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360° Clinical Intelligence

CCD Analyzer Overview

prepared for

the sequoia project

Content Testing Workgroup

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Diameter Health Team

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Diameter Health provides strong technical expertise and rich industry experience to the evaluation of CCD/C-CDA clinical content.

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Diameter team consists members include:

- Editor of HL7 C-CDA Standard
- Successful entrepreneur of health IT startup & experience with EHR technology
- Lead authors on multiple Health IT publications on interoperability

Together, we are bringing 50+ years of healthcare expertise.

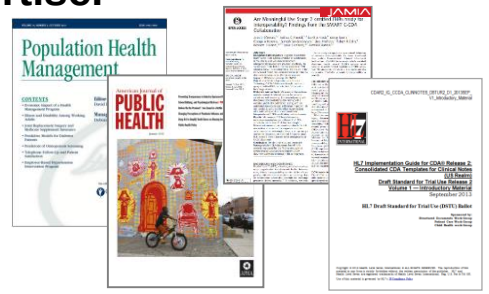
premise
Visualize | Optimize | Realize

Allscripts

MEMORIAL HERMANN

ECLIPSYS
The Outcomes Company

Hartford HealthCare



Need for Data Quality Surveillance

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Research and applications

OPEN ACCESS

Are Meaningful Use Stage 2 certified EHRs ready for interoperability? Findings from the SMART C-CDA Collaborative

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ABSTRACT

Background and objective Upgrades to electronic health record (EHR) systems scheduled to be introduced in the USA in 2014 will advance document interoperability between care providers. Specifically, the second stage of the federal incentive program for EHR adoption, known as Meaningful Use, requires use of the Consolidated Clinical Document Architecture (C-CDA) for document exchange. In an effort to examine and improve C-CDA based exchange, the SMART (Substitutable Medical Applications and Reusable Technology) C-CDA Collaborative brought together a group of certified EHR and other health information technology vendors.

Materials and methods We examined the machine-readable content of collected samples for semantic correctness and consistency. This included parsing with the open-source BlueButton.js tool, testing with a validator used in EHR certification, scoring with an automated open-source tool, and manual inspection. We also conducted group and individual review sessions with participating vendors to understand their interpretation of C-CDA specifications and requirements.

Results We contacted 107 health information technology organizations and collected 91 C-CDA sample documents from 21 distinct technologies. Manual and automated document inspection led to 615 observations of errors and data expression variation across represented technologies. Based upon our analysis and vendor discussions, we identified 11 specific areas that represent relevant barriers to the interoperability of C-CDA documents.

Conclusions We identified errors and permissible heterogeneity in C-CDA documents that will limit semantic interoperability. Our findings also point to several practical opportunities to improve C-CDA document quality and exchange in the coming years.

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BACKGROUND AND SIGNIFICANCE

Health Level 7 (HL7), a leading standards development organization for electronic health information, defines interoperability as 'the ability of two parties, either human or machine, to exchange data or information where this deterministic exchange preserves shared meaning.'[1] In addition, semantic interoperability has been operationally defined to be 'the ability to import utterances from another computer without prior negotiation, and have your decision support, data queries and business rules continue to work reliably against these utterances.'[2]

In our study, we apply the operational definition of semantic interoperability to assess structured data within Consolidated Clinical Document Architecture (C-CDA) documents, which certified electronic health record (EHR) systems must produce to satisfy federal regulation of EHR adoption. We study core variation in document samples to examine if reliable semantic interoperability is possible.

EHR adoption and Meaningful Use

EHR use in the USA has risen rapidly since 2009 with certified EHRs now used by 78% of office-based physicians and 85% of hospitals.[3 4] Meaningful Use (MU), a staged f… program enacted as part of the Am… and Reinvestment Act of 2009, has… of US$21 billion to hospitals and physicians for installing and using certified EHRs pursuant to specific objectives.[5 6] Stage 1 of the program (MU1) commenced in 2011, Stage 2 (MU2) in 2014, and Stage 3 is expected by 2017.

While the term interoperability can refer to messages, documents, and services, MU provides several objectives that prioritize document interoperability.[7] Although multiple document standards existed prior to MU1, providers with installed EHRs rarely had the capability to send structured patient care summaries to external providers or patients, as noted by the President's Council of Advisors on Science and Technology and the Institute of Medicine.[8 9] MU1 advanced document interoperability by requiring Continuity of Care Document (CCD) or Continuity of Care Record (CCR) implementation as part of EHR certification. Many vendors chose the CCD, which was created to harmonize the CCR with more widely implemented standards.[10 11] In MU2, the C-CDA, an HL7 consolidation of the MU1 CCD with other clinical document types, became the primary standard for document-based exchange.[12]

C-CDA use in document interoperability

The C-CDA is a library of templates using extensible markup language (XML) to transmit patient-specific medical data in structured and unstructured formats.[13] It builds upon the HL7's Clinical Document Architecture release 2.0 (CDA) and the Reference Implementation Model (RIM), a consensus view of how information can be abstractly represented.[14] The CDA constrains the RIM by

Lots of ways that data were wrong or omitted in CCDs

Monitor and track real-world document quality

In real-world clinical environments, a multitude of C-CDA documents will be generated to satisfy clinical workflows. To quantify and improve document quality, metrics could be calculated using a C-CDA quality surveillance service running within the firewall or at a trusted cloud provider. Such a service could use existing tools, such as the TTT validator and SMART C-CDA Scorecard. These services could also be offered through health information exchanges that transmit C-CDA documents between organizations.

Paper cited three times in Meaningful Use Stage 3 NPRM (March 2015)

Document Quality Scoring

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- In the real-world, not all documents meet the standards of document exchange (e.g. SHALL requirements of C-CDA 1.1).
- There are other tools that check the full XML of documents to the schema/schematron. Lots of these checks are fields with “zero information.”
- Some optional data (e.g. MAY or SHOULD) are pretty important. Checking optional things and terminology have not been addressed through XML validation.
- **Thesis:** It would benefit those working on interoperability to have a way to score documents on their semantic **completeness** and **syntax**.

Problem Detail

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Below are two examples of how **missing** or **wrong** clinical data can jeopardize high quality care transitions. Monitoring data exchange quality helps identify and prevent such problems.

Clinical Content Omission (Result)

Sample XML

```
<observation classCode="OBS" moodCode="EVN">
    <templateId root="2.16.840.1.113883.10.20.22.4.2" />
    <code codeSystem="2.16.840.1.113883.6.1" code="718-7" displayName="Hemoglobin" />
    <statusCode code="completed" />
    <effectiveTime value="20130513154302" />
    <value xsi:type="PQ" value="9" unit="g/dl" />
    <interpretationCode />
    <referenceRange>
        <observationRange>
            <text>13.5 - 18.0 g/dl</text>
        </observationRange>
    </referenceRange>
</observation>
```

The hemoglobin was below the reference range, but you don't state it's low!

Clinical Content Error (Medication)

Sample XML

```
<code code="7982" displayName="Codeine Phosphate"
   codeSystem="2.16.840.1.113883.6.88" codeSystemName="RxNorm">
```

That's not the code for codeine…Code "7982" means penicillin!

Tool Comparison

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Category	CCD Analyzer	SMART Scorecard	NIST TTT
Rules	200+	15	Schematron-based
Logical Testing	✓	✓	
Helpful Tips	✓	✓	
C32 Compatible	✓		Not integrated
Terminology Support	✓	Partial	Very Limited
Examines MU Relevant Sections	✓		✓
Batch Upload	✓		
Customizable Scores	✓		
Packaged API	✓		
Shows Human Readable Content	✓		
Vendor Support	✓		
PHI / HIPAA Secure	✓		