Organizational Track

2 p.m.-3 p.m. Legacy Data Issues

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Overview

• 8 independently organized and governed regions:
  – Northern California, Southern California, Georgia, Hawaii, Colorado, D.C., Oregon and Ohio
    • **Different** clinical workflows
    • **Different** ancillary interfaces
    • **Different** billing practices due to payor/plan offerings
    • **Different** business model (centralized vs. localized testing)
  – Coding solution to support divergent requirements
Objectives for using coding standards

- Exchange and pooling of data elements among internal and external entities
- Establishing common data definitions to support the standardized use of terminology for clinical and billing practices
- Standardizing laboratory and electronic medical record (EMR) interface design
- Overcoming geographical and organizational cultural barriers and encourage collaboration

Logical Observation Identifiers Names and Codes (LOINC®) is the foundations for standardization, containing more than 6,000 unique meanings
### Regional laboratory applications

<table>
<thead>
<tr>
<th>Region</th>
<th>Laboratory System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern California</td>
<td>Cerner® Classic</td>
</tr>
<tr>
<td>Southern California</td>
<td>Home-dev</td>
</tr>
<tr>
<td>Colorado</td>
<td>Misys® version A</td>
</tr>
<tr>
<td>Oregon</td>
<td>GGG®</td>
</tr>
<tr>
<td>Georgia</td>
<td>Cerner® Millennium</td>
</tr>
<tr>
<td>Ohio</td>
<td>Misys® version B</td>
</tr>
<tr>
<td>D.C.</td>
<td>Misys® version C</td>
</tr>
<tr>
<td>Hawaii</td>
<td>Misys® version D</td>
</tr>
</tbody>
</table>
Disparate ancillary code-sets

<table>
<thead>
<tr>
<th>Region</th>
<th>Lab System result code for Cholesterol (2093-3 LOINC®)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>Cholesterol</td>
</tr>
<tr>
<td>Northern California</td>
<td>8752226</td>
</tr>
<tr>
<td>Southern California</td>
<td>CHOL_WLA</td>
</tr>
<tr>
<td>Colorado</td>
<td>CHOL_AUTO</td>
</tr>
<tr>
<td>Oregon</td>
<td>CHOL_WAUTOD</td>
</tr>
<tr>
<td>Georgia</td>
<td>5650000</td>
</tr>
<tr>
<td>Ohio</td>
<td>CHOLES</td>
</tr>
<tr>
<td>D.C.</td>
<td>CHOLPNL</td>
</tr>
<tr>
<td>Hawaii</td>
<td>CHOLR</td>
</tr>
</tbody>
</table>
Method (How the regions did the mapping)

- The dictionary of LOINC® terms is created and maintained at a National Level
- Terms are distributed to the regional database environments via push technology, on a regular 3 week cycle or via hot fixes for urgent situations.
Method (How the regions did the mapping)

- While some of the configurations can be customized by region, the database components associated with laboratory results (LOINC® terms) cannot be created or added to at the regional level.
- Each region must find a National (LOINC®) code which translates to their laboratory system’s (local) result code.
The EPIC database allows each instance (copy) of their result master file to contain regional translation values for these records. This is referred to as ‘localization’ or the use of ‘identity’ to link a regional code to the National equivalent.

If the region needs a code that does not exist, the code is added by a centralized, national team to the National LOINC® database and distributed to all the regional databases to be localized (mapped to their lab system’s result codes).
To separate interfaces, a unique identification number is assigned, again at the national level, to each interface from each region. For example:

- **NCAL**: 1000  Lab result component
- **SCAL**: 2000  Lab result component
- **OHI O**: 3000  Lab result component

Paired with the local laboratory result code, EPIC is able to find the correct translation in EPIC to translate the local result code to the National LOINC® code:

- **NCAL** lab results interface would send: 1000, 8752226
- **SCAL** lab results interface would send: 2000, CHOL_WLA
- **OHI O** lab results interface would send: 3000, CHOLEs

EPIC would translate all of these disparate codes to the National Cholesterol LOINC® code: 2093-3
The mapping process

• **Step 1:** Extract all result codes from the laboratory systems in each of the Kaiser (eight) regions.

• **Step 2:** This lab extract was then compared to an extract taken from the National LOINC® result database.

• **Step 3:** Using a variety of tools which included Microsoft Excel® and Microsoft Access®, the files are matched manually as closely as possible. (National to local codes)
The mapping process

- **Step 4:**
  - All regions have a local copy of the National LOINC® result database (via the push technology described before)
  - National populates the display name and LOINC® code in this database. The identity items associated with each LOINC® code is not populated at the National level.
  - The local laboratory system result codes are imported into the identity items of the regional copy of the National LOINC® result database.

Validation occurs at many steps in this process but the most important is to validate every local laboratory result code that is mapped to a National LOINC® code. This is a manual process due to the nature of result components and the associated workflows.
Sample identity mapping

<table>
<thead>
<tr>
<th>National Result Component name</th>
<th>National LOINC ® code</th>
<th>OHIO regional lab system result code</th>
<th>NCAL regional lab system result code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol</td>
<td>2093-3</td>
<td>Chol</td>
<td>8965325</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>2571-8</td>
<td>Trig</td>
<td>1247775</td>
</tr>
<tr>
<td>HDL</td>
<td>2085-9</td>
<td>HDL</td>
<td>1224785</td>
</tr>
<tr>
<td>Albumin</td>
<td>2862-1</td>
<td>ALB</td>
<td>6682322</td>
</tr>
<tr>
<td>Calcium</td>
<td>2000-8</td>
<td>CA</td>
<td>58666665</td>
</tr>
<tr>
<td>Sodium</td>
<td>2951-2</td>
<td>NA</td>
<td>5578932</td>
</tr>
</tbody>
</table>
Challenges

- The eight Kaiser regions have been autonomous in the way they have created procedures and result components. The addition of having to request new result components from a National team not only adds time, but restricts the autonomy they have enjoyed up to now.

- Many of the local result codes were highly region-specific and could not easily fit into the LOINC® structure even though result components could be mapped many-to-one. The effort involved in finding a match for these result codes was significant.

- While laboratorians (medical technologists) were the best choice to do this local result code to LOINC® mapping, these resources were not dedicated in many regions. Validation and testing, which require dedicated resources, became a challenge.
Mapping Challenges with LOINC

We had to seek a solution for each challenge, and at the same time, meet our goals.
Mapping Challenges with LOINC

1) The ability to utilize the first six axis in LOINC to derive an unambiguous, meaningful and useful term name.

- Goal: maintain usability as an organizational priority.
- Approach: developed naming convention guidelines for commonly used names used in the laboratory
- Examples:
  - VDRL, not, Reagin Ab
  - Ethanol, not, ethyl alcohol
  - CEA, not, CARCINOEMBRYONIC AG
  - TSH, not, THYROTROPIN
Mapping Challenges with LOINC

• 2) Differentiate "interface" from "reference" terminology
  – Approach: worked closely with the KP and Vendor Interface teams to understand and meet interface requirements.
  – Example 1:
    Cultures reporting more than one organism (OBX-4, Observation Sub-ID)
    • Some LIS vendors send result codes that LOINC does not support: For cultures, reporting more than one organism in a Microbiology result message like Organism 1, Organism 2, Organism 3, Organism 4, Organism 5.
Mapping Challenges with LOINC

Example 2:

- Knowing how to handle methodologies in chemistry
- It may be challenging as to whether to include the methodology or not. In general, LOINC only includes the methodology if it make a difference in specificity and/or sensitivity.

Example:

- ALBUMIN: 1751-7
- ALBUMIN ELECTROPHORESIS: 2862-1
- HIV 1 RNA, PCR: 23876-6
- HIV-1 IB: 21009-6
Example 3:
- Some LIS result codes do not represent a measurement result, but they need to map to a LOINC concept because they are sent across the interface to the KPHC application.

- KP region may need a term that is a header for aggregating test results. No matching LOINC code exists, and if the term is modeled and submitted to LOINC, it probably will not be accepted.

- Example: Lab test name, test performed at.
Mapping Challenges with LOINC

- 3) The LOINC Short name is not Clinician friendly.
  - 1824-1: AFP Ser-mCnc. We used AFB.
  - 2732-6: PTH Mid Mol SerPl-mCnc: We used PTH.

- Goal: Make it easy for users to find the terms they need, given that the local names are different from the LOINC names. Also needed user friendly abbreviated result names that are used in clinical information system chart documentation via automated links.

- Approach: Developed naming convention guidelines that are close to what the KP regional users are accustomed to. Created conversion list to transform LOINC names to common names.
Mapping Challenges with LOINC

4) Ongoing Maintenance with the LOINC Standard
   - Ongoing updates and changes by the LOINC committee
   - Release of updated database versions 1-2 times per year
   - Updates to existing terms

   - Goal 1: Have a well defined approach to maintain LOINC for Kaiser Permanente
     - Approach: Developed process to identify the changes in the new LOINC release such as new codes, updated codes and deprecated codes.
     - Examples: Transformation rules and scripts
Mapping Challenges with LOINC

- Goal 2: Have a well defined process to communicate LOINC changes to downstream KP regional users.

- Approach: National Terminology team published release notes identifying the terms undergoing the changes.

- Examples: Release Notes, Excel format.
Mapping Challenges with LOINC

- Goal 3: Ensure that KP is overall in sync with the Standard LOINC Terminology Source

- Approach: Apply a synchronization process with every new LOINC release
5) The LOI NC Submission Process is a lengthy process.

- Goal: ensure that the LOI NC codes submitted by KP are adopted by the Standard in a timely manner.
- Approach: developed a process to identify and submit new terms to LOI NC.
- Example: LOI NC Submission Process.
Mapping Challenges with LOINC

• 6) Lack of Resources with adequate laboratorian expertise needed to perform the mapping of local and LOINC codes.
  
  - Goal: Provide orientation and training to KP resources to be able to perform the mapping.
  - Approach: Conducted training and presentations
  - Examples: Use the LOINC user manual and RELMA
References

• Suzanne Spradley, Kaiser Permanente
  – Suzanne.Spradely@kp.org

• Rita Barsoum, Kaiser Permanente
  – Rita.H.Barsoum@kp.org
Legacy Data Issues

Susan Matney & Cessily Johnson

Intermountain Health Care
Interfacing Systems

Lab System A

Lab System B

Hospital System

Clinical Data Repository

Clinic
Data Dictionary

- Concept Based Data Dictionary
- External Terms (Representations) mapped as synonyms to the concept.
- Hierarchical structure
Concepts and Terms

Concept

Diabetes Mellitus

Term

Diabetes Mellitus, Insulin Dependant

Diabetes Mellitus, Type I

Diabetes Mellitus, Brittle
Matching

- Drugs
  - Antibiotics
    - Penicillins
      - Pen VK
    - Cephalosporins
      - Amoxicillin
  - Analgesics
  - Cardiovascular
    - Aminoglycosides
      - Nafcillin

Lexicon
Standardized Terminologies Used

- Orders = LOINC
- Observations = LOINC
- Values = SNOMED
- Drugs = First Data Bank
- Billing = CPT/ICD-9
Terms Created Locally

- Orders – if not in LOINC
- Nursing problems – role based
- Goals – come from Clinical Practice Guidelines
- Values not found in external terminologies
Pre/Post-coordination

• Complex Vocabulary ⇒ Simple data model
  - 20.4.4.58.6.2 Chest X-ray shows abnormal inflation in left lower lobe

• Simple Vocabulary ⇒ Complex data model
  - Procedure: Chest X-ray
  - Finding Type: shows
  - Finding: inflation
    • QualitativeQualifier: abnormal
  - Location Relationship: in
  - Location: lobe (of lung)
    • Laterality Qualifier: left
    • Upper/Lower Qualifier: lower
Information Model

- A set of templates (data structures)
- Used to store data as medical events
- Currently Use XML Clinical Element

Model

Storage

Database

Unit #
Drug:
Route:
Date:
Time:
Physician:
HELP System
Rectal Temperature
PTXT Code: 13.1.1.2.4.6.8.9

<VitalSigns>
  <Temperature>97.6</Temperature>
  <BodyLocation>Oral</BodyLocation>
</VitalSigns>
Labor and Delivery Application
Group B Strep Neg
Code: AAB224

<LabObservation>
  <Group B Strep>Negative</Group B Strep>
  <SubjectOfInformation>PrenatalRecord</SubjectOfInformation>
  <Comment>Not a verified lab</Comment>
</LabObservation>
Help2 Clinical Desktop

- Retrieves information from the CDR
- Originally developed to view Laboratory data
- Additional modules created for different use cases
  - Clinical notes, image types and demographics
  - Laboratory and Microbiology results
  - Radiology, allergies and medications
Text Reports

• Controlled list of document names
  – New names are requested through a webform
• Scanning or direct electronic input
• Some coded content is available for Progress notes
• Encounters view designed to mimic paper chart organization
Lab to LOINC

• Laboratory team creates a new test in the Lab system
• They submit a mapping request on a spreadsheet
  – LOINC code may be included in the request
• LOINC mapping is validated and the test code and display are mapped in the Data Dictionary as terms
Issues

- No definitions in some legacy systems.
- Lack of understanding regarding terminology server and standardized terminologies.
- Pre vs. Post-coordination
  - Decomposition into information model.
- Lab shifts meaning without changing mapping.
Questions?
Clinical Vocabulary Mapping Methods Institute
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