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Section C

From Integration to Interoperability
“Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged.”

—HL7 EHR Interoperability Working Group
HL7 EHR WG Definition

- “Coming to Terms” working paper developed in 2006

- Compilation and analysis
  - 100+ definitions
  - Many sources, including HL7, ISO, IEEE, NAHIT, US Executive Order ...
  - Approximately 50% – 50% (US/international)

Source: HL7 EHR Interoperability Working Group.
HL7 Definition Key Aspects

- Technical interoperability
  - Structure, syntax, reliable communication

- Semantic interoperability
  - Full meaning preserved

- Process interoperability
  - Integral to (health care delivery) process, work flow
System-to-System Messaging

- Public health systems have been engaged in data exchange for years (mostly to them)

- Though flat file formats still dominate, HL7 messaging is beginning to gain steam
## Semantic Interoperability: VT Health Info Tech Plan

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
</table>
| CMS' Healthcare Common Procedure Code System (HPCPCS)/American Medical Association (AMA) Current Procedural Terminology (CPT®) Fourth Edition (CPT-4) | This is the standard coding for procedures widely used in the healthcare community:  
  • Level I: hospital outpatient procedures (CPT4)  
  • Level II: products, supplies and other services |
| Centers for Disease Control and Prevention (CDC) Race and Ethnicity Code Sets | These code sets are based on current federal standards                                                                                         |
| College of American Pathologists Systematized Nomenclature of Medicine Clinical Terms (SNOMED CT®) | This is the standard coding used for a wide variety of medical and health care terms                                                            |
| International Classification of Diseases, Ninth Edition, Clinical Modifications (ICD-9-CM) | This is the standard coding used for diagnoses and procedures by hospitals:  
  • Volume 1 and 2: hospital diagnoses  
  • Volume 3: inpatient hospital procedures |
| International Classification of Diseases, 10th revision, Related Health Problems (ICD-10 CM) | This revision to ICD-9-CM contains a number of important improvements. This standard is not yet widely implemented |}

Process Interoperability: Immunization Management

Figure 7-1. Vaccine and Drug Administration and Reporting

From Integration to Interoperability: Why?

- To support outwardly-facing projects
- To assimilate into an emerging HIE-enabled world
- As a bi-product of ARRA/HITECH
How #1: Data-Centered Approach

- Data-centered: traditional structures to represent the data being transported (a row in a file for a record; delimited or fixed length fields within the record) which goes into a database
  - E.g., X12 or HL7 messages
How #1: Data-Centered Approach

- **Data-centered:** traditional structures to represent the data being transported (a row in a file for a record; delimited or fixed length fields within the record) which goes into a database
  - E.g., X12 or HL7 messages

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MSH|^~\&|||VXU^V04|19970522MA53|P|2.3.1|
PID||221345671|^~~SS||KENNEDY^JOHN^FITZGERALD^JR|BOUVIER^^^^^^M|19900607|M||~^^^^MA^^^BDL|
NK1|1|KENNEDY^JACQUELINE^LEE|MTH^MOTHER^HL70063|
RXA|0|1|19900607|19900607|08^HEPB-PEDIATRIC/adolescent^CVX|.5|ML^^ISO+|||||||
MRK12345||MSD^MERCK^MVX|
Challenges: Data-Centered Approach (Messaging)

- Messages are complex
  - Lots of data

- Patient matching

- Multiple versions
  - Not backward compatible
  - Migration between versions not trivial

- Implementation guides help cut down the uncertainty
  - But still lacking in many areas

- “The last mile”—getting data out of systems

- Transport not standardized, though less of an issue

- Semantics and coding usually defined, but still very challenging
How #2: Document-Centered Approach

- **Document-centered**: electronic document where data is pre-arranged in a structured format which is “filed” in a document repository

- Two primary examples:
  - Continuity of Care Record (CCR)
  - Continuity of Care Document (CCD)
Continuity of Care Record (CCR)

- History: Outgrowth of Patient Care Referral Form (PCRF) from the MA Department of Public Health

- Core data set
  - Most relevant administrative, demographic, and clinical information facts about a patient’s health care, covering one or more health care encounters
  - Summary of the patient’s health status (for example, problems, medications, allergies) and basic information about insurance, advanced directives, care documentation, and the patient’s care plan

Source: [http://www.astm.org/Standards/E2369.htm](http://www.astm.org/Standards/E2369.htm)
Continuity of Care Record (CCR)

- Primary use case: snapshot in time containing the pertinent clinical, demographic, and administrative data for a specific patient

- Technical specification
  - XML coding that is required when the CCR is created in a structured electronic format
  - Permits users to display the fields of the CCR in multiple formats
Sample CCR

Source: Google Health.
Sample CCR

Source: Google Health.
Continuity of Care Document (CCD)

- History: collaborative effort between ASTM and HL7 as an alternate to the one specified in ASTM ADJE2369 for organizations committed to implementation of HL7 CDA

- Core data set
  - Most relevant administrative, demographic, and clinical information facts about a patient’s health care, covering one or more health care encounters
  - Standard intended to specify the encoding, structure, and semantics of a patient summary clinical document for exchange

- Primary use case: provide a snapshot in time containing the pertinent clinical, demographic, and administrative data for a specific patient

Continuity of Care Document (CCD)

- Technical specification
  - Constraint on the HL7 Clinical Document Architecture (CDA) standard based on the HL7 Reference Information Model (RIM)
  - Basis of many IHE profiles and HITSP constructs

## Sample CCD

### Good Health Clinic Continuity of Care Document

**Created On:** April 7, 2000

**Patient:** Henry Levin, the 7th  
**Birthdate:** September 24, 1932  
**Guardian:** Kenneth Ross  
17 Daws Rd.  
Blue Bell, MA, 02368  
tel:(888)555-1212  

**MRN:** 996-756-495  
**Sex:** Male  
**Next of Kin:** Henrietta Levin  
tel:(999)555-1212

### Results

<table>
<thead>
<tr>
<th>Test Type</th>
<th>March 23, 2000</th>
<th>April 06, 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hematology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HGB (M 13-18 g/dl; F 12-16 g/dl)</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>WBC (4.3-10.8 10^+3/μl)</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>PLT (135-145 meq/l)</td>
<td>123*</td>
<td></td>
</tr>
<tr>
<td><strong>Chemistry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NA (135-145 meq/l)</td>
<td></td>
<td>140</td>
</tr>
<tr>
<td>K (3.5-5.0 meq/l)</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>CL (98-106 meq/l)</td>
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<td>102</td>
</tr>
<tr>
<td>HCO3 (18-23 meq/l)</td>
<td></td>
<td>35*</td>
</tr>
</tbody>
</table>

Source: HIMSS EHR Association. All Rights Reserved.
Good Health Clinic Continuity of Care Document

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IIS Interoperability Model