.4.13'/>
  <code code='...' displayName='...' codeSystem='2.16.840.1.113883.6.1'
    codeSystemName='LOINC'/>
  <effectiveTime low value='...'/>
  <statusCode value='N'/>
  <value xsi:type='PQ' value='100' unit='g/dl'>
    <interpretationCode code="N" codeSystem="2.16.840.1.113883.5.83"/>
    <referenceRange>
      <observationRange>
        <text>M 13-18 g/dl; F 12-16 g/dl</text>
      </observationRange>
    </referenceRange>
  </value>
</observation>
```
Thank you!