Representing knowledge, data and concepts for EHRS using Detailed Clinical Models

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Outline

- Two level modeling
- Detailed clinical models as new kid on the block
- Method: requirements for EHRs
- Results: DCM process and format
- Discussion
- Conclusion
2 level modeling

Two level modeling for:
- electronic health record (EHR),
- electronic data exchange for continuity
- aggregation purposes.

Disentangle clinical content (model 1) from the EHR system & technology (model 2).

Different challenges in data uses & technology spaces
Clinical modeling benefits

- Next generation EHR systems require that clinical knowledge is made explicit used in data specification, user interface, and that terminologies and codes are applied for data communication and re-use.
- Standards facilitate long term ownership, maintenance, collaboration
- Moreover: prevents vendor lock-in.
Detailed Clinical Model

- Conceptual representation of clinical knowledge, data elements, relationships and terminology binding for use in EHR and electronic message.

- Atomic or small molecular scale

- Can be grouped without limits in any kind of arrangements (assessments, discharge summary, CCD, care plan)

  (Goossen, Goossen-Baremans, vd Zel, 2010, ISO WD 13972 part 2).
Position statement

- Adoption of conceptual level Detailed Clinical Modeling (DCM) is required to move to the next generation EHRS in which:
  - clinical knowledge, concepts, and data elements are represented in a logical manner allowing semantics to be exchanged
  - without being trapped in a specific technology.
Method

- Requirement analysis for data elements from different data uses
  - EHR data clinical management
  - Continuity of care
  - Financial parameters
  - Epidemiological data (vital health statistics)
  - Quality indicators
- Integrate the requirements in DCM format
- Set up DCM governance
Adjusting EHR content to different requirements
## DCM conceptual format

<table>
<thead>
<tr>
<th>Major categories of a DCM expression: clinical knowledge as reference and logical model</th>
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</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
</tr>
<tr>
<td><strong>Data elements</strong></td>
</tr>
<tr>
<td><strong>Logical model</strong></td>
</tr>
<tr>
<td><strong>Meta information</strong></td>
</tr>
</tbody>
</table>
Logical Model expression

There are different alternatives possible for DCM expression:

- UML chosen because of IT industry standard, allows round trip modeling and transformations via XMI
- Archetype Definition Language option not chosen because bound to specific IT reference model
- HL7 v3 model and XML representations
- Web Ontology Language not chosen due to lack of skills, and limited transformations.
Assumption: from clinical via the conceptual generic model (DCM) to the implementation specification is better to maintain.

Approach gives EHR projects / users more control compared to technology driven or vendor specific materials.
## Processes for DCM

<table>
<thead>
<tr>
<th>ISO CD 13972 part 2: processes for DCM</th>
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<tbody>
<tr>
<td><strong>Clinician involvement</strong></td>
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<tr>
<td>Stakeholders, in particular clinicians can define their EHR and other uses data needs. Consensus building required. Multi requirements for different uses expressed in DCM. Endorsement of DCM by different stakeholders.</td>
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<tr>
<td><strong>Governance</strong></td>
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<tr>
<td>Quality testing</td>
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<tr>
<td>Repository for storage and distribution</td>
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<tr>
<td>Change requests and version management</td>
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<tr>
<td>Transformations between different formats</td>
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<tr>
<td><strong>Patient Safety</strong></td>
</tr>
<tr>
<td>Simple specifications</td>
</tr>
<tr>
<td>Control on maintenance, verifications, validations</td>
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<tr>
<td>Accountability for DCMs</td>
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Discussion

- DCM as new kid on the block: knowledge representation will continue to evolve, best of many worlds?
- Current examples work with relative simple topics (scales, weight and such), what if more complex?
- Discussion if DCM is feasible remains ongoing, in particular: why not alternative a,b,c
- Is enter once and use multiple times feasible for EHR? To some extend if type of query is known for design
Conclusions

- Detailed Clinical Models for re-use of specified clinical content works
- Multiple requirements, clinical, continuity, quality, billing, management, epidemiology can be met
- ISO standardization will facilitate uptake.
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