Essential SNOMED

→ Simplifying S-CT

→ Supporting integration with health information models

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Overview

• Historical development S-CT
• Functional requirements of S-CT “in use”
• Role of Pre & Post Coordination
• Features of Essential SNOMED
• Relation to existing SNOMED
• Implementation issues
• Relationship to current SCT development
• Return to first principles – desiderata
SNOMED-CT has sourced content from many terminologies and classifications, each reflecting their own user requirements and usage in applications.
S-CT contains a mix of pre-coordinated and atomic or essential concepts; clinical terminology and classification concepts

**Precoordination**
- Pregestational diabetes mellitus AND/OR impaired glucose tolerance
- Amoxycillin 250mg capsule
- Bleeding chronic gastric ulcer
- Left paramedian incision
- Acute gastric ulcer with hemorrhage
- Posttransfusion hepatitis
- Dendritic cell sarcoma, not otherwise specified
- Recurrent hernia
- Fractured left femur

**Atomic concepts**

<table>
<thead>
<tr>
<th>Atomic concepts</th>
<th>Precoordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent</td>
<td>capsul</td>
</tr>
<tr>
<td>Ulcer</td>
<td>left femur</td>
</tr>
<tr>
<td>Chronic</td>
<td>Amoxycillin</td>
</tr>
<tr>
<td>Left</td>
<td>Hepatitis</td>
</tr>
<tr>
<td>Primary</td>
<td>Acute</td>
</tr>
</tbody>
</table>

*Atomic = Semantic Unit of thought*
Pre-coordinated complex concepts support the language of use and are very valuable.

Amoxicillin 250mg capsul

No allergy to latex
Terminology concepts support the language of meaning when used within an appropriate information model to support:

- Communication
- EHR
- Data retrieval
Harmonisation and transformation between the terminology model and the data model is better supported by atomic terminology.

HL7- version 3 example: negation
## Terminology model vs. Data Model (Archetype)

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T</strong> Diagnosis (specialisation of: Problem)</td>
<td>The index diagnosis</td>
<td>Coded text</td>
<td>Terminology Any term that is a diagnosis</td>
</tr>
<tr>
<td><strong>T</strong> Status</td>
<td>The status of the diagnosis</td>
<td>Coded text</td>
<td>provisional working</td>
</tr>
<tr>
<td><strong>Date of initial onset</strong></td>
<td>The date that the problem began causing symptoms or signs</td>
<td>Date &amp; Time</td>
<td>Date only yyyy-??-??</td>
</tr>
<tr>
<td><strong>Age at initial onset</strong></td>
<td>The age of the at the onset of the problem</td>
<td>Duration</td>
<td>years, months, weeks, days, hours, minutes, seconds</td>
</tr>
<tr>
<td><strong>Severity</strong></td>
<td>The severity of the index problem</td>
<td>Ordinal</td>
<td>1, Mild 4, Moderate 7, Severe</td>
</tr>
<tr>
<td><strong>Clinical description</strong></td>
<td>Description of the clinical aspects of the problem</td>
<td>Text</td>
<td>Free or coded text</td>
</tr>
<tr>
<td><strong>Date clinically recognised</strong></td>
<td>Date the problem was recognised by clinicians</td>
<td>Date &amp; Time</td>
<td>Partial date yyyy-??-xx</td>
</tr>
</tbody>
</table>

**Bleeding chronic gastric ulcer**

OpenEHR archetype - diagnosis

Concepts identified build compositional expressions. Codes for concepts and relationships stored in database. Used for indexing and searching the records.

Uni. Sydney example - ICU

An ICU sample note:
Underlined texts are inferred to be medical concepts


True positives
False negatives

Extracted medical concepts

235471009-Debridement of pancreatic and peripancreatic necrosis (procedure)
95563007 Gallstone pancreatitis (disorder)
44054006- Diabetes mellitus type 2 (disorder)
207057006-[D]Shortness of breath (context-dependent category)
29857009- Chest pains (finding)
22298006- Myocardial infarction (disorder)
194985005- Aortic incompetence, non-rheumatic (disorder)
90688005- Chronic renal failure syndrome (disorder)
Free Text Record – Mayo Clinic

REFERRAL SOURCE:

CHIEF COMPLAINT/REASON FOR VISIT:
This is a 57-year-old gentleman who presents with multiple complaints.

HISTORY OF PRESENT ILLNESS:
#1 Chest pain
Patient is a 57-year old gentleman with a 30-pack-year smoking history. He has a family history of early coronary disease. Patient has had no peripheral edema or shortness of breath at rest. He has had no episodes where the pain lasted

#2 Right knee pain
Patient has had an 8-year history of right knee pain. Patient works as a construction worker and had a fork lift injury 3 years ago. Patient smokes a pack a day and has a 30-pack-year smoking history. He was smoking less than this until last year. Patient is somewhat overweight and has had difficulty losing weight despite being a smoker. Patient has tried dieting and

CURRENT MEDICATIONS:
Ibuprofen on C/O mg po q.i.d.
Multivitamin 1 po q.d.
Vitamin C 400 mg po q.d.
Vitamin E 400 IU po q.d.

ALLERGIES:
Sulfur drugs - gets a rash.
Penicillin - has had an anaphylactic reaction.

SYSTEMS REVIEW:
He sees well. He hears without difficulty. He has no difficulty with speech or movement. He has good strength. He is able to perform his ADLs independently.

PAST MED/SURG HISTORY:
Patient has a history of nicotine dependence, obesity, pneumonia, bronchitis, and sinusitis.

SOCIAL HISTORY:
Drinks 2 ounces of alcohol daily.
Smoker 1 pack daily and has a 30-pack-year smoking history.
Lives at home with his wife and 5 children.

FAMILY HISTORY:
Father had an MI at age 43.
Brothers have had heart attacks in their 50s.
Father had hypertension and elevated cholesterol levels.
Mother had breast cancer.
Grandfather had history of colon cancer in his 70s.
Paternial grandfather had prostate cancer in his 80s.

HEIGHT:
190 cm
WEIGHT:
110 kg
TEMP:
36.3 C
HISTORY OF PRESENT ILLNESS:

Patient is a 57-year-old gentleman with a 20-pack-year smoking history. He has a family history of early coronary disease on his father's side, as his father had a heart attack at age 43. Patient does not exercise very much. He drinks 2 ounces of alcohol a day. He does not have diabetes mellitus, hypertension, nor does he know his cholesterol level. Patient was in his usual state of health until 2 months ago when he began having exertional dyspnea and chest pain at peak exercise. Patient could walk 4 blocks and up 2 flights of stairs before he would have crushing substernal chest pain, which radiated to his left arm. On a scale of 0 to 10, it was as bad as 8 out of 10. Patient had some diaphoresis and dyspnea associated with the chest pain. He would sit down and this would be relieved after about 15 minutes. Patient has taken it upon himself to limit his activities based on this symptomatology. Patient has an interest in quitting smoking. He denies palpitations, syncope, pre-syncope, PND, or orthopnea. Patient has had no peripheral edema or shortness of breath at rest. No episodes where the pain lasted greater than half hour.

#3 Right knee discomfort

Patient has anterior discomfort. He denies pain on valgus or varus stress. Suspect may have an anterior cruciate ligament injury. Send him for an x-ray of his knee. The patient may need an MRI. In order to evaluate this further, also have him seen by Orthopedics. Re-visit with him after seeing the Orthopedics.

Injury (disorder) [122549002] [K]

has Finding Site

Entire anterior cruciate ligament of knee joint (body structure) [182443006] [M]

has Laterality

Right (qualifier value) [24028007] [L]
Data Retrieval: Searching across multiple sources using different codesets eg US National Cancer Institute (NCI) Data Collection (acknowledgement Harold Solbrig – NCI/Apelon)
Complex hierarchies, combinatorial explosion, incomplete modelling. Terminology – information model mismatch

Terminology must support pre and post coordination – more gracefully

The chickens come home to roost:
Separate pre-coordinated concepts from the core hierarchical representation LINKING back via a formal pre-coordinated concept definition.

Use the existing S-CT structures that manage compositional grammar (expressions), normal forms, description logic & computation of equivalence.
We would create “pre-defined post-coordinated concepts”.

Each pre-coordinated concept has a post-coordination expression and is related to hierarchy by this link.

The pre-coordinated concepts exist within a separate logical or physical data structure and are linked to the core or essential SNOMED by the compositional form.

Essential SNOMED

370221004 severe asthma
195967001|asthma|:246112005|severity|=24484000|severe|
Linkage of Pre-coordinated Concepts to S-CT hierarchies

Is defined by

195967001|asthma|:246112005|severity|=24484000|severe|

370221004 severe asthma
SNOMED-CT current model

- Post-coordination Grammar
- Description logic Normal form
- Classification map

Diagram:
- S-CT current model
  - Atomic & Pre-coordinated concepts
    - Term
      - Relationship type
      - 1
      - 2,*
      - 1,*
      - 1,*
Proposed Structure of SNOMED-ET

Pre-coordinated concepts to “move” to a new home

Existing Pre-coordinated concepts remain, and new ones can be added.

All pre-coordinated concepts would be defined
Pre-conditions

A complete and expressive syntax for post-coordination

Ability to identify pre-coordinated concepts/expressions

Research & Resources
Strategies for identifying atomic concepts

- Ontological Unit (Solbrig)
- Concepts likely to be found in a medical dictionary – commonly used
- Analyse existing S-CT relationships
- Cannot be adequately defined by post-coordinated expression
- Commence with known subsets/domains
Essential SNOMED: Why bother?

Tackle the morbid obesity and complexity of SCT core

EHR and messaging information models

Natural language processing & Multi-site data retrieval

Change is Great!!!
You go first.
Next Steps

“that’s the international symbol for don’t rock the boat”

Peer feedback
IT industry-user views
IHTSDO development directions?
Research
Parallel efforts – NCI Thesaurus

What comes after?
Change is the essence of life. Be willing to surrender what you are for what you could become.

“those charged with maintaining the vocabulary must accommodate graceful evolution of their content and structure.

Jim Cimino
Essential SNOMED

OR

[Image of a statue with a beard and raised hand]

[Image of a cartoon character smoking a cigarette]

[Image of water droplets on blue background]