PRE-CONFIGURED POST-COORDINATION: AN APPROACH FOR IMPLEMENTING SNOMED CT IN AN EPR SYSTEM

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Outline

• SNOMED CT
• LORENZO
• User interface challenge
• Information model design
• Limitations and summary
SNOMED CT

- Comprehensive clinical terminology

- Each SNOMED CT concept represents a unit of clinical information and is associated with
  - Fully Specified Name
  - Descriptions
    - Preferred term
    - Synonym(s)
  - Relationships
    - Hierarchy
    - Defining
    - Qualifying
SNOMED CT Relationships

- Relationships is one of the key features which distinguishes SNOMED CT from most other clinical terminologies.

- SNOMED CT relationships are used for many features:
  - Hierarchical parent-child linkages between SNOMED CT concepts are expressed as IS-A relationships.
  - Definitional relationships are used to represent the meaning of a SNOMED CT concept in relation to other concepts.
  - Qualifying relationships are used to refine the meaning of a SNOMED CT concept by using a number of qualifiers.
Post-coordination

• Another key feature of SNOMED CT is post-coordination.

• It provides the ability to express detailed clinical information in a structured manner without having to create a concept code for each such item of detail (pre-coordination).

• A post-coordinated expression is created by combining a SNOMED CT concept with any specified defining and/or qualifying relationships with their corresponding SNOMED CT concept codes.
Sample Clinical Data using SNOMED CT

- While it is easy to understand pre-coordinated concepts, it is important to understand and recognise the complexity associated with post-coordinated expressions.
- E.g. Gradual onset of mild to moderate age-related cataract in the left eyeball can be expressed as
  - 39450006 | age-related cataract |
  - 272741003 | laterality | = 7771000 | left |
  - 363698007 | finding site | = 81745001 | eyeball |
  - 246112005 | severity | = 371923003 | mild to moderate |
  - 263502005 | clinical course | = 61751001 | gradual onset |
- E.g. Phacoemulsification of left eye cataract of intraocular lens implantation can be expressed as
  - 415089008 | Phacoemulsification of cataract with intraocular lens implantation |
  - 272741003 | laterality | = 7771000 | left |
  - 363698007 | finding site | = 78076003 | lens of eye |
LORENZO

- LORENZO is CSC’s strategic electronic patient record system
- Multi-professional multi-specialty multi-care setting
- Comprises both administrative and clinical functionality
- Deployed in UK and the Netherlands to date
- All structured patient clinical data underpinned by use of clinical terminologies
SNOMED CT in LORENZO

• First release of LORENZO targeted for NHS in England

• National Programme for Information Technology (NPfIT) in England stipulated use of SNOMED CT

• Hence SNOMED CT was chosen as clinical terminology for clinical data in LORENZO in NHS England

• Specifically this presentation will focus on the use of SNOMED CT for recording problems and procedures in LORENZO
At the very outset, it was decided to ensure that LORENZO was capable of recording information needed to produce valid post-coordinated expressions.

Problems could come from two SNOMED CT domains – Clinical Findings and Disease.
Procedures could come from one SNOMED CT domain – Procedure.

Each of these domains was associated more than 15 defining and/or qualifying attributes.
Furthermore two concepts from the same SNOMED CT domain could have different number of attributes.
<table>
<thead>
<tr>
<th>Clinical Finding</th>
<th>Disease</th>
<th>Procedure</th>
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</thead>
<tbody>
<tr>
<td>After</td>
<td>After</td>
<td>Access</td>
</tr>
<tr>
<td>Associated morphology</td>
<td>Associated morphology</td>
<td>Access instrument</td>
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<tr>
<td>Associated with</td>
<td>Associated with</td>
<td>Approach</td>
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<tr>
<td>Causative agent</td>
<td>Causative agent</td>
<td>Component</td>
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<tr>
<td>Course</td>
<td>Course</td>
<td>Direct device</td>
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<td>Due to</td>
<td>Due to</td>
<td>Direct morphology</td>
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<tr>
<td>Episodicity</td>
<td>Episodicity</td>
<td>Direct substance</td>
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<tr>
<td>Finding site</td>
<td>Finding site</td>
<td>Has focus</td>
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<tr>
<td>Has definitional</td>
<td>Has definitional manifestation</td>
<td>Has intent</td>
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<tr>
<td>Has interpretation</td>
<td>Has interpretation</td>
<td>Has specimen</td>
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<tr>
<td>Interprets</td>
<td>Interprets</td>
<td>Indirect device</td>
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<tr>
<td>Occurrence</td>
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<td>Indirect morphology</td>
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<td>Measurement method</td>
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<tr>
<td>Severity</td>
<td>Pathological process</td>
<td>Method</td>
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<tr>
<td>Stage</td>
<td>Severity</td>
<td>Priority</td>
</tr>
<tr>
<td>Subject of information</td>
<td>Stage</td>
<td>Procedure device</td>
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<tr>
<td></td>
<td>Subject of information</td>
<td>Procedure morphology</td>
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<td>Procedure site</td>
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<td></td>
<td></td>
<td>Procedure site – Direct</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Procedure site – Indirect</td>
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<td>Time aspect</td>
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<td>Using</td>
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</table>
Source of User Interface Challenge

• The only way to facilitate the recording of data for a complete post-coordinated expression would be to dynamically configure the user interface based on the selected problem or procedure.

• This poses a significant challenge from many perspectives:
  – Design
  – Engineering
  – Training
  – Point of care use

• Furthermore, the sheer number of attributes poses a real estate challenge.
In order to overcome the user interface challenges described earlier, it was decided to use list of the SNOMED CT attributes to inform the design of the LORENZO information model.

Clinicians involved in the design of LORENZO examined all the attributes and chose the key ones which became attributes of Problem and Procedure in the LORENZO information model.

The LORENZO information model also includes other necessary attributes.

The LORENZO user interface is based directly on the LORENZO information model and is a fixed user interface.

This helped to overcome the user interface challenges.
LORENZO Information Model – Key Problem Attributes

- Problem type
- Problem name – SNOMED CT Clinical Finding or Disease
- Onset date
- Subtype
- Body site + laterality – SNOMED CT Finding Site – Body Structure
- Course – SNOMED CT Clinical Course
- Certainty – SNOMED CT Certainty
- Severity – SNOMED CT Severity
- Comments
LORENZO Information Model – Key Procedure Attributes

- Procedure – SNOMED CT Procedure
- Performed date and time
- Body site + laterality – SNOMED CT Finding Site – Body Structure
- Approach – SNOMED CT Approach
- Direct device – SNOMED CT Direct Device
- Method – SNOMED CT Method
- Priority – SNOMED CT Priority
- Comments
Allowable Qualifier Values

• User selects problem and/or procedure from the respective SNOMED CT subset
• All other SNOMED CT-related attributes are refined as per their definition in the SNOMED CT Concept Model
• This is either done by getting the list of allowable values from the SNOMED CT definition of the chosen problem/procedure, or by associating a subset with the attribute
• Attributes such as Laterality are conditionally mandatory based on the ‘mandatory to refine’ refinability property
  – If the user chooses a body part which needs laterality, then user must choose a laterality as well
Recording Problem Name + Body Site + Laterality
Recording Problem Course + Certainty + Severity

Acute Q fever

Course: Gradual onset
Certainty: Definitely present
Severity: Mild to moderate
Expected conclusion date: Enter date
On expected conclusion date:
On behalf of:

DANIEL, Williams, administrator role
HUMBER NHS FOUNDATION TRUST
Recording Procedure + Body Site + Laterality

GREEN, Gavin (Master) Male DOB: 12-Nov-2004 8 Yrs Patient ID: HPASID-000000000386
Allergies/ADRs - None Recorded (Not Checked On 27-Sep-2013)

Record procedure

Performed date and time
- Complete date
- 27/09/2013
- Not specified

Procedure
- Phacoemulsification of cataract with intrasocular lens implantation

Approach
- Term not selected

Direct device
- Term not selected

Method
- Term not selected

Priority
- Term not selected

Performed service point
- 

Performed by
- daniel, williams

Body site
- Lens of eye

Laterality
- Left

Problems (Onset date)
- Age-related cataract (27/09/2013)
- Acute Q fever (03/08/2013)
- Allergic asthma

Comments
Limitations

• LORENZO information model only supports some of the SNOMED CT defining and qualifying attributes based on clinician feedback

• As a result, incoming post-coordinated data which uses other defining and/or qualifying attributes will need to be degraded to text to import the data into a LORENZO patient record
Summary

- Designing user interfaces to collect post-coordinated data is potentially complex due to their dynamic nature and number of possible attributes.

- LORENZO has simplified this by aligning its information model to the most clinically relevant SNOMED CT defining and qualifying attributes.

- As a result, LORENZO has a consistent fixed, simple and usable user interface which easily supports users in recording post-coordinated data at the point of care.