Using SNOMED CT as a Mediation Terminology

Mapping Issues, Lessons Learned, and Next Steps Toward Achieving Semantic Interoperability

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The President has ordered Federal agencies to promote improved healthcare quality and efficiency through secure, standard-based data exchange. The Clinical Data Repository/Health Data Repository (CHDR) project exchanges clinical information between VA and DoD. CHDR exchanges standardized, computable data as opposed to text, allowing improved electronic decision support.
- VA terms are standardized at the source
- DoD terms are mapped to the 3M standard

Translation to Nat. Std. (SNOMED CT)

SNOMED CT = 300359004
Finding of Vomiting (finding)
• CHDR has been implemented at several sites where active dual consumers exist
• Allergy reactions are exchanged using SNOMED CT, in accordance with HITSP recommendations
• Each agency mapped its allergy reactions to SNOMED CT; the SNOMED codes were then exchanged bidirectionally
• Mediation success rates were calculated for a 5-month period (February-June 2007) and ranged from 74-99%
• Analysis of mediation failures revealed issues related to mapping and SNOMED CT concept modeling
• We describe the methodology used, lessons learned, and next steps
A 4-part terminology mediation strategy was employed:

1. Select a mediation terminology compliant with CHI/HITSP standards (if possible)
2. Map each agency’s terms to the mediation standard
3. Exchange the mediation codes
4. Coordinate content maintenance plans
• Business rules for mapping allergy reactions to SNOMED CT were developed jointly by VA and DoD
• Allergy reactions were primarily signs and symptoms (SNOMED CT’s Clinical Findings hierarchy), but could be Disorders or other conditions
SNOMED CT hierarchies were used in preferential order for mapping:
1. Clinical Findings (“headache”)
2. Disorders (“dermatitis”)
3. Morphologic Abnormality (“blister”)
4. Observable Entity (“disinhibition”)
5. Context-dependent Category (“abdominal cramps”)

• For mapping validation, 2 reviewers conducted 3 separate reviews
• Discrepancies were identified in about 5% of total terms, and were corrected
• An independent review of concepts common to both agencies was performed to ensure accurate translations
## Common and Unique Allergy Reaction Concepts

<table>
<thead>
<tr>
<th>Agency</th>
<th>Total</th>
<th>Common Terms</th>
<th>Mapped Terms Unique to Each Agency</th>
<th>Unmapped Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA</td>
<td>346</td>
<td>299</td>
<td>25 (7%)</td>
<td>22 (6%)</td>
</tr>
<tr>
<td>DoD</td>
<td>456</td>
<td>299</td>
<td>47 (10%)</td>
<td>110 (24%)</td>
</tr>
</tbody>
</table>
Mediation success rate: the percentage of data in one system that is understood and computable by the other system.

For each direction of data exchange (outbound vs. inbound) there is a different mediation success rate.
Inbound Mediation Success Rate (VA ↔ DoD)  
= Sum of Freq (3) / Sum of Freq (3+4)

Outbound Mediation Success Rate (VA → DoD)  
= Sum of Freq (3) / Sum of Freq (2+3)
## VA-to-DoD Mediation Statistics for Allergy Reactions, Feb-June 2007

<table>
<thead>
<tr>
<th>VA-to-DoD</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total VA-to-SNOMED CT translation attempts</td>
<td>168</td>
<td>193</td>
<td>338</td>
<td>959</td>
<td>502</td>
</tr>
<tr>
<td>Translation failures (VA-to-SNOMED CT)</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Total VA allergy reactions sent to DoD</td>
<td>164</td>
<td>193</td>
<td>337</td>
<td>946</td>
<td>501</td>
</tr>
<tr>
<td><strong>Translation Success Rate: VA-to-SNOMED CT</strong></td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
<td>99%</td>
<td>100%</td>
</tr>
<tr>
<td>Total allergy reactions received by DoD</td>
<td>164</td>
<td>193</td>
<td>337</td>
<td>946</td>
<td>501</td>
</tr>
<tr>
<td>Translation failures (SNOMED CT-to-DoD)</td>
<td>17</td>
<td>17</td>
<td>34</td>
<td>121</td>
<td>5</td>
</tr>
<tr>
<td>Total VA allergy reactions sent to DoD CDR</td>
<td>147</td>
<td>176</td>
<td>303</td>
<td>825</td>
<td>496</td>
</tr>
<tr>
<td><strong>Translation Success Rate: SNOMED CT-to-DoD</strong></td>
<td>90%</td>
<td>91%</td>
<td>90%</td>
<td>87%</td>
<td>99%</td>
</tr>
<tr>
<td><strong>MEDIATION SUCCESS RATE: VA-to-DoD</strong></td>
<td>88%</td>
<td>91%</td>
<td>90%</td>
<td>86%</td>
<td>99%</td>
</tr>
</tbody>
</table>
## DoD-to-VA Mediation Statistics for Allergy Reactions, Feb-June 2007

<table>
<thead>
<tr>
<th>DoD-to-VA</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total DoD-to-SNOMED CT translation attempts</td>
<td>1,509</td>
<td>1,788</td>
<td>2,025</td>
<td>3,521</td>
<td>4,030</td>
</tr>
<tr>
<td>Translation failures (DoD-to-SNOMED CT)</td>
<td>306</td>
<td>467</td>
<td>432</td>
<td>432</td>
<td>107</td>
</tr>
<tr>
<td>Total allergy reactions sent to VA</td>
<td>1,203</td>
<td>1,321</td>
<td>1,593</td>
<td>3,089</td>
<td>3,923</td>
</tr>
<tr>
<td><strong>Translation success rate: DoD-to-SNOMED CT</strong></td>
<td><strong>80%</strong></td>
<td><strong>74%</strong></td>
<td><strong>79%</strong></td>
<td><strong>88%</strong></td>
<td><strong>97%</strong></td>
</tr>
<tr>
<td>Translation failures (SNOMED CT-to-VA)</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>11</td>
<td>69</td>
</tr>
<tr>
<td>Total DoD allergy reactions sent to VA HDR</td>
<td>1,202</td>
<td>1,321</td>
<td>1,585</td>
<td>3,078</td>
<td>3,854</td>
</tr>
<tr>
<td><strong>Translation success rate: SNOMED CT-to-VA</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>99%</strong></td>
<td><strong>100%</strong></td>
<td><strong>98%</strong></td>
</tr>
<tr>
<td><strong>MEDIATION SUCCESS RATE: DoD-to-VA</strong></td>
<td><strong>80%</strong></td>
<td><strong>74%</strong></td>
<td><strong>78%</strong></td>
<td><strong>87%</strong></td>
<td><strong>96%</strong></td>
</tr>
</tbody>
</table>
5 main causes of mediation failures

1. SNOMED CT concept modeling allowed for divergent mapping options
2. New reactions were added independently at each agency
3. Updates to new releases of SNOMED CT did not occur simultaneously at each agency
4. Criteria for inclusion of specific terms as allergy reactions differed between VA and DoD
5. Divergent approaches to SNOMED CT mapping emerged, despite shared business rules
1. SNOMED CT concept modeling allowed for divergent mapping options.

<table>
<thead>
<tr>
<th>SCTID</th>
<th>Fully Specified Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>249366005</td>
<td>Bleeding from nose (finding)</td>
</tr>
<tr>
<td>162371009</td>
<td>Nosebleed/epistaxis symptom (finding)</td>
</tr>
<tr>
<td>12441001</td>
<td>Epistaxis (disorder)</td>
</tr>
<tr>
<td>162373007</td>
<td>Has nosebleeds - epistaxis (disorder)</td>
</tr>
<tr>
<td>206993003</td>
<td>[D]Epistaxis (situation)</td>
</tr>
</tbody>
</table>
Discussion continued

- Other SNOMED CT mapping dilemmas

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>84229001</td>
<td>Fatigue (finding)</td>
</tr>
<tr>
<td>272060000</td>
<td>Fatigue - symptom (finding)</td>
</tr>
<tr>
<td>272044004</td>
<td>Complaining of vomiting (finding)</td>
</tr>
<tr>
<td>249497008</td>
<td>Vomiting symptom (finding)</td>
</tr>
<tr>
<td>162288000</td>
<td>Has an itchy eye (finding)</td>
</tr>
<tr>
<td>74776002</td>
<td>Itching of eye (finding)</td>
</tr>
</tbody>
</table>
2. New reactions were added independently at each agency

3. Updates to new releases of SNOMED CT did not occur simultaneously at each agency
   - Needed a maintenance process addressing changes in SNOMED CT Concept status (to ambiguous, duplicate, erroneous, retired, etc.)
4. Criteria for inclusion of specific terms as allergy reactions differed between VA and DoD

– Examples:
  » “allergic reaction”
  » “systemic disease”
5. Divergent mapping approaches emerged, despite common rules

– Examples:

  » “Orthostatic hypotension (disorder)” vs. “postural drop in blood pressure (finding)”

  » “Hypertension” : “Hypertensive disorder, systemic arterial (disorder)” vs. “finding of increased blood pressure (finding)”
Lessons Learned

• Mapping rules must always be tailored to the specific purpose of the mapping.
  – Mapping practices may be influenced by many issues
  – Potential for entire message to fail if any part failed led to establishment of particular mapping guidelines in this context
Lessons Learned

• Ongoing communication between agencies is essential, even with established mapping rules in place

• Mappers’ clinical backgrounds, familiarity with CliniClue®, and knowledge of SNOMED can influence mapping results

• Ideally, a common team, process, and toolset would be used for mapping
Lessons Learned

• SNOMED CT modeling issues were probably the most difficult to address, as these require a sophisticated knowledge of concept modeling and of the evolution of SNOMED hierarchies over time
Lessons Learned

• Maintenance plans must include coordination of updates to the standard (SNOMED CT), including plans for synchronization with release schedules.

• Coordination of updates between agencies must be maintained on a regular basis.
New Subset for Allergy Reactions

• A significant outcome of this project is the generation of a new, unique subset of Allergy Reactions which could be submitted for inclusion in SNOMED CT as an official subset

• It could also be published and shared among federal agencies and non-federal partners
HITSP Recommendations Regarding Allergy Reactions Terminology

• In December 2007, HITSP designated the VA/Kaiser Permanente (KP) Problem List subset (16,430 entries) as the recommended standard for allergy reactions.

• The previous (CHI) recommendation had been to use the VA/DoD Allergy Reactions subset (864 entries).
• Use of the Problem List subset to record allergy reactions may prove problematic
  – “circumoral paresthesia” and “edema of pharynx” are allergy reactions not found in the current Problem List subset

• Use of the smaller subset, which is specifically created for documenting allergy reactions, would enable simpler data entry, better computing speed and preservation of data integrity
Conclusions

- Mapping is relatively resource-intensive and costs of maintenance must be considered
- Adopting standards natively is more efficient, but we’re not there yet
- Use of mediation terminologies is an effective, practical method for advancing the goal of semantic interoperability
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