Kaiser’s CMT and SNOMED
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and CMT team Kaiser Permanente

How Kaiser’s Convergent Medical Terminology (CMT) is used to manage standardization of clinical information

How Kaiser leverages Systematized Nomenclature of Medicine (SNOMED)

How use of SNOMED Description Logic (DL) allows automated evaluation of clinical information
Kaiser donates CMT to IHTSDO and to NLM

Kaiser has agreed to donate CMT to the IHTSDO organization as well as NLM in the USA.

The donation will include Kaiser mappings between various terminologies.

It will include our modifications to the IHTSDO work bench.

This will greatly reduce the burden of adding SNOMED to an enterprise EHR.
Domains covered by CMT

(1)

• Diagnosis
  – Support Problem List, Encounter Diagnosis, and Medical History
  – Mapped to SNOMED and ICD9, and in the process of mapping to ICD10
• Procedures (Medical, lab, radiology, etc.)
  – Supports Order Entry
  – Supports documentation of Performed Procedures
  – Mapped to SNOMED and CPT4 or HCPCS
• Lab Results
  – Supports Results Review
  – Mapped to LOINC
• Reasons for visits/Chief Complaints
  – Supports scheduling/intake
  – Mapped to SNOMED
• Immunizations
  – Supports Immunization/Vaccine Administration
  – Mapped to CVX codes (CDC’s Vaccine codes)
Domains covered by CMT (2)

- **Organisms**
  - Supports Results Review
  - Mapped to SNOMED codes
- **Clinical Observations**
  - Supports clinical assessment documentation
  - Mapped to SNOMED and Clinical LOINC (in process)
- **Nursing Documentation**
  - Supports nursing documentation of nursing interventions and nursing assessments
  - Mapped to SNOMED and Clinical LOINC (in process)
- **Specimen Type and Body Site**
  - Supports Order Entry for cultures
  - Mapped to SNOMED
- **Allergens**
  - Supports Allergy entry
  - Mapped to Medispan, FDB, and RxNorm (in process)
Why “Enterprise Terminology”?

• There is no one terminology that meets all needs.
• Standard terminologies were created to meet certain specific needs.
• We have a need to use all or most of the different terminologies.
• We have a need to integrate or “converge” these disparate terminologies in a central model that leverages the efficiencies of each of these terminologies, provides interoperability, and meets other business requirements.
• None of the standard terminologies are ever “complete”. Therefore, there is a need to create new concepts or enterprise specific concepts.
• Turnaround time from reference terminologies is slow (i.e. SNOMED is 2x/year).
• Having a central terminology system eliminates duplication of effort and provides a “common definition” of concepts/terms across the enterprise.
What is Kaiser’s CMT?

• CMT is KP’s Enterprise Terminology System that includes several components:
  – End user terminology
  – Standard terminology
  – Administrative codes
  – Query and Decision support
  – Request process
Kaiser CMT

You use at least 4 different kinds of vocabularies to run a healthcare enterprise
Physician interface (locally created)
Billing (CPT and ICD)
Patient facing (locally created)
Reference (SNOMED LOINC others)
Example of mapping of 4 terms

- Amaurosis fugax  <Physician interface term>
- Amaurosis fugax (disorder)  <SNOMED FSN>
- AMAUROSIS FUGAX (ONE SIDED TEMPORARY VISION LOSS)  <Patient Display Name>
- Transient arterial occlusion  <ICD9 Name>
End User Terminology component (1):

• Terminology used in KPHC (KP EMR)
• End User terms are mapped to the standard terminologies and have attributes the application needs
• End Users use/see the terms that are familiar to them, and the application uses the codes and attributes it needs
End User Terminology component (2):

- Protects end users from changes in Standard terminology or coding schemes. Examples:
  - Majority of the diagnosis terms currently being used does not have to be changed or deleted because of transition from ICD9 to ICD10.
  - When LOINC names change, it doesn’t have to change the Result display name that end users are seeing.
  - When SNOMED descriptions change, it does not change the display names end users see.

- Neither ICD9 or SNOMED’s focus is end user usability. KP CMT is a bi-product of years of actual user experience, and continues to improve.
Standard Terminology Component:

• CMT is mapped/integrated to Standard Terminology, such as SNOMED and LOINC.
• CMT can be mapped to other terminology as needed.
• Supports requirements for standard terminology for Meaningful Use and Health Information Exchange.
Administrative Code Component:

- CMT supports Revenue Cycle and Charge Capture.
- Diagnosis terms are mapped to ICD9 (and ICD10 in process). Clinicians can pick a problem list and can use the same term as encounter diagnosis.
- Procedure terms are mapped to CPT4 or HCPCS codes. When a lab order is resulted/completed, CPT4 codes mapped to it can be sent to the Billing System.
A view of a single concept:

Concept: Congestive heart failure (disorder) (SNOMED ID: 42343007)

Mappings:
- 428.0 (ICD-9 CM)
- I50.9 (ICD-10 CM)

Descriptions:
- "CHF" [EDG Display Name]
- "Congestive heart disease" [Synonym]
- "CHF (congestive heart failure)" [Pt. friendly name]

Relationships:
- Is A: Heart Failure
- Has site: Cardiac ventricular structure

KPHC:
- Epic load file
- Prodnam
- Regional instances

SNOMED ID: 42343007
EDG Community ID: 12020738
EXM: Epic translation file
ICD9

Course grained
Diagnosis and Findings
Reasons for visits or procedures
Not a DL
Single Hierarchy only (Diabetic Retinopathy is either a Diabetes or a Retinopathy, can’t be both)
Difficult to find patient cohorts (must be lexical or single Hierarchy searches)
CPT

Only for Procedures
Required for Billing
Not DL based
Only Name/Code pairs
Only concerned with “how much work was done? How much time was spent?”
SNOMED
Systematized Nomenclature Of MEDicine
Can describe anything
Diagnosis
Procedure
Entity
Morphology
Etiology (To name just a few)
SNOMED

Based on Formal Description Logic
Concerned with clinical meaning, not billing
Fine grained enough to be clinically meaningful
Can be used for Outcomes measurements
Can be used by machines to make inferences
Strep throat is caused by streptococcus
Pneumococcal pneumonia is caused by pneumococcus
Streptococcus and pneumococcus are both subtypes of gram positive cocci
Therefore both pneumococcal pneumonia and strep throat are gram positive cocci infections.
Query and Decision Support Component (1):

• CMT is based on SNOMED.
• Can leverage SNOMED’s structure, including poly-hierarchy and description logic (formal definitional attributes).
• Can query different ways to identify subsets terminology:
  • for supporting decision support modules in KPHC
  • for identifying patient cohorts for Population Care
  • for identifying KPHC terminology for reporting criteria, etc.
Query and Decision Support Component (3):

- Easily identify patient cohorts for certain conditions for Population Care.
- Identify subsets for use as “input criteria” for KPHC decision support modules, such as Best Practice Alerts, Reminders, etc.
- Do precise queries, such as “find all conditions where causative organism is “Aspergillus”, etc.
- Do large aggregate queries, such as “find all patients with cardiovascular system disorders”, etc.
Query and Decision Support Component (2):

- Example of SNOMED Description Logic:

  Concept: Anthrax pneumonia
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## Subset Management Interface

### Query Builder

#### Criteria

**Query Name**: EDS NAIT: MALIGNANT NEOPLASTIC DISEASE

**Query Desc**: Grouping for all malignant neoplastic disorders affecting the LIVER INCLUDING INTRAHEPATIC BILE DUCTS

**INC**: EDS Clinical (Diagnosis)

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<td>Primary malignant neoplasm of renal pelvis (disorder)</td>
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<td>Complication of transplanted kidney (disorder)</td>
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<td>DV</td>
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**Legend:**
- Items that no longer meet criteria but still exist in QML File.
- Items that met criteria but not on the QML File.
- Items has changed between criteria search and QML File.
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<th>Region</th>
<th>Coding Validation</th>
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</tbody>
</table>

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Web Ontology Language (Coming Soon)

OWL Has a large community independent of Health Care Domain

The Description Logic of OWL is more expressive than EL+ (SNOMED)

Allows for Negation and Disjunction

All Non Pulmonary conditions caused by Mycobacteria (example)
SNOMED to OWL Project

We will modify the IHTSDO toolbench so that it can use OWL
Will add Negation and Disjunction
Will have a new reasoner that can classify all of SNOMED/OWL in 2 minutes
In My Mind it's all Triplets

There are probably a dozen ways to think about this but in my mind it all boils down to triplets

I'll explain later as we go along
How Kaiser uses the IHTSDO Toolbench

- We call our modification of the toolbench the Enterprise Terminology Tool or ETT
- In order to talk about and understand what it does, it is very helpful to think in terms of Triplets
**Triplets**

- Triplets basically say “this is related to that”.
- Everything that the ETT does can be explained in terms of triplets.
- The “this” part can be either a whole concept or a code or a description.
- The That part can also be any of these three things.
Triplets

- The relationships can be these kinds
- Defining relationships
- Non defining relationships
- Core model relationships
- Relationships represented only in Refsets
**ETT and triplets**

- When you think in terms of triplets, you only have to think to yourself, what is “this” what is “that” and how are they related.
- In technical terms “this” is called the “subject”, “that” is called the “object” and the relationship is called the “predicate”
ETT and Triplets

- So you can think “this is related to that” and you can say “subject predicate object” if you talk to a semantic web person
- For one defining triplet example consider “Pneumonia has finding site Lung”
ETT and Triplets

- This defining relationship or triplet would be modeled as part of the core model.
- A non defining triplet might be this.
- “CHF <is the KP physician friendly name for> Congestive heart failure (disorder)”
- Or “CHF <is part of> the NLM cardiovascular disorders subset”
Kaiser ETT

- The ETT has two ways of modeling triplets
- You can add relationships (triplets) to the core model
- You can add relationships (triplets) using the “Refset” mechanism.
Kaiser ETT Refsets

- Kaiser adds descriptions, codes and defining relationships to the core model
- We use Refsets for 3 different non core types of relationships (triplets).
- They are:
Refsets used for three things

- Generating the Epic specific load files
  - For example, specifying that CHF is the “dot 2” for the Epic EDG master file.

- Specifying sub sets of concepts like specialty diagnosis groups, or NLM donations groups

- Linking our concepts to administrative billing codes like ICD9 and 10 and CPT
Load up toolbench Screen Shots?
KP ETT Screen Shots

IHTSDO Toolbench modified for KP
CMT