

Alberta Health Services

Capital Health Palliative Care Program
Clinical Vocabulary Pilot Project

Project Report

Tuesday, December 22, 2009

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Abstract

- ▣ A 1-year pilot project was recently completed in Canada where SNOMED CT was incorporated into an existing palliative care information system (PCIS) used by the community palliative care team in Edmonton, Alberta. The project explored the creation of a palliative care term set, a step-by-step SNOMED CT encoding methodology, and the perceived value of SNOMED CT to clinicians. A 10-week trial use of the enhanced PCIS with formative evaluation was included. The key evaluation findings and lessons learned will be discussed in this seminar.

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Presentation Outline

1. Project Overview
2. Encoding Methodology & Results
3. Enhanced Palliative Care Information System (EPCIS)
4. Non-EPCIS Additional Features
5. Trial Use & Evaluation
6. SNOMED CT Issues & Versioning
7. Lessons Learned

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Part 1

Project Overview

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Project Overview

Objective:

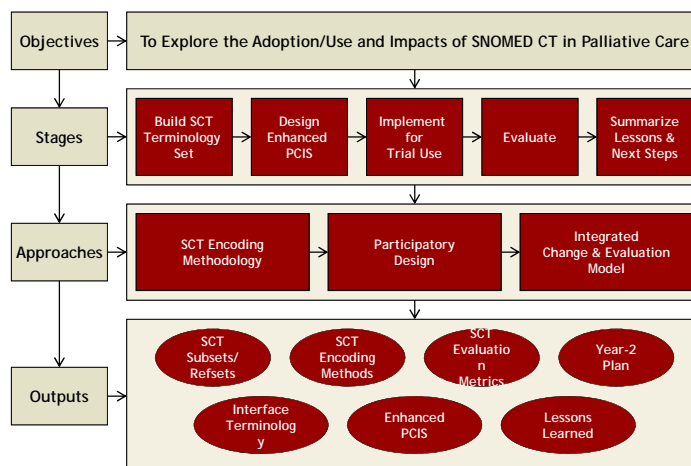
- 1-yr pilot to design, implement and evaluate a standards-based palliative care information system (PCIS)

Project Phases:

- Build a palliative SNOMED CT terminology set
- Enhance the current PCIS with SCT
- Implement enhanced PCIS for 10-week trial use
- Evaluate SCT-encoded, enhanced PCIS
- Write-up lessons and year-2 plan

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Project Overview Diagram



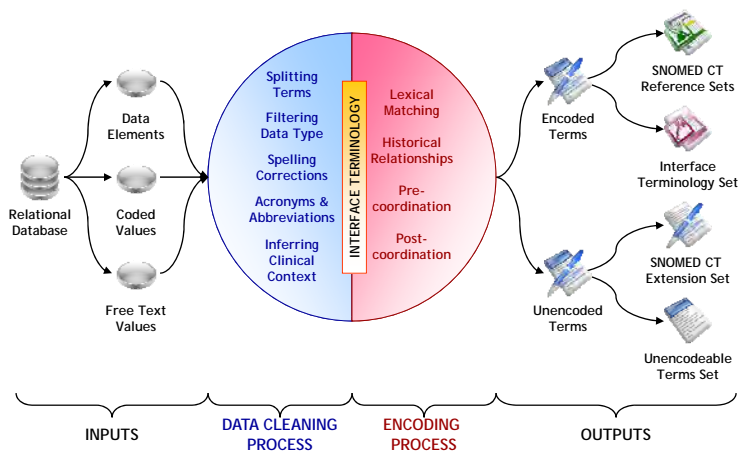
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Part 2

Encoding Methodology & Results

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SNOMED CT Encoding Methodology

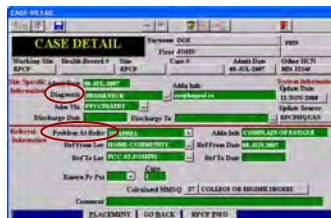
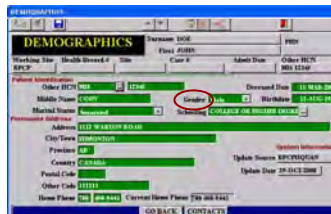


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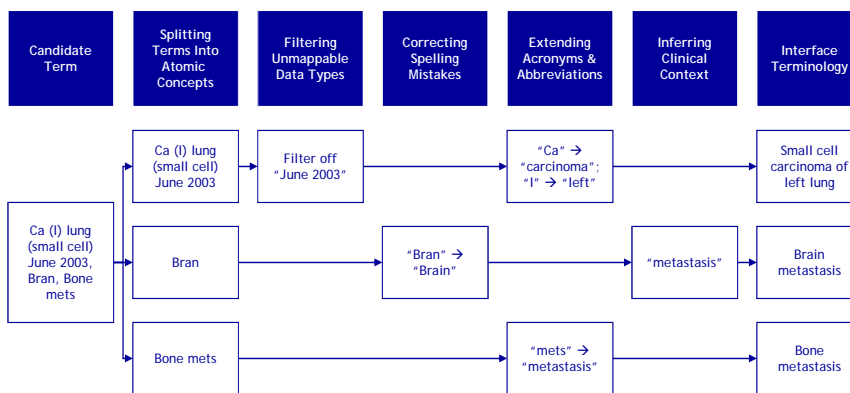
Inputs

Regional Palliative Care Program (RPCP) Database

- Data Elements
 - Gender
 - Diagnosis
 - Problem at Refer
- Coded Values
 - Gender: Male
 - Diagnosis: Head & neck
 - Problem: Dyspnea
- Free Text Values
 - Diagnosis: Esophageal ca
 - Problem: Complain of fatigue

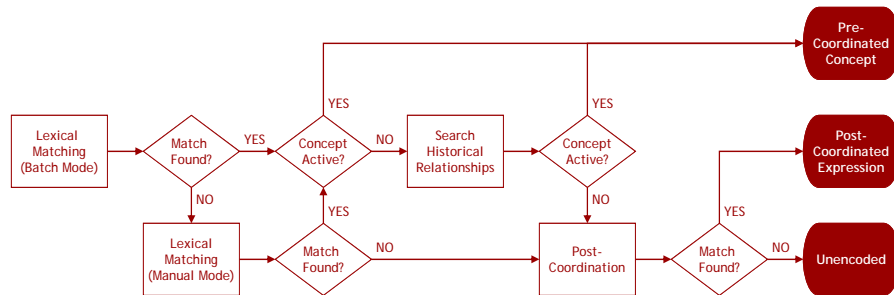


Data Cleaning Process



```
<observation classCode="OBS" moodCode="EVN" >
  <code code="ASSERTION" codeSystem="2.16.840.1.113883.5.4" />
  <value codeSystem="2.16.840.1.113883.6.96" codeSystemName="SNOMED CT"
    code="254632001" displayName="Small cell carcinoma of lung
    (disorder)" />
  <effectiveTime value="200306" />
</observation>
```

Encoding Process



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Lexical Matching Algorithm

□ Lexical Matching

- Exact match
- Match all words
- Match any words

□ Target Descriptions

- Original SNOMED CT descriptions
- UMLS normalised SNOMED CT descriptions
- Porter stemming SNOMED CT descriptions

□ Stop and Exclude Words

- Stop Words (10): and, by, for, in, of, the to
- Exclude Words (45): an, as, at, being, into

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Normalisation Example

No	Step	Example
1.	Remove genitive	Hodgkin' s diseases, NOS → Hodgkin diseases, NOS
2.	Remove stop words	Hodgkin diseases, NOS → Hodgkin diseases,
3.	Lowercase phrase	H odgkin diseases, → hodgkin diseases,
4.	Strip punctuation	hodgkin diseases. , → hodgkin diseases
5.	Uninflect phrase	hodgkin diseases s → hodgkin disease
6.	Sort words	hodgkin disease → disease hodgkin

Historical Relationships

No	Historical Relationship	Description
1.	370124000 REPLACED BY (attribute)	Relates an <i>erroneous</i> concept to a corrected concept that replaces it.
2.	168666000 SAME AS (attribute)	Relates a <i>duplicate</i> concept with an active concept that has the same meaning.
3.	149016008 MAY BE A (attribute)	Relates an <i>ambiguous</i> concept to the concepts that represent each of its possible meanings.
4.	159083000 WAS A (attribute)	Relates a concept to an inactive concept that was formerly considered to be one of its <i>subtypes</i> .
5.	370125004 MOVED TO (attribute)	Relates to the <i>namespace</i> concept for a different namespace in which this concept is now maintained.
6.	384598002 MOVED FROM (attribute)	Relates to a concept in another <i>namespace</i> that is replaced by this concept.

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Encoding Examples

Local Terms	SCT Descriptions	SCT Concepts
<ul style="list-style-type: none"> ▪ Dyspnea (951) ▪ SOB dyspnea (1) ▪ Short of breath (8) ▪ Shortness of breath (329) ▪ SOB (7) 	<ul style="list-style-type: none"> ▪ Breathless ▪ Breathlessness ▪ Dyspnea ▪ Shortness of breath ▪ SOB – Shortness of breath 	267036007 Dyspnea (finding)
<ul style="list-style-type: none"> ▪ Chronic obstructive airway disease (1) ▪ Chronic obstructive lung disease (1) ▪ Chronic obstructive pulmonary disease (1) ▪ COPD (200) ▪ Obstructive lung disease (11) 	<ul style="list-style-type: none"> ▪ CAFL – Chronic airflow limitation ▪ CAO – Chronic airflow obstruction ▪ Chronic airflow limitation ▪ Chronic airflow obstruction ▪ Chronic airway disease ▪ Chronic airway obstruction ▪ Chronic obstructive airway disease ▪ Chronic obstructive lung disease ▪ COPD ▪ COPD –Chronic obstructive pulmonary disease 	13645005 Chronic obstructive lung disease (disorder)
<ul style="list-style-type: none"> ▪ Caregiver burn out (3) ▪ Caregiver exhausted (3) ▪ Caregiver exhaustion (15) ▪ Caregiver stress (72) ▪ Caregiver stressed (3) 	<ul style="list-style-type: none"> ▪ Caregiver role strain 	129891007 Caregiver role strain (finding)

Detailed Encoding Examples

❑ Pre-coordination (Ovarian cancer)

363443007|Malignant tumor of ovary (disorder)|

❑ Refinement (Cancer of right ovary)

363443007|Malignant tumor of ovary (disorder)|:

363698007|Finding site (attribute)|=

20837000|Structure of right ovary (body structure)|

❑ Qualification (Recurrent ovarian cancer)

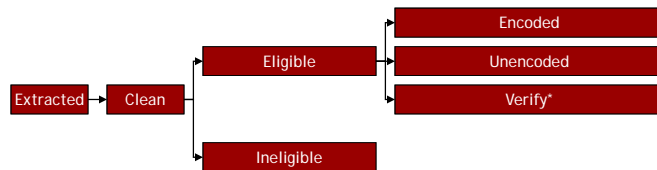
363443007|Malignant tumor of ovary (disorder)|:

263502005|Clinical course (attribute)|=

255227004|Recurrent (qualifier value)|

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Encoding Summary Statistics



Source	Extracted	Clean	Eligible	Ineligible	Encoded	Unencoded	Verify*	
Data Elements	211	211	146	65	32	124	0	
Coded Values	145	145	145	0	74	71	0	
Free Text Values	Unique	15,075	8,582	8,436	146	1,939	3,368	1,129
	Total	37,248	58,829	58,272	507	49,475	3,954	4,844

Free Text Encoding Summary Statistics

No	Encoding	Unique	Synonyms	Total	%
1.	Pre-coordination	1,471	3,181	48,102	81.77
2.	Post-coordination	468	691	1,373	2.33
3.	Ambiguous	4	4	5	0.01
4.	Requires post-coordination	693	693	1,002	1.70
5.	Requires verification	342	342	3,634	6.18
6.	Incorrect syntax or encoding	121	155	250	0.42
7.	Unencoded ($f < 5$)	3,370	3,370	3,956	6.72
8.	Unencodeable	146	146	507	0.86
	Total	6,615	8,582	58,829	100.00

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UVic-HTG Web Tools

- ❑ Browser
- ❑ Search
- ❑ Normalisation
- ❑ Expression Builder (MRCM)
- ❑ Expression Validation (MRCM)
- ❑ Versioning
- ❑ Subset Analysis
- ❑ Hierarchy Plotter
- ❑ Cross Maps

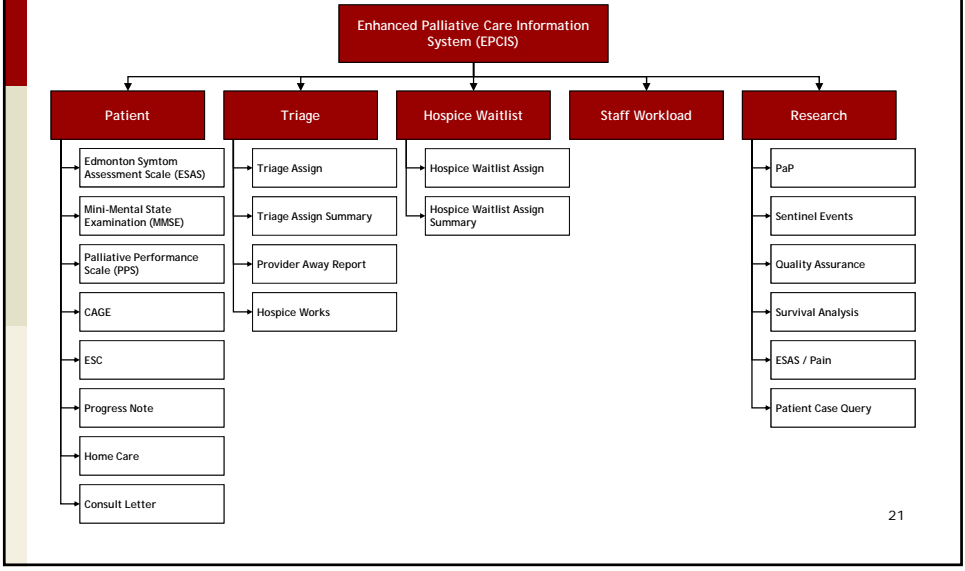
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Part 3

Enhanced Palliative Care
Information System (EPCIS)

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EPCIS Overview



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Consult Letter – EPCIS

Assessment 347794

Major Responsible Diagnosis	Temporal	Finding	Clinical Course	Episodicity	Interpretation	Occurrence	Severity	Procedure	Free Text
Squamous cell carcinoma	Imper	Persistent	Ongoing epis	Increasing			Severe		

Metastasis	Temporal	Finding	Clinical Course	Episodicity	Interpretation	Occurrence	Severity	Procedure	Free Text
Bony metastasis	Imper	Persistent	Ongoing epis	Increasing			Severe		clival bone destruction c

Part Medical History	Temporal	Finding	Clinical Course	Episodicity	Interpretation	Occurrence	Severity	Procedure	Free Text
CADG - Coronary arter				Old episode					2008
Hip replacement				Old episode					4 X left hip, 1 X right hip
Diabetes mellitus type	Imper	Persistent	Ongoing epis	Borderline			Mild		

History of Primary Illness	Date	Event/Imaging	Notes
	5/1/2008	CT Head and neck	Presented with headaches, optaxis - CT revealed 4.5 soft

History of Current Concerns	Concerns	Notes
Decreased Cognition		Pt was experiencing restlessness, aphasia, settle
Disposition		Pt unable to return home as care needs greater th

Review of Symptoms / Systems:
 No changes in vision, no headaches, no DTR or clonus, No dysphagia, drinking 3-5 sips per day, small amount of meals, sleep 1 hr per day at home, restless on TV BS @ 20hr. Occasional incontinence of bladder. Bedridden, up in Brody chair but causing discomfort to Left hip.

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Consult Letter – Printer Friendly

Alberta Health Services
Healthier People in Healthier Communities

Family Physician / Consultant

Page 1 of 2

History of Present Illness:

Date	Event	Notes
10/10/09	CT head and neck	Increased left paranasal opacities (CT paranasal CT with bone window). No left maxillary wall expansion into the sinus and bone erosion. No significant abnormal soft tissue signal.
10/02/09	ENT exam	negative for tumor
10/02/09	MRI	small amount of transverse ethmoiditis
10/02/09	CRX	normal, no acute
09/29/09	visited to OHS	progressive physical and cognitive decline, incontinence, delirium,
09/29/09	CT head	increased left temporal parietal volume and bone change

History of Current Conditions:

Condition	Notes
Chronic Kidney Disease	Stage 3 CKD
Diabetes	Insulin dependent

Alberta Health Services
Healthier People in Healthier Communities

Family Physician / Consultant

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Lab Results:

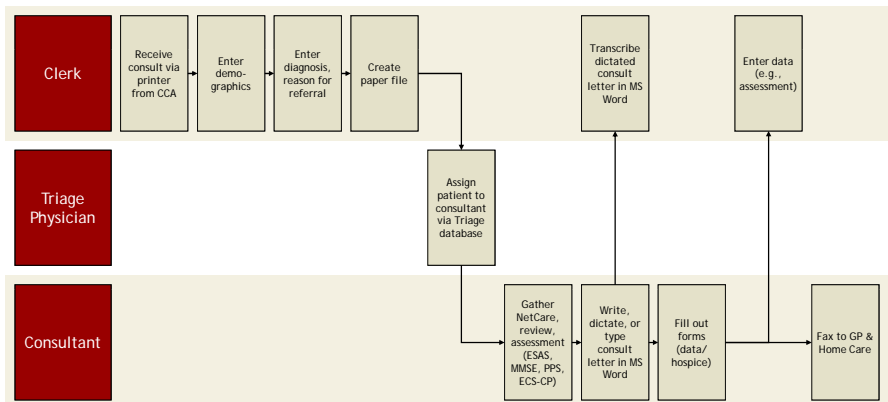
Ref	Result	Unit	Normal Range
101	10.2	mmol/L	3.6 - 6.0
102	1.2	mmol/L	0.0 - 0.3
103	1.2	mmol/L	0.0 - 0.3
104	1.2	mmol/L	0.0 - 0.3
105	1.2	mmol/L	0.0 - 0.3
106	1.2	mmol/L	0.0 - 0.3
107	1.2	mmol/L	0.0 - 0.3
108	1.2	mmol/L	0.0 - 0.3
109	1.2	mmol/L	0.0 - 0.3
110	1.2	mmol/L	0.0 - 0.3

Medications:

- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID
- Levetiracetam 1500mg PO BID

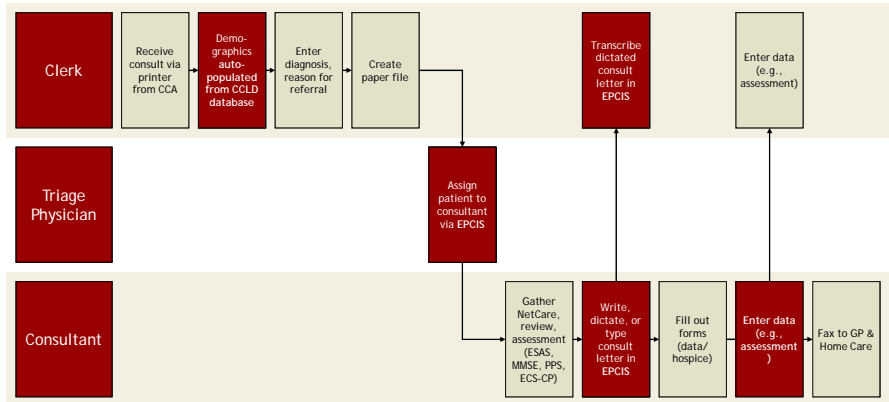
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PCIS – Clinician Workflow



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EPCIS – Clinician Workflow



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Part 4

Non-EPCIS Additional Features

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Consult Letter – Machine Readable HL7 CDA v3

UVIC-HTG Consultation Note

Created On: June 9, 2009

Patient:	Dennis Lee	MRN:	
Birthdate:	January 1, 2000	Sex:	Male
Guardian:			

Table of Contents

- [REASON FOR REFERRAL](#)
- [ASSESSMENT](#)
- [HISTORY OF PRESENT ILLNESS](#)
- [PROBLEM LIST](#)
- [REVIEW OF SYSTEMS](#)
- [PROCEDURE HISTORY](#)
- [ALLERGIES, ADVERSE REACTIONS](#)
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- [SOCIAL HISTORY](#)
- [RELEVANT DIAGNOSTIC TESTS AND](#)
- [VITAL SIGNS](#)
- [PLAN](#)

[REASON FOR REFERRAL](#)

Thank you for asking Regional Palliative Care to see this patient (age) year old (gender) with (primary diagnosis) with (secondary diagnosis).

```

<entry typeCode="DRIV"
  <organizer classCode="CLUSTER" moodCode="EVN">
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        codeSystemName="International Statistical Classification of Diseases and Related Health Problems, Tenth Revision" />
      <translation code="B298" displayName="Open wound(s) (multiple of unspecified site(s))" codeSystem="2.16.840.1.113883.6.5.3.1"
        codeSystemName="International Classification of Diseases and Related Health Problems, 9th Revision, Clinical Modifications" />
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  </organizer>
</entry>

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Patient Case Queries

- ❑ IHTSDO SNOMED CT Transforming Expressions to Normal Forms
- ❑ Structural Subsumption
- ❑ Unique Expressions Table – Candidates
 - Closer-to-user form
 - Long normal form
 - Long normal form with context
- ❑ Predicate
 - Convert to normal form

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Patient Case Queries – Equivalency Testing

□ Option 1

- 22253000|Pain (finding)|:
363698007|Finding site (attribute)|=
(61685007|Lower limb structure (body structure)|:
272741003|Laterality (attribute)|=
7771000|Left (qualifier value)|)

□ Option 2

- 22253000|Pain (finding)|:
363698007|Finding site (attribute)|=
32153003|Left lower extremity structure
(body structure)|

□ Option 3

- 287047008|Pain in left leg (finding)|

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Patient Case Queries – Subsumption Testing

□ Predicate

- 27624003|Chronic disease (disorder)|

□ Candidates

- 197927001|Recurrent urinary tract infection (disorder)|
- 424413001|Sarcoma (disorder)|:
263502005|Clinical course (attribute)|=
255227004|Recurrent (qualifier value)|
- 425748003|Acute exacerbation of chronic bronchitis
(disorder)|
- 28119000|Renal hypertension (disorder)|:
263502005|Clinical course (attribute)|=
255212004|Acute-on-chronic (qualifier value)|
- 426749004|Chronic atrial fibrillation (disorder)|
- 64766004|Ulcerative colitis (disorder)|

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Patient Case Queries – Select Predicate Expression

Enhanced Palliative Care Information System Patient Case Query

EAV Query Template

Query

Template: EPCIS Patient Case Query

Database: Enhanced Palliative Care Information System

Query Type: Data Aggregation

Consult Letter **Sort**

Most Responsible Diagnosis

Most Responsible Diagnosis [+|-]

- Mental disorder
- Metabolic disease
- Neoplasm and/or hamartoma**

Metastasis

Metastasis [+|-]

- Acute disease
- Chronic disease
- Congenital disease

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Patient Case Queries – Summary of Results

Summary **Search Results** SNOMED CT EAV

Your query produced 127 results in 2.498 seconds.

MRD

No	SNOMED CT	Subsumption	Patients
1.	399981008 Neoplasm and/or hamartoma (disorder)	61	127

[Return to Top](#)

All Parameters

No	SNOMED CT	Subsumption	Patients
1.	Total Results	N/A	127

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Patient Case Queries – Patient Search Results

Summary		Search Results	SNOMED CT	EAV
Patient Records				
Note: Only the first 100 patient records are shown.				
No	Patient Id	MRD	View	
1.	88887	363349007 Malignant tumor of stomach (disorder)		
2.	89005	93143009 Leukemia, disease (disorder)		
3.	89292	363358000 Malignant tumor of lung (disorder)		
4.	89467	363358000 Malignant tumor of lung (disorder)		
5.	89682	64572001 Disease (disorder) : 116676008 Associated morphology (attribute) = 399961007 Malignant adenomatous neoplasm - category (morphologic abnormality) , 363698007 Finding site (attribute) = 14742008 Large intestinal structure (body structure)		
6.	90672	269533000 Carcinoma of colon (disorder)		
7.	90697	109989006 Multiple myeloma (disorder)		
8.	90739	254637007 Non-small cell lung cancer (disorder)		

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Patient Case Queries – SNOMED CT Expressions

Summary		Search Results	SNOMED CT	EAV
MRD				
No	SNOMED CT			
1.	399981008 Neoplasm and/or hamartoma (disorder)			
1.1.	118601006 Non-Hodgkin's lymphoma (disorder)			
1.2.	109841003 Liver cell carcinoma (disorder)			
1.3.	109989006 Multiple myeloma (disorder)			
1.4.	126885006 Neoplasm of bladder (disorder)			
1.5.	188725004 Lymphoid leukemia (disorder)			
1.6.	254582000 Adenocarcinoma of rectum (disorder)			
1.7.	254622008 Squamous cell carcinoma of bronchus (disorder)			
1.8.	254632001 Small cell carcinoma of lung (disorder)			
1.9.	254637007 Non-small cell lung cancer (disorder)			
1.10.	254829001 Liposarcoma (disorder)			
1.11.	254837009 Malignant tumor of breast (disorder)			
1.12.	254938000 Astrocytoma of brain (disorder)			
1.13.	255052006 Malignant tumor of unknown origin (disorder)			
1.14.	255056009 Malignant tumor of head and/or neck (disorder)			
1.15.	255108000 Carcinoma of bladder (disorder)			

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Journal Watch

The screenshot shows the Palliative.org website. The main heading is 'Resources'. Underneath, there is a section titled 'Resources: Journals' which lists various journals such as 'Journal of Pain and Symptom Management', 'Pain', 'ContantsDirect General Information', 'EJPC online', 'Journal of the National Cancer Institute', 'WHO's Cancer Pain', 'European Journal of Cancer', 'Cancer Control Journal: Table of Contents', 'Cancer Online', 'LMI - Progress in Palliative Care', 'Cancer Pain Release', 'The Lancet', 'BMJ', 'Journal of Palliative Care', 'New England Journal of Medicine Online', and 'JAMA Table of Contents - June 25, 1997 © AMA 1997'. There is also a section for 'Electronic Journals' with a link to 'MedWeb'. A navigation menu at the top includes 'Palliative Care Program', 'Clinical Information', 'Educational Opportunities', 'Research', and 'General Public'.

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Journal Watch, 2

www.palliative.org

- Encoded 130 journal topics and keywords with SNOMED CT
- Linked 250 journals articles
- Linked 37k+ anonymised patient cases

The screenshot shows the 'Journal Watch' application interface. On the left, there is a tree view of 'Journal Watch Topics' with various categories like 'Anorexia / Cachexia (8 publications / 411 cases)', 'Ascites (0 publications / 0 cases)', 'Bowel Obstruction (1 publication / 463 cases)', 'Cancer Pain (6 publications / 0 cases)', 'Assessment of Pain (0 publications / 0 cases)', 'General (17 publications / 13,398 cases)', 'Management: Specific Procedures (0 publications / 0 cases)', 'Specific Types of Pain (0 publications / 0 cases)', 'Communication (0 publications / 5 cases)', 'Complementary / Alternative Therapies (4 publications / 0 cases)', 'Constipation (7 publications / 1,196 cases)', 'Cultural Issues (0 publications / 0 cases)', 'Delirium (11 publications / 2,444 cases)', 'Depression (10 publications / 394 cases)', 'Dyspnea (7 publications / 2,601 cases)', 'Economics (4 publications / 0 cases)', 'Edema / Lymphedema (1 publication / 125 cases)', 'Education and Training (0 publications / 0 cases)', 'Echols (4 publications / 0 cases)', 'Euthanasia / Assisted Suicide (4 publications / 0 cases)', 'Fatigue (3 publications / 1,903 cases)', and 'Gastrointestinal Problems (0 publications / 16 cases)'. On the right, the 'Journal Watch Details' panel shows 'General' information, 'SNOMED CT' codes (e.g., 22253000: Pain (finding)), 'Key Words / Synonyms' (e.g., Dolor, Pain, Pain (finding), Pain observations, Pain, NOS, Painful, Part four to), 'Cases' (e.g., Diagnosis (85), Problems at Referral (13,333)), and 'Journals'. Below this, a table lists journal articles:

No.	Journal	Year
1.	High prevalence of pain in patients with cancer in a large population based study in The Netherlands	2008
2.	What Patients with Cancer Want to Know About Pain: A Qualitative Study	2008
3.	Pain Management in Hospitalized Cancer Patients: A	2007

At the bottom, there is a 'Cases' section with a note 'Only the first 100 cases will be displayed.' and a table showing diagnosis and problem at referral:

No.	Diagnosis	Problem at Referral
1.	2504002: Headache (finding)	26726007: Dyspnea (finding)
	43895002: Malignant neoplasm of gastrointestinal tract (disorder)	
	22253000: Pain (finding)	

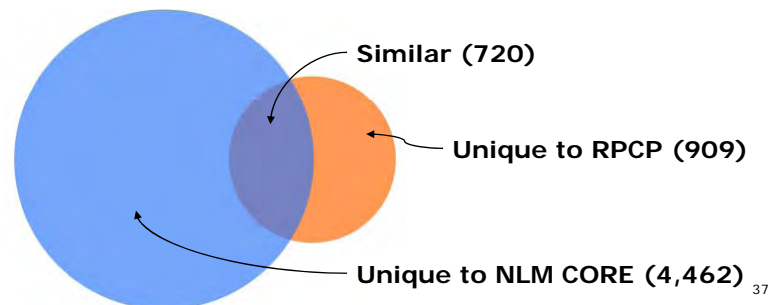
NLM Clinical Observations Recording and Encoding Problem List Subset

□ RPCP Database

- 1,629 concepts from 1,939 unique expressions

□ NLM CORE Problem List Subset

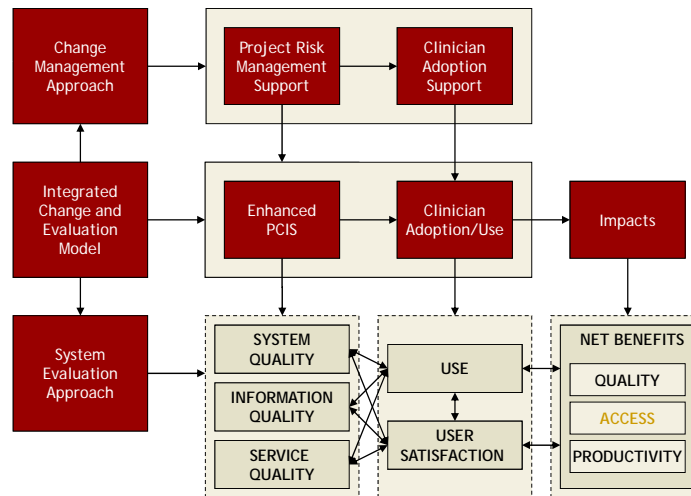
- 5,191 concepts



Part 5

Trial Use & Evaluation

Integrated Change and Evaluation Model



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Integrated Change and Evaluation Plans

□ Clinician Support

Clinician Support	Direct Activities to Support Clinician Adoption
Awareness	Project team met with clinicians to discuss objectives and potential value of pilot project
Desire	Clinicians expressed interest to participate in pilot as part of their research work/role
Knowledge	Project team to provide training/support to assist clinicians learn and adopt the system
Adoption	Clinicians start to use the system during the 3-month trial use phase
Reward	Project team work with clinicians to assess the impact/value of the system, and share experiences

□ Project Support

Project Support	Enabling Activities to Ensure Project Success by Mitigating Risks
Technological	Enhancement to an existing PCIS already used by palliative care clinicians and program staff
Human/User	Clerical staff to augment data entry/retrieval and project meetings to discuss expectations
Usability	Developer already supports existing PCIS, with feedback sought from clinician users/champions
Project Team	Project team has palliative care knowledge and working experience in SNOMED CT
Project	Has defined project plan, funding, experience with complex projects, and clinician champions
Organizational	Has strong executive support and dedicated project staff, but uncertain healthcare environment
Strategic/Political	Funding and project partners show leadership and commitment, and consider year-2 follow-up

Integrated Change and Evaluation Plans

Dimensions	Metrics	Data Collection and Analysis Methods
Information Quality	% Domain coverage	Percent of encoded terms in palliative care term set thru <i>inspection</i>
	% Full/part/no-matches	Percent of fully/partial/non-matched terms in term set thru <i>inspection</i>
	% Post-coordination	Percent/type of post-coordination in term set thru <i>inspection</i>
	% Extensions, local terms	Percent/type of extensions and local terms in term set thru <i>inspection</i>
	Advanced SCT features	Extent of SCT subsumption/equivalence/navigation thru <i>inspection</i>
System Quality	Links to patient records	Percent of data fields linked to SCT in patient records thru <i>inspection</i>
	SCT encoded design	Extent of SCT encoding feasible in the EPCIS thru <i>inspection</i>
	% Enhanced features	% of new features present in the EPCIS thru <i>inspection</i>
Service Quality	Performance speed	Performance in response time of EPCIS thru <i>inspection</i>
	% PCIS maintenance	Percent/type of EPCIS maintenance required thru <i>support log</i>
Use/Satisfaction	% SCT maintenance	Percent/type of SCT maintenance required thru <i>support log</i>
	Usefulness, ease-of-use	Usefulness and ease-of-use of EPCIS thru <i>interview</i>
	User satisfaction	User satisfaction toward EPCIS thru <i>interview</i>
Quality of Care	% actual system use	Frequency/type of actual system use thru <i>system log</i>
	Safety-high risk patients?	Extent of high risk patients identified thru <i>system log</i> and <i>interview</i>
	Documentation quality?	% documentation completeness in patient records thru <i>inspection</i>
Productivity	% QA follow-up?	% quality assurance follow-up thru <i>system log</i> and <i>interview</i>
	Workflow change?	Extent of workflow change with EPCIS thru <i>interview</i>
	Refer/consult cases?	% referral/consult cases with EPCIS thru <i>inspection</i> and <i>system log</i>
	Patient case retrieval?	Extent of case retrieval with EPCIS thru <i>interview</i> and <i>system log</i>

Trial Use

- ❑ 10 week trial
- ❑ Users
 - Six clinicians
 - Two support staff
- ❑ Consult Letters
 - 164 EPCIS
 - 20 Manual
- ❑ Usage
 - Duration: Average of 9.4 days during trial use
 - Screens: 277 per user

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Preferred Terms vs Synonyms

No	Section	Preferred	Synonym	Total
1.	Most Responsible Diagnosis (MRD)	60 (44.4%)	75 (55.6%)	135
2.	Metastasis (METS)	7 (5.7%)	116 (94.3%)	123
3.	Past Medical History (PMH)	308 (49.0%)	321 (51.0%)	629
	Totals	375 (42.3%)	512 (57.7%)	887

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EPCIS Consult Letters

No	Section	Pre	Post	Local	Total
1.	MRD	129	6	42	177
2.	METS	117	6	28	151
3.	PMH	606	23	224	853
	Totals	852	35	294	1,181

- ❑ 887 encoded by clinicians
 - 320 unique expressions
- ❑ 336 local terms
 - 294 manually encoded with 234 unique expressions
 - 167 not in palliative care subset, mainly PHM

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Use/Satisfaction

□ Usefulness

- Clinicians – “the way to go”
- Sharable, legible consult letters

□ Ease-of-use

- Some difficulties with software features
- Issues with real-time access

□ Satisfaction

- Participants had mixed feelings
- Multiple barriers (access, errors, training)

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Quality of Documentation

No	Description	EPCIS	Manual
1.	Consult Letters	164	20
2.	Total Expressions	1,181	149
3.	Average Total	7.20	7.45
4.	Unique Expressions	554	119
5.	Average Unique	3.38	5.95
6.	Not in Palliative Care Subset	167 (71.4%)	52 (43.7%)
7.	In Palliative Care Subset	67 (28.6%)	67 (56.3%)

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Part 6

SNOMED CT

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SNOMED CT

- ❑ Encoding Issues and Challenges
- ❑ Expressions Transformation
- ❑ SNOMED CT Versioning

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1. Inability to Create Expressions with Required Level of Granularity

□ Care Planning/Provision

■ Example 1: Inability for patient to cope at home

□ 47695004|Inability to cope (finding)|

□ 264362003|Home (environment)|

■ Example 2: Husband unable to cope

□ 302203004|Wife unable to cope (finding)|

□ Medication Use

■ Example 1: Change of medication route

□ 182838006|Change of medication (procedure)|

■ Example 2: Complications with medication

□ 35688006|Complication of medical care (disorder)|

□ 77519009|Complication of preventive medicine procedure (disorder)|

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2. Inferring Clinical Context & Unambiguous Encoding

□ Data Element

■ Cancer Patient

□ Coded Value

■ Boolean: True or False

□ 31874001|True (qualifier value)|

□ 64100000|False (qualifier value)|

■ Code: Yes or No

□ 373066001|Yes (qualifier value)|

□ 373067005|No (qualifier value)|

□ Unambiguous Encoding

■ 363346000|Malignant neoplastic disease (disorder)|

■ 395100000|No evidence of cancer found (situation)|

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3. Challenges of Local Terms

□ Issues

- Ambiguity of terms
- Lack of accuracy
- Lack of specificity
- Lack of clarity of meaning

□ Example

- Local Term
 - Non-melanoma of skin
- Encoding
 - 399899001|Acquired melanocytic nevus (disorder)|
 - 398744007|Lentigo (disorder)|

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4. Selecting Terms from the Appropriate Hierarchy

□ Acute leukemia

No	Description	Fully Specified Name	Hierarchy
1.	91855006 Acute leukemia	91855006 Acute leukemia, disease (disorder)	404684003 Clinical finding (finding)
2.	24072005 Acute leukemia	24072005 Acute leukemia, morphology, including blast cell OR undifferentiated leukemia (morphologic abnormality)	123037004 Body structure (body structure)

□ Morphine

No	Description	Fully Specified Name	Hierarchy
1.	122160018 Morphine	73572009 Morphine (product)	373873005 Pharmaceutical / biologic product (product)
2.	1211997019 Morphine	373529000 Morphine (substance)	105590001 Substance (substance)

5. Attributes & Qualifiers

- Concept Model Attributes
 - 61 concept model attributes
 - 21 used to link to qualifier values
- Qualifier Values
 - ~9k qualifier values
 - ~1.9k sanctioned

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6. Staging & Grades (1)

- Pre-coordinated

Term	SNOMED CT Concept
Adenocarcinoma lung, stage IV	424993006 Adenocarcinoma of lung, stage IV (finding)
End stage renal disease	46177005 End stage renal disease (disorder)
Stage II Non-small cell lung carcinoma	425048006 Non-small cell carcinoma of lung, TNM stage 2 (disorder)

- Unsanctioned Qualifier Values

Qualifier	SNOMED CT Concept	Example
End stage	42796001 End-stage (qualifier value)	<i>End stage</i> peripheral vascular disease
Stage 3	258224005 Stage 3 (qualifier value)	<i>Stage 3</i> melanoma of right eye
Stage 3a	261638004 Stage 3A (qualifier value)	Non Hodgkin's lymphoma <i>stage 3a</i>
Low grade	349915008 Low grade (qualifier value)	<i>Low grade</i> non Hodgkin's lymphoma
High grade	24484000 Severe (severity modifier) (qualifier value)	<i>High grade</i> sarcoma

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6. Staging & Grades (2)

□ Terminal Alzheimer

- 10532003|Primary degenerative dementia of the Alzheimer type, **presenile onset**, with **depression** (disorder)|
- 26852004|Primary degenerative dementia of the Alzheimer type, **senile onset**, with **depression** (disorder)|
- 65096006|Primary degenerative dementia of the Alzheimer type, **presenile onset**, with **delirium** (disorder)|
- 55009008|Primary degenerative dementia of the Alzheimer type, **senile onset**, with **delusions** (disorder)|
- 230280008|Progressive aphasia in Alzheimer's disease (disorder)|

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Expression Transformation

□ Ambiguity in transformation guide

- Merging of role groups
- Merging of group with ungroup
- Sorting of role groups
- Use of { } for role group 0
 - Expressions
 - 211334007|Abrasion, ankle (disorder)|
 - 399963005|Abrasion (disorder)|:
363698007|Finding site (attribute)|=
67269001|Skin structure of ankle (body structure)|
 - Normal Forms
 - 64572001: { 116676008=400061001,363698007=67269001 }
 - 64572001: 116676008=400061001,363698007=67269001

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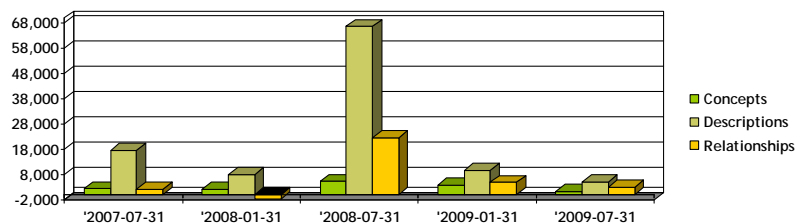
SNOMED CT Versioning

1. Fully-specified name and preferred term
2. Concept status
3. Primitive/fully-defined status, defining attributes and normal forms
4. Changes in position in hierarchy
5. Changes to Concept Model

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SNOMED CT Releases: Core Tables Changes

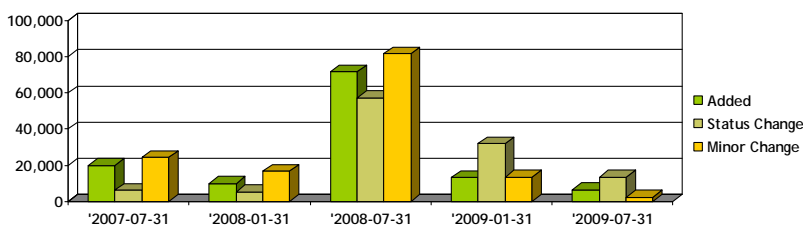
Core Tables / Release	July 31, 2007	Jan 31, 2008	July 31, 2008	Jan 31, 2009	July 31, 2009
Concepts	2,315	2,065	5,119	3,735	1,324
Descriptions	17,553	7,854	66,495	9,550	5,083
Relationships	2,005	-1,716	22,508	4,726	2,977
Total	21,873	8,203	94,122	18,011	9,384



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SNOMED CT Releases: Change Types

Change Type / Release	July 31, 2007	Jan 31, 2008	July 31, 2008	Jan 31, 2009	July 31, 2009
Added	19,868	9,919	71,614	13,285	6,407
Status Change	6,157	5,398	57,429	32,031	13,679
Minor Change	24,306	16,660	81,457	13,679	2,489
Total	50,331	31,977	210,500	57,686	22,584



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Change in Concept Status

No	Concept	July 2008	January 2009	July 2009	Replaced By
1.	75189007 Borderline (qualifier value)	C	C	A	<ul style="list-style-type: none"> ❑ 442779003 Borderline low (qualifier value) ❑ 442777001 Borderline high (qualifier value)
2.	274738006 Chest lump (disorder)	C	A	A	<ul style="list-style-type: none"> ❑ 440299000 Mass of thoracic structure (finding) ❑ 441124000 Mass of chest wall (finding)
3.	328383001 Chronic liver disease (disorder)	L	L	C	
4.	131170007 Decreased hemoglobin (finding)	C	C	D	<ul style="list-style-type: none"> ❑ 165397008 Hemoglobin low (finding)
5.	41006004 Depression (finding)	C	C	A	<ul style="list-style-type: none"> ❑ 35489007 Depressive disorder (disorder) ❑ 366979004 Depressed mood (finding)
6.	429424001 History of depressive disorder (situation)	C	C	D	<ul style="list-style-type: none"> ❑ 161469008 History of - depression (situation)

Change in Concept Status, Example #1: Borderline Delirium

□ July 31, 2008

- 2776000|Delirium (disorder)|:
363713009|Has interpretation (attribute)|=
75189007|Borderline (qualifier value)|

□ July 31, 2009 – Option A

- 2776000|Delirium (disorder)|:
363713009|Has interpretation (attribute)|=
442779003|Borderline low (qualifier value)|

□ July 31, 2009 – Option B

- 2776000|Delirium (disorder)|:
363713009|Has interpretation (attribute)|=
442777001|Borderline high (qualifier value)|

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Change in Concept Status, Example #2: Chest lump, left

□ July 31, 2008

- 274738006|Chest lump (disorder)|:
363698007|Finding site (attribute)|=(
51185008|Thoracic structure (body structure)|:
272741003|Laterality (attribute)|=
7771000|Left (qualifier value)|
)

□ July 31, 2009 – Option A

- 440299000|Mass of thoracic structure (finding)|:
363698007|Finding site (attribute)|=(
51185008|Thoracic structure (body structure)|:
272741003|Laterality (attribute)|=
7771000|Left (qualifier value)|
)

□ July 31, 2009 – Option B

- 441124000|Mass of chest wall (finding)|:
363698007|Finding site (attribute)|=(
78904004|Chest wall structure (body structure)|:
272741003|Laterality (attribute)|=
7771000|Left (qualifier value)|
)

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Implications of Changes in Hierarchy

No	Disease SubType Concept	Jan 09	Jul 09	+/-
1.	2704003 Acute disease (disorder)	95	73	-22
2.	116223007 Complication (disorder)	62	101	+39
3.	66091009 Congenital disease (disorder)	127	133	+6
4.	74627003 Diabetic complication (disorder)	41	0	-41
5.	414029004 Disorder of immune function (disorder)	50	56	+6
6.	87858002 Drug-related disorder (disorder)	71	5	-66
7.	8504008 Environment related disease (disorder)	5	71	+66
8.	385494008 Hematoma (disorder)	9	20	+11
9.	32895009 Hereditary disease (disorder)	31	9	-22
10.	37064009 Hyperproteinemia (disorder)	1	31	+30

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Changes to Concept Model

No	Type of Change	Jan 2009	Jul 2009
1.	Changes to the range for HAS INTERPRETATION Section 4.2	<input type="checkbox"/> 260245000 Findings values (qualifier value) <input type="checkbox"/> 281296001 Result comments (qualifier value)	<input type="checkbox"/> 260245000 Findings values (qualifier value)
2.	Changes to the range for PATHOLOGICAL PROCESS Section 4.2	<input type="checkbox"/> 263680009 Autoimmune (qualifier value)	<input type="checkbox"/> 263680009 Autoimmune (qualifier value) <input type="checkbox"/> 441862004 Infectious process (qualifier value)
3.	Changes to the domain for the six attributes previously identified for use with MEASUREMENT PROCEDURES Section 4.4	<input type="checkbox"/> 122869004 Measurement procedure (procedure)	<input type="checkbox"/> 386053000 Evaluation procedure (procedure)

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Part 7

Lessons Learned

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Lessons Learned

1. Feasible but demonstrate value
2. Review and standardise clinical terms
3. Review, streamline and improve workflow
4. Adaptable software application
5. Policies/procedures for maintenance
6. Can lead to policy and practice changes

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Thank You

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