Post-Coordination in the Mapping of Interface Terms of a Clinical Wound Documentation System to SNOMED CT

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Objectives

• Development of a HL7-CDA level 3 conformant representation for a clinical wound documentation system in dermatology
  – Map SNOMED CT to clinical items/values
  – Map LOINC to structuring entities

• Understand the SNOMED CT post-coordination rules, syntax and semantics
  – formalize them with DL
Web based clinical wound documentation system (dermatology)

Methods

• Wound documentation: 15 sections, 44 items with 130 values (after reduction: total of 154 terms)
• Independent assignment of LOINC and SNOMED CT codes or expressions by 2 persons
  – Consent on divergent or ambiguous assignments
• CliniClue-Browser version 5.6 with expression builder
• LOINC version 2.19 and SNOMED CT versions 0607CORE and 0701CORE
• SNOMED CT documentation from IHTSDO (Nov. 2006 version)
Results

- N = 154
- 33 LOINC codes
- 140 SNOMED CT codes or expressions
  - 91 pre-coordinated
  - 49 post-coordinated
- Very high coverage in this clinical domain

<table>
<thead>
<tr>
<th>N=154</th>
<th>none</th>
<th>LOINC</th>
<th>LOINC &amp; SNOMED CT</th>
<th>SNOMED CT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>13</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>pre-coordinated</td>
<td></td>
<td></td>
<td></td>
<td>91</td>
</tr>
<tr>
<td>post-coordinated</td>
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<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>140</td>
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</tbody>
</table>
Refinement of individual attribute values

• “A defining relationship of the base concept can be refined by applying a value that is a subtype of the defining value.”

(SNOMED CT Abstract Logical Model and Representational Forms)

$$(A \sqsubseteq B) \rightarrow (\exists r. A \sqsubseteq \exists r. B)$$
Refinement of individual attribute values (example)

- Body structure
  - Wound (morphologic abnormality)
  - Associated morphology
- Clinical finding
  - Wound (disorder)
Refinement of individual attribute values (example)
Refinement of individual attribute values (normal form)

416462003|wound (disorder)|
  116680003|is a|=64572001|disease|
  ,116676008|associated morphology|=  
  13924000|wound (morph. abnormality)|

64572001|disease|:
  116676008|associated morphology|= 
  400061001|abrasion|
Refinement of attribute names

• “A defining relationship of the base concept can also be refined by applying a name that is a subtype of the defining attribute name. For example, if the defining relationship specifies a "procedure site" this may be refined to "procedure site – direct" or "procedure site – indirect".”

(SNOMED CT Abstract Logical Model and Representational Forms)
Refinement of defining relationship groups

• “If a refinement is applied to one of the defining relationships within a relationship group, it is the group a whole that is refined.”

(SNOMED CT Abstract Logical Model and Representational Forms)

\[(A \sqsubseteq B) \rightarrow (\exists \text{has part.}(\exists r_1.A \sqcap \exists r_2.C) \sqsubseteq \exists \text{has part.}(\exists r_1.B \sqcap \exists r_2.C))\]

\[(r_1 \sqsubseteq r_2) \rightarrow (\exists \text{has part.}(\exists r_1.C \sqcap \exists r_3.D) \sqsubseteq \exists \text{has part.}(\exists r_2.C \sqcap \exists r_3.D))\]

Med. 2006;45:354-8
Refinement of defining relationship groups (example)
Refinement of defining relationship groups (example)
Refinement of defining relationship groups (normal form)

19429009|chronic ulcer of skin|
  116680003|is a|=64572001|disease|
    {116676008|associated morphology|=  
        405719001|chronic ulcer|  
    ,363698007|finding site|=  
        39937001|skin structure|}

64572001|disease|:
  {116676008|associated morphology|=  
        405719001|chronic ulcer|  
  ,363698007|finding site|=  
        15651003|skin structure of lateral  
                       surface of lower leg|}

unsanctioned use of “Concept Model attributes”

• “In some situations it may seem to be useful to use one of the attributes used in the SNOMED CT Concept Model to refine a concept that does not have a defining relationship or qualifier named by this attribute. Provided that this is limited to qualifications that the Concept Model specifies for concepts of the same general type this approach can be applied.”

(SNOMED CT Abstract Logical Model and Representational Forms)

\[(\exists r_1.A \land \exists r_2.B) \subseteq \exists r_1.A\]
unsanctioned use of “Concept Model attributes” (example)
unsanctioned use of “Concept Model attributes” (example)
complex example
Lessons learned

• only 4 basic refinement rules in post-coordination
  (1) Subconcept of individual attribute value
  (2) Subrelation
  (3) Introduction of new defining relations (allowed by the Concept Model)
  (4) Use of (1)-(3) in role groups or nested usage

• Distributed SNOMED CT technical documentation on post-coordination over several documents
  – not standardized or formalized

• Tool support is poor
Suggestions for progress

• Update documentation on post-coordination
  – Convergence, Standardization, Formalization

• Provide SNOMED CT Browsers with graphical post-coordination features

• Provide classifiers to test on subsumption and equivalence of post-coordinated expressions
Conclusions

• High coverage of SNOMED CT (pre-/ post-coordination) in a specialized clinical area
• Post-coordination error prone and inefficient without appropriate tools support
• Only four basic refinement (post-coordination) rules
• Need for improvements
  – Documentation (Convergence, Standardization, Formalization)
  – Tools (SNOMED CT browser with graphical post-coordination support)