"Maintaining Mapping SNOMED CT for the Canadian Emergency Department Diagnosis Shortlist and comparison of maps from other source"

SNOMED CT Expo 2016
Ginette Therriault CHIM, CIHI
• **Purpose**
  – To inform on the mapping from a classification to a terminology

• **Audience**
  – Anyone interested in learning about mapping and maintenance of maps
Presentation Outline

1. CED-DxS presentation
2. Mapping to a terminology
3. Updating the maps
4. Tooling and Validation
5. Comparing the results
6. Conclusion
CIHI Snapshot

• Independent, not-for-profit corporation

• 30 health databases and registries
  – Types of care: acute and ambulatory, rehab, mental health, long-term care and home care
  – Health spending
  – Health workforce
  – Patient experience

• 5 offices
CIHI’s Strategic Plan 2016 to 2021

Vision

Mandate
Deliver comparable and actionable information to accelerate improvements in health care, health system performance and population health across the continuum of care

Strategic goals
- Be a trusted source of standards and quality data
- Expand analytical tools to support measurement of health systems
- Produce actionable analysis and accelerate its adoption

Priority themes and populations
- Themes
  - Patient experience
  - Quality and safety
  - Outcomes
  - Value for money
- Health system performance
- Populations
  - Seniors and aging
  - Mental health and addictions
  - First Nations, Inuit and Métis
  - Children and youth

Foundation
- Our people
- Stakeholder engagement and partnerships
- Privacy and security
- Information technology

Values
- Respect
- Integrity
- Collaboration
- Excellence
- Innovation
What does CIHI do?

• We collect, analyze and publish data in a standardized way

• Giving all jurisdictions the ability to:
  – Understand
  – Compare
  – Learn from best practices

• To make the decisions that lead to healthier Canadians
Canadian Emergency Department Diagnosis Shortlist (CED-DxS)

- Project for an Emergency Department Discharge Diagnosis project undertaken in 2008

- Partnership with the Canadian Institute for Health Information (CIHI) and the Canadian Association of Emergency Physicians (CAEP) and its working group, the Canadian Emergency Department Information Systems (CEDIS)

- Develop a list of the most common and important discharge diagnoses in emergency departments for clinical and administrative use in emergency rooms in Canada

- This involved clinical input and feedback from over 80 physicians and Medical Directors from across Canada.
<table>
<thead>
<tr>
<th>Infectious and parasitic diseases</th>
<th>Inhaling</th>
<th>Neurotic disorder</th>
<th>OM - Ulcers media</th>
<th>Diseases of the respiratory system</th>
</tr>
</thead>
<tbody>
<tr>
<td>A047</td>
<td>Costudium difficile</td>
<td>D489</td>
<td>Tumor of unknown behaviour</td>
<td>F509</td>
</tr>
<tr>
<td>A051</td>
<td>Botulism</td>
<td>F609</td>
<td>Personality disorder</td>
<td>H729</td>
</tr>
<tr>
<td>A039</td>
<td>Bacterial foodborne intox</td>
<td>D570</td>
<td>Sick-cell anemia crisis</td>
<td>F39</td>
</tr>
<tr>
<td>A099</td>
<td>GE - Gastroenteritis / Diarrhea</td>
<td>D649</td>
<td>Anemia</td>
<td>H811</td>
</tr>
<tr>
<td>A1991</td>
<td>TB - Tuberculosis</td>
<td>D65</td>
<td>DIC - Disseminated intravascular coagulation</td>
<td>G009</td>
</tr>
<tr>
<td>A35</td>
<td>Tularemia</td>
<td>D689</td>
<td>Coagulation defect</td>
<td>G039</td>
</tr>
<tr>
<td>A391</td>
<td>Pertussis / Whooping cough</td>
<td>D6898</td>
<td>PTP - Idiopathic thrombocytopenic purpura</td>
<td>G049</td>
</tr>
<tr>
<td>A36</td>
<td>Scarlet fever</td>
<td>D696</td>
<td>Thrombocytopenia</td>
<td>G080</td>
</tr>
<tr>
<td>A390</td>
<td>Meningitis, meningococcal</td>
<td>D700</td>
<td>Neutropenia</td>
<td>G081</td>
</tr>
<tr>
<td>A392</td>
<td>Meningococcal, acute</td>
<td>D709</td>
<td>Disease of the brain</td>
<td>G082</td>
</tr>
<tr>
<td>A419</td>
<td>Septicemia</td>
<td>D899</td>
<td>Immune mechanism disorder</td>
<td>G20</td>
</tr>
<tr>
<td>A45</td>
<td>Encephalitis</td>
<td>E100</td>
<td>Epilepsy</td>
<td>G21</td>
</tr>
<tr>
<td>A440</td>
<td>Gas gangrene</td>
<td>E109</td>
<td>Hypothyroidism</td>
<td>G248</td>
</tr>
<tr>
<td>A441</td>
<td>Legionnaire's disease</td>
<td>E159</td>
<td>Hypothyroidism</td>
<td>G349</td>
</tr>
<tr>
<td>A442</td>
<td>TSS - Toxic shock syndrome</td>
<td>E689</td>
<td>Thyroidis</td>
<td>G35</td>
</tr>
<tr>
<td>A449</td>
<td>Sarcopenia</td>
<td>E710</td>
<td>GM type 1 com</td>
<td>G779</td>
</tr>
<tr>
<td>A549</td>
<td>Gonorrhoea</td>
<td>E1010</td>
<td>GM type 1 DNA</td>
<td>G4090</td>
</tr>
<tr>
<td>A630</td>
<td>Genital warts</td>
<td>E1063</td>
<td>GM type 1 hypoglycemia</td>
<td>G419</td>
</tr>
<tr>
<td>A64</td>
<td>Sexually transmitted infection</td>
<td>E109</td>
<td>GM type 1</td>
<td>G438</td>
</tr>
<tr>
<td>A682</td>
<td>Lyme disease</td>
<td>E110</td>
<td>GM type 2 com</td>
<td>G448</td>
</tr>
<tr>
<td>A685</td>
<td>Encephalitis, viral</td>
<td>E1163</td>
<td>GM type 2 hypoglycemia</td>
<td>G454</td>
</tr>
<tr>
<td>A691</td>
<td>Meningitis, viral</td>
<td>E119</td>
<td>GM type 2</td>
<td>G459</td>
</tr>
<tr>
<td>B009</td>
<td>Herpes</td>
<td>E149</td>
<td>GM unspec</td>
<td>G500</td>
</tr>
<tr>
<td>B019</td>
<td>Chickenpox / Varicella</td>
<td>E162</td>
<td>Hypoglycemia (non-DM)</td>
<td>G510</td>
</tr>
<tr>
<td>B029</td>
<td>Shingles / Zoster</td>
<td>E215</td>
<td>Parathyroid gland disorder</td>
<td>G529</td>
</tr>
</tbody>
</table>

**Diseases of the nervous system**

- CED-DxS

**Diseases of the circulatory system**

- CED-DxS
Canadian Emergency Department Diagnosis Shortlist (CED-DxS) – Map to Terminology

- Mapped manually to SNOMED CT® in 2009 using July 2009 version using CliniClue® browser
- Specific use case
- One to one map (not always possible)
- Difficulties encountered
  - Modelling issues in SNOMED CT
  - CED DxS terms unclear
CED-Dxs – Parameters

In order to ensure consistency, reproducibility and validation, the following parameters must be determined prior to locating SNOMED CT concepts:

• The use case of the source/target list

• The match type between the source and target terminologies (semantic vs. lexical)

• Acceptable SNOMED CT hierarchies to match the source terminology (i.e. Clinical findings, Event, Situations with explicit context, Organism, etc.)

• The version or edition of the SNOMED CT, CliniClue ® browser and source term reference (e.g. ICD-10) to be used
CED-DxS – Pre Mapping Assumptions

- SNOMED CT concepts will be chosen in the context of diagnostic statements used in a clinical record.  
  *Example*: Amputation leg means traumatic amputation of leg rather than amputation of leg as a procedure

- All SNOMED CT concepts from the determined hierarchies can be chosen with the exception of concepts with limited or inactive status

- SNOMED CT concepts will be chosen as semantic matches where the concept selected most closely reflects the intended meaning of the source term

- The Preferred Term or Preferred Term and Synonym of the concept will be chosen to match the meaning of the source term(s)

- When the source terminology is or linked to an ICD-10/ICD-10-CA code, ICD-10 conventions and guidance will be applied wherever applicable
Mapping to SNOMED CT® Approach

- Perform search in the CliniClue® browser for each common term.
- Use synonymous terms when the common term could not be located in CliniClue®
- Evaluate target concepts based on hierarchy, meaning and defining relationships to determine a semantic match for the common term.
- Select the preferred term of the target concept in most matches.
- Select a synonym of the target concept if it is closer in wording to the common term.
## Analysis of first mapping exercise

<table>
<thead>
<tr>
<th>Findings</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match to preferred term (1:1)</td>
<td>591</td>
<td>71%</td>
</tr>
<tr>
<td>Match to synonym of the preferred term</td>
<td>155</td>
<td>19%</td>
</tr>
<tr>
<td>Multiple matches for a common term</td>
<td>68</td>
<td>8%</td>
</tr>
<tr>
<td>No match</td>
<td>6</td>
<td>7%</td>
</tr>
</tbody>
</table>
Major SNOMED CT findings

• **Modeling inconsistencies**
  – With/without complication
  – Open/close, traumatic
  – Different structure from one concept to another
  – Incomplete modelling

• **Lack of concept representing open wound or no wound forcing the use the same SNOMED CT concept for two different clinical meanings**
Maintenance of maps

- Required updating as part of the maintenance in versioning cycle of the CED-DxS.

- Updated for CED-DxS v2015 Common Terms manually mapped using Cliniclue Xplore® browser
Mapping support tools

• Tools available to map ICD-10-CA to SNOMED CT®
  – Clinicue Xplore®
    – Requires individual search of each common term and manual copy of the results
    – Difficult to triage changes with new versions of SNOMED CT®
      – IHTSDO
        – Requires individual search of each common term and manual copy of the results
        – Not all versions are displayed

And

– Apelon
  – TermWorks Excel Add-Inn that has an Auto completion Mapping Feature
Maintaining SNOMED CT® Maps - Method

• Search in the Clinicue Xplore® browser for each common term and IHTSDO browser for difficult terms to match.

• Evaluate target concepts based on hierarchy, meaning and defining relationships to determine a semantic match for the common term.

• Select the preferred term of the target concept in most matches.

• Chose a synonym of the target concept if it was closer in wording to the common term
Validation and Quality Assurance

- Apelon TermWorks Version 6.0 was used with two objectives
  - Validation of the manual maps
  - Evaluation of the relevance of the output of the tool

  Also
  - Evaluate the quality of the maps by comparison to outsourced maps
Autocompletion Mapping Results

**Review of Total Non-Match Records**

- **74%** (262 of 353) – Correct concept found when search results provided by autocompletion reviewed
- **26%** (91 of 353) - No correct concept found in search results provided by autocompletion

**Chart Descriptions**

- **39%** (353/911) - Did not match cliniclue mapping
- **61%** (558/911) - Match Cliniclue mapping
- **36%** (126/353) - Match found hierarchy Level 6-10
- **7%** (25/353) - Match found in hierarchy Level 11 and over
- **1%** (6/353) - Match found hierachy Level 5 and under
- **30%** (105/353) - Autocompletion correct/Error with Cliniclue mapping

- No match could be found in any of choices search results displayed
Issues with Autocompletion Mapping

**Search issues:**
- Abbreviations not always recognized
- Inconsistency between which abbreviation was recognized
- Selected an ID that was more specific than the Common Term searched
- Sort alphabetically function is useful (but page forward buttons inconsistent, sometimes skips pages when move forward by one page)
- Doesn't always recognize a 'negative term' in the Common Term
- Doesn't appear to look within the description for a synonym that might be an exact match in order to get the right ID for auto-completion
- Can only see the 'synonyms' when you click on 'details' for a specific Concept ID
- No consistency (or couldn't figure out any logic) behind when autocompletion would select an 'organisms' concept over a 'disorder' concept

![Autocompletion Mapping Pie Chart]

- **63%** (575/911) No issue - correct autocompletion mapping - exact match with Cliniclue
- **61%** (558/911) No issue - correct autocompletion mapping - Cliniclue mapping error
- **37%** (336/911) Search issue
- **2%** (17/911) Cliniclue error
TermWorks Add-In

**Pros**

- Add on tool for Excel spreadsheets
- Columns for mapped results can be automatically incorporated into existing spreadsheet.
- Semi-automated -can search one, many or all terms at once.
- Auto completion – faster than searching each common term
- Customizable search features
- Status change allows means of validating (no not) the concept choice selected by auto-completion.
- No need to copy/type each term into a browser
- Match/No Match feature to validate the autocompletion selection
- Feature of sorting alphabetically is a good idea – although limited in its functionality
- Details provides the ‘synonyms’ to assist with validating the Concept ID chosen.
- Additional concepts can be added to the spreadsheet from the search results box.
- Inactive concepts are not included, eliminating the chance of being used in maps
- Browser experience not required
- Can be used in tandem with a browser to have benefits of each tool

**Cons**

- Cost
- Add-In doesn’t work from a group directory
- Can only select the preferred term of the concept (no synonyms)
- SNOMED CT ® is the only built in data source at this point
- Search Results is ‘small font’ and difficult to view
- Sort Alphabetically only sorts per page that is visible – so still have to go through each page to find the term you are looking for
- Termworks had a newer SNOMED CT® version versus Cliniclue ®. Want to be able to have a version selection in both
- Auto-completion
  - Not clear on the ‘hierarchy’
  - Even though can expand the search filter to search only on e.g. ‘disorder’ over other concepts, doesn’t always resolve the issue
  - Fewer matches when performing autocompletion by using the expanded search
  - Does not always recognize abbreviations
  - Can’t see the parents unless you open the ‘detail’ for each concept

**Notes**

- Semi-automated - can search one, many or all terms at once.
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Conclusion

• This exercise was beneficial in developing parameters for locating SNOMED CT® concepts for diagnosis terms on pick-lists.

• Knowledge and expertise related to SNOMED CT® and mapping activities was enhanced, particularly regarding concept selection, validation and versioning activities.

• Work to be continued.
Questions?