IMPLEMENTING SNOMED CT BINDINGS IN CLINICAL DATA CAPTURE FORMS

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Clinical Terminology Director
About me

- Medical background – practising GP
- Clinical Terminologist for ~ 20 years
- NHS & commercial sectors
- Content Committee member on original CAP/NHS project
- Involved in SNOMED CT implementation past 6 years
  - Medusa ambulance application
  - Lorenzo Regional Care
- UK Edition Committee member
- IHTSDO QA Committee member
Outline

SNOMED CT / Application Issues – the problems
Lorenzo Interface Terminology – the solution
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SNOMED CT / Application Issues – the problems
Lorenzo Interface Terminology – the solution
Lorenzo Regional Care

- Centrally hosted application developed for English NHS
- Multi-professional
- Live in 10 hospitals
- Three areas of SNOMED CT functionality
  - Health Issues
    - Diagnosis, Symptoms, Allergies, Interventions
    - Subset driven > 35 SNOMED CT subsets in use
  - Clinical Narrative
    - Smart tags
  - Clinical Data Capture (CDC) forms
    - Developed collaboratively with NHS
    - Primarily secondary care
### CDC Forms

#### Angina Pectoris Form

<table>
<thead>
<tr>
<th>Field</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual date of assessment</td>
<td>-</td>
</tr>
<tr>
<td>Assessed/Performed by</td>
<td>-</td>
</tr>
<tr>
<td>Date</td>
<td>14/08/2012</td>
</tr>
<tr>
<td>Medical history</td>
<td>-</td>
</tr>
<tr>
<td>Intensity</td>
<td>-</td>
</tr>
<tr>
<td>Location</td>
<td>-</td>
</tr>
<tr>
<td>Vegetative symptoms present</td>
<td>-</td>
</tr>
<tr>
<td>Relation with effort</td>
<td>-</td>
</tr>
<tr>
<td>NYHA classification</td>
<td>-</td>
</tr>
<tr>
<td>Maximal pain presence</td>
<td>-</td>
</tr>
<tr>
<td>Frequency of cardiac symptoms</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Intensity
- Increasing
- Stable

#### Sensation
- Heavy weight
- Stabbing
- Tightness
- Burning

#### Type
- Pressure
- Pain

#### Location
- Centre of chest
- Back
- Upper abdomen
- Throat

#### Radiation present
- Without radiation
- Using radiation to

#### Radiation
- Left arm
- Right arm
- Left shoulder
- Right shoulder

#### Vegetative symptoms
- Nausea
- Vomiting
- Sweat
- Shortness of breath

#### Relation with effort
- Did not resolve
- Resolved within

#### Trigger
- Mid exertion
- Heavy exertion
- At rest
- Cold

#### NYHA classification
- I
- II
- III
- IV

#### Maximal pain presence
- Continue
- Up to

#### Frequency of cardiac symptoms
- Equal to
- More than
- Less than
- About
CDC Forms & Issues

- Holy grail – set of national reusable SNOMED CT coded forms & data items
  - Early adopters strong influence
  - Simple translation of current processes - NHS is not a single organisation
  - In reality often difficult to persuade users to modify practices
- SNOMED CT specific issues
  - Availability & lateralisation of observables
  - Usability of SNOMED CT terms
- Lorenzo issues
  - Application constraints on subsets
CDC Forms Data Item Library

- Currently > 10,000 data items
- Governance process to approve additions/changes
- Managed in SQL Server Database
  - CSC & NHS access
  - MS Access front end
- Different data types
  - Numeric
  - String
  - Date
  - Enumerator
  - Terminology subset
SNOMED CT Bindings on CDC Forms

• Binding to the data item with additional data – observables
  – Body mass index
  – Systolic blood pressure
  – Barthel Index
  – Oxygen saturation
  – Claudication distance

• Bindings to response sets – findings/interventions
  – Short list e.g. relevant diagnoses
  – Repeating responses – e.g. Yes/No/Not known
  – Includes SNOMED CT context
Observables in CDC

- Mainly straightforward
- Some missing observables
  - Eponymous scales
    - Ongoing work on observables & procedure concepts
    - Guidance to use procedure concepts where available
    - Additions via UKTC request portal
- Laterality
  - Non-laboratory concepts e.g. joint range of movement
  - Laterality not modeled in SNOMED CT (was in CTV3)
  - Ongoing work on observable model
  - Escalated via UK Edition Committee
  - Lateralised concepts added to UK extension
Enumerators in CDC

• More challenging
  – But a lot more fun

• 2 main issues
  – Application constraints – subsets on CDC
  – Usability of SNOMED CT terms
Subsets in CDC

- ‘All or nothing’ rule for subsets
- In practice rare that all enumerators can/should be coded
- Repeating response sets
  - Epilepsy
    - Yes 84757009 Epilepsy
    - No Negation in context model but not in subsets
    - Not given Not in finding context
    - Not known Not in finding context
- Specific response sets
  - Diabetes control method
    - Diet 170745003 Diabetic on diet only
    - Insulin 170747006 Diabetic on insulin
    - Oral 170746002 Diabetic on oral treatment
    - Other Not in SNOMED CT!
Usability of SNOMED CT Terms

- Lorenzo subsets display preferred terms
- Tension between unambiguity & usability
- Strong user push back
- Urinalysis protein
  - Negative  167273002 Urine protein test negative
  - Trace    167274008 Urine protein test trace
  - +        167275009 Urine protein test = +
  - ++       167276005 Urine protein test = ++
  - +++      167277001 Urine protein test = +++
  - ++++     167278006 Urine protein test = ++++
Outline

SNOMED CT / Application Issues – the problems
Lorenzo Interface Terminology – the solution
Lorenzo Reference Domains

- Internal terminology
- Variety of uses
- Used to populate pick lists
  - Gender
  - Language
- May affect application behaviour
- Adapted to support SNOMED CT
## Lorenzo SNOMED CT Reference Domains – Fixed Response Set

<table>
<thead>
<tr>
<th>ValueDomainCode</th>
<th>ConceptCode</th>
<th>TermText</th>
<th>Display Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC_CDC_F_YNNGN K</td>
<td>CC_CDC_F_YES</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>CC_CDC_F_YNNGN K</td>
<td>CC_CDC_F_NO</td>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td>CC_CDC_F_YNNGN K</td>
<td>CC_CDC_F_NK</td>
<td>Not known</td>
<td>3</td>
</tr>
<tr>
<td>CC_CDC_F_YNNGN K</td>
<td>CC_CDC_F_NG</td>
<td>Not given</td>
<td>4</td>
</tr>
</tbody>
</table>

### SNOMED CT Expression

1. **CC_CDC_F_YES**
   - ValueDomainCode: CC_CDC_F_YNNGN
   - Display Order: 1
   - ConceptCode: CC_CDC_F_YES
   - TermText: Yes
   - Prefix: 413350009 | finding with explicit context |:
   - Suffix: |
   - 246090004 | associated finding | : |
   - 847570009 | Epilepsy |
   - 408729009 | finding context | = |
   - 521010004 | present |
   - 408731000 | temporal context | = |
   - 410512000 | current or specified |
   - 408732007 | subject relationship context | = |
   - 410604004 | subject of record |

2. **CC_CDC_F_NO**
   - ValueDomainCode: CC_CDC_F_YNNGN
   - Display Order: 2
   - ConceptCode: CC_CDC_F_NO
   - TermText: No
   - Prefix: 413350009 | finding with explicit context |:
   - Suffix: |
   - 246090004 | associated finding | : |
   - 847570009 | Epilepsy |
   - 408729009 | finding context | = |
   - 2667000 | absent |
   - 408731000 | temporal context | = |
   - 410512000 | current or specified |
   - 408732007 | subject relationship context | = |
   - 410604004 | subject of record |

3. **CC_CDC_F_NK**
   - ValueDomainCode: CC_CDC_F_YNNGN
   - Display Order: 3
   - ConceptCode: CC_CDC_F_NK
   - TermText: Not known
   - Prefix: 413350009 | finding with explicit context |:
   - Suffix: |
   - 246090004 | associated finding | : |
   - 847570009 | Epilepsy |
   - 408729009 | finding context | = |
   - 410512000 | current or specified |
   - 408732007 | subject relationship context | = |
   - 410604004 | subject of record |

4. **CC_CDC_F_NG**
   - ValueDomainCode: CC_CDC_F_YNNGN
   - Display Order: 4
   - ConceptCode: CC_CDC_F_NG
   - TermText: Not given
   - Prefix: 413350009 | finding with explicit context |:
   - Suffix: |
   - 246090004 | associated finding | : |
   - 847570009 | Epilepsy |
   - 408729009 | finding context | = |
   - 2667000 | absent |
   - 408731000 | temporal context | = |
   - 410512000 | current or specified |
   - 408732007 | subject relationship context | = |
   - 410604004 | subject of record |
Lorenzo SNOMED CT Reference Domains – Fixed Response Set

Classification
- Classify 1: SysObs Neuro
- Classify 2: 
- Classify 3: 

Expression Component Table

Lookup Table Decomposed expression

SNOMED Expression

Enumerated values  Order  Source  Forms
- Yes
- No
- Not given
- Not known

Pre-operative Assessment Medical History
## Lorenzo SNOMED CT Reference Domains – Unique Response Set

<table>
<thead>
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<th>TermText</th>
<th>DisplayOrder</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC_CDC_115</td>
<td>CC_CDC_115_1</td>
<td>Brisk</td>
<td>1</td>
</tr>
<tr>
<td>CC_CDC_115</td>
<td>CC_CDC_115_2</td>
<td>Normal</td>
<td>2</td>
</tr>
<tr>
<td>CC_CDC_115</td>
<td>CC_CDC_115_3</td>
<td>Reduced</td>
<td>3</td>
</tr>
<tr>
<td>CC_CDC_115</td>
<td>CC_CDC_115_4</td>
<td>Absent</td>
<td>4</td>
</tr>
</tbody>
</table>

### SNOMED CT Expression

413350009 | finding with explicit context | { 246090004 | associated finding | = 299879008 | Ankle reflex brisk , 408729009 | finding context | = 52101004 | present , 408731000 | temporal context | = 410512000 | current or specified | , 272741003 | Laterality | = 7771000 | Left , 408732007 | subject relationship context | = 410604004 | subject of record | }

### ConceptCode

<table>
<thead>
<tr>
<th>ConceptCode</th>
<th>Prefix</th>
<th>Suffix</th>
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</table>
| CC_CDC_F_YES_L | 413350009 | finding with explicit context | { 246090004 | associated finding | = 408729009 | finding context | = 52101004 | present , 408731000 | temporal context | = 410512000 | current or specified | , 272741003 | Laterality | = 7771000 | Left , 408732007 | subject relationship context | = 410604004 | subject of record | }
Lorenzo Reference Domains – SNOMED CT Context

- Pre-configured post-coordinated representation of contextual SNOMED CT expressions
- Internal display in SNOMED CT compositional grammar
- Driven by user requirements
- Pareto effect?
- Scope
  - Findings context
    - Present, Absent, Suspected
  - Temporal context
    - Default, Past, Recent
  - Laterality
    - Findings & Procedure
  - Procedure context
    - Done, Not done, Planned, Indicated
Lorenzo CDC SNOMED CT Expressions - Validation

• Collaborative exercise with NHS
  – UK Terminology Centre
  – CFH Content Team
• Review of entire data item library
  – 10,000 items
• Initial assignment by CSC team
• Regular review sessions via webex
  – 4 persons
  – > 1 year
Lorenzo CDC SNOMED CT Expressions - Summary

• > 3000 SNOMED CT expressions
  – Findings 2316
  – Observables 183
  – Procedures 539

• Transparent to the user

• SNOMED CT binding application
  – Includes SNOMED CT browser for finding & entering concepts
  – Displays in SNOMED CT compositional grammar

• Lookup table
  – Decomposed relationship values for future retrieval
  – HL7 expressions for future messaging

• Excellent relationship with UKTC
  – Validation of bindings
  – Addition of content
Acknowledgements

• NHS
  – Ian Arrowsmith
  – Zac Whitewood-Moores
  – Richard Gain
  – Elaine Wooler

• CSC
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  – Nilesh Jain
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THANK YOU