Towards Demonstrating the Clinical Value of SNOMED CT in Primary Care

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IHTSDO Implementation Showcase
Thursday, October 10, 2013
Outline

1. Research Question
   - How can we demonstrate the clinical value of SNOMED CT?

2. SNOMED CT Clinical Value Framework

3. Materials

4. Methods, Results
   - Completeness of Problem List
   - Adherence of Care Guidelines
   - Completeness of Clinical Summaries

5. Summary of Clinical Value of SNOMED CT
Canadian & Dutch Initiatives

- Canadian Institute for Health Information
  - EMR Content Standards
  - Primary Health Care Indicators

- Canada Health Infoway
  - Health System Use Project
  - Primary Health Care Reference Sets
  - Clinical Value Targets

- Dutch Healthcare Inspectorate / Quality Institute
  - Healthcare Quality Indicators

- Netherlands’ Healthcare ICT Institute (Nictiz)
  - Healthcare information standards
  - Generic Dataset for Transitions of Care
Canada Health Infoway Clinical Value Targets

Clinical Value Level 1

- General Data Use
  - Enter encounter notes
  - Enter problem lists

- Data Capture
  - Enter immunisations
  - Enter vital stats
  - Enter new or renewal prescriptions and print the prescription
  - Generate automated alerts from within the EMR
  - Generate automated reminders from within the EMR
  - Receive laboratory results into the EMR
  - Receive diagnostic imaging results into the EMR
  - Access hospital records and encounter summaries from EMR
  - Create referral letters or consultation reports

Clinical Value Level 2

- Data Retrieval
  - Clinician’s use of an EMR
  - Interoperability with drug information systems
  - Clinician’s use of electronic prescribing capability from EMR

- Data Sharing
## SNOMED CT Clinical Value Framework

<table>
<thead>
<tr>
<th>Data Uses / Data Use Targets</th>
<th>Patient</th>
<th>Practice</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Capture</td>
<td>Suggest diagnostic code based on encounter diagnosis</td>
<td>Audit (critique) completeness of problem list and encounter diagnosis</td>
<td>Generate statistics on key clinical quality measures (CQM)</td>
</tr>
<tr>
<td></td>
<td>Suggest encounter diagnosis based on diagnostic code</td>
<td>Audit (critique) accuracy of diagnostic codes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suggest adding encounter diagnosis to problem list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Retrieval</td>
<td>Alert clinicians to drug-allergy interactions</td>
<td>Audit (critique) evidence-based guideline adherence</td>
<td>Compare quality of care between practice and population</td>
</tr>
<tr>
<td></td>
<td>Remind clinicians to order routine tests</td>
<td>Patient recall / patient case queries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suggest medications based on out of range test results</td>
<td>Assess patient conditions</td>
<td></td>
</tr>
<tr>
<td>Data Sharing</td>
<td>Generate patient clinical summary in the form of the Continuity of Care Document (CCD)</td>
<td>Generate practice quality reports in the form of the Quality Reporting Document Architecture (QRDA) Category II and III</td>
<td>Generate practice quality reports in the form of the Quality Reporting Document Architecture (QRDA) Category III</td>
</tr>
</tbody>
</table>
**Materials**

- Anonymised Primary Care Dataset (3,298 active patients)
- SNOMED CT (January 31, 2012)
- Wright & Hahn papers
- Continuity of Care Document (CCD)
Encoding Results

<table>
<thead>
<tr>
<th>Encoding</th>
<th>Problem Lists</th>
<th>Encounter Diagnoses</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Unique</td>
<td>Total</td>
</tr>
<tr>
<td>Number of Records</td>
<td>20,140</td>
<td>2,880</td>
<td>266,029</td>
</tr>
<tr>
<td>Fully encoded record</td>
<td>18,298</td>
<td>2,246</td>
<td>231,963</td>
</tr>
<tr>
<td>Partially encoded record</td>
<td>1,666</td>
<td>582</td>
<td>27,198</td>
</tr>
<tr>
<td>Fully unencoded record</td>
<td>177</td>
<td>43</td>
<td>6,149</td>
</tr>
</tbody>
</table>

- **Problem Lists**
  - COPD
  - 13645005|Chronic obstructive lung disease (disorder)|

- **Encounter Diagnoses**
  - Chronic neck pain
  - 81680005|Neck pain (finding)|: 263502005|Clinical course (attribute)|= 90734009|Chronic (qualifier value)|

- **Medications**
  - Metformin (Glucophage) 500 mg PO BID
  - 109081006|Metformin (product)|
## Methods Used to Demonstrate Clinical Value

<table>
<thead>
<tr>
<th>No</th>
<th>Method</th>
<th>Data Use / Data Use Target</th>
<th>Problem</th>
<th>Encounter</th>
<th>Lab Result</th>
<th>Diag. (ICD-9-CM)</th>
<th>Medication</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Completeness of problem list(^1)</td>
<td>Data Capture Practice</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>Adherence of care guidelines(^2)</td>
<td>Data Retrieval Practice</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>Completeness of clinical summaries</td>
<td>Data Sharing Patient</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Completeness of Problem List

If patient meets one of these three definitions

- Definition 1 – Laboratory Results (at least 1 occurrence)
  - Haemoglobin A1c/ Haemoglobin.total in Blood - (LOINC: 4548-4) ≥7

- Definition 2 – Billing Diagnostic Codes (at least 2 occurrences)
  - Diabetes mellitus - (ICD-9-CM: 250) or one of its subtypes

- Definition 3 – Medications (at least 1 occurrence)
  - ETC: 5886 – Injectable Antidiabetic Agents & 154 – Oral Antidiabetic Agents
  - SNOMED CT: 384953001|Antidiabetic preparation (product)| & 373245004|Antidiabetic agent (substance)|

And do not have any of these problems

- 21584002|Syndrome of infant of diabetic mother (disorder)|
- 9414007|Impaired glucose tolerance (disorder)|
- 73211009|Diabetes mellitus (disorder)|

Then suggest adding these problems:

- Default problem
  - 73211009|Diabetes mellitus (disorder)|

- Additional options as related terms
  - 46635009|Diabetes mellitus type 1 (disorder)|
  - 44054006|Diabetes mellitus type 2 (disorder)|
  - 9414007|Impaired glucose tolerance (disorder)|
  - 68256003|Increased glucose level (finding)|
  - ...

Closer Look at Diabetes Concepts

73211009 | Diabetes mellitus (disorder) |

44054006 | Diabetes mellitus type 2 (disorder) |

46635009 | Diabetes mellitus type 1 (disorder) |

11687002 | Gestational diabetes mellitus (disorder) |
## Completeness of Problem List Results

<table>
<thead>
<tr>
<th>No</th>
<th>Definition</th>
<th>Patients identified in definition</th>
<th>Patients without diabetes in problem list</th>
<th>Percent without diabetes in problem list</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Definition 1 (Laboratory results ≥ 1)</td>
<td>110</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td></td>
<td>Haemoglobin A1c ≥ 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Definition 2 (Billing codes ≥ 2)</td>
<td>168</td>
<td>11</td>
<td>6.5%</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Definition 3 (Medications ≥ 1)</td>
<td>235</td>
<td>32</td>
<td>13.6%</td>
</tr>
<tr>
<td></td>
<td>Antidiabetic medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total number of unique patients</strong></td>
<td><strong>274</strong></td>
<td><strong>42</strong></td>
<td><strong>15.3%</strong></td>
</tr>
</tbody>
</table>

- **42 (15%)** patients have at least one **Haemoglobin A1c ≥ 7**, at least two billing codes of **250**, or at least one antidiabetic medication, do not have diabetes on the problem list.
Adherence of Care Guidelines

- **Diabetes assessment scores** were based on documentation in the medical record of five assessments (20 points each):
  - Haemoglobin A1c level tested in the past six months
  - Urine microalbumin level tested in the past year
  - Low-density lipoprotein cholesterol (LDL-C) level tested in the past year
  - Smoking status
  - Blood pressure

- **Diabetes treatment scores** consisted of documentation in the medical record of 4 measures (25 points each):
  - Haemoglobin A1c level at or below 8% or use of a hypoglycemic agent
  - Urine microalbumin level below 30 mg/g (3.39 mg/mmol) or use of an angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB)
  - LDL-C below 100 mg/dL (2.59 mmol/L) or use of lipid-lowering agent
  - Blood pressure at or below 130/85 mm Hg or use of an antihypertensive agent

Smoking Status

- 365981007 | Finding of tobacco smoking behavior (finding) |
- 160616005 | Trying to give up smoking (finding) |
- 160617001 | Stopped smoking (finding) |
- 65568007 | Cigarette smoker (finding) |
- 8517006 | Ex-smoker (finding) |
- 77176002 | Smoker (finding) |
## Adherence of Care Guidelines Results

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment Scores</strong> (20 points per criteria; Overall average: 43.2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1. Haemoglobin A1c level tested in the past six months                 | 86    | 39.4%
| 2. Urine microalbumin level tested in the past year                     | 73    | 33.5%
| 3. Low-density lipoprotein (LDL-cholesterol) level tested in the past year | 129   | 59.2%
| 4. Smoking Status                                                       | 23    | 10.6%
| 5. Blood pressure                                                       | 160   | 73.4%
| Criteria met: 5 (n=4, 1.8%), 4 (n=45, 20.6%), 3 (n=47, 21.6%), 2 (n=47, 21.6%), 1 (n=36, 16.5%), 0 (n=39, 17.9%) |
| **Treatment Scores** (25 points per criteria; Overall average: 39.8)   |       |      |
| 1. Haemoglobin A1c level at or below 8% or use of a hypoglycemic agent  | 78    | 35.8%
| 2. Urine microalbumin level below 30 mg/g creatine or use of an angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) | 58    | 26.6%
| 3. LDL-cholesterol below 100 mg/dL or use of lipid-lowering agent       | 97    | 44.5%
| 4. Blood pressure at or below 130/85 mm Hg or use of an antihypertensive agent | 114   | 52.3%
| Criteria met: 4 (n=21, 9.6%), 3 (n=34, 15.6%), 2 (n=57, 26.1%), 1 (n=47, 21.6%), 0 (n=59, 27.1%) |
Completeness of Clinical Summaries

Where are most coded information found?

- Problem List: 20,130
- Billing Diagnostic Codes: 188,168
- Encounter Diagnoses: 266,029

<table>
<thead>
<tr>
<th>Capture</th>
<th>Pt</th>
<th>Prac</th>
<th>Pop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrieval</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sharing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Closer Look at Problems and Encounters**

- **Diabetes mellitus (disorder)**
  - Patients: 171 (19% overlap)
  - Problem List: 2
  - Encounter Diagnoses: 27
  - Total: 142

- **Diabetes mellitus type 1 (disorder)**
  - Patients: 65 (48% overlap)
  - Problem List: 1
  - Encounter Diagnoses: 31
  - Total: 33

- **Diabetes mellitus type 2 (disorder)**
  - Patients: 196 (53% overlap)
  - Problem List: 3
  - Encounter Diagnoses: 103
  - Total: 90
## Continuity of Care Document Sections

<table>
<thead>
<tr>
<th>Section</th>
<th>HL7 Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary Purpose</strong></td>
<td>2.16.840.1.113883.10.20.1.13</td>
<td></td>
</tr>
<tr>
<td><strong>Payers</strong></td>
<td>2.16.840.1.113883.10.20.1.9</td>
<td></td>
</tr>
<tr>
<td><strong>Advance Directive</strong></td>
<td>2.16.840.1.113883.10.20.1.11</td>
<td></td>
</tr>
<tr>
<td><strong>Functional Status</strong></td>
<td>2.16.840.1.113883.10.20.1.5</td>
<td></td>
</tr>
<tr>
<td><strong>Problems</strong></td>
<td>2.16.840.1.113883.10.20.1.11</td>
<td>Include: 64572001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exclude: 281647001</td>
</tr>
<tr>
<td><strong>Family History</strong></td>
<td>2.16.840.1.113883.10.20.1.14</td>
<td>Include: 57177007</td>
</tr>
<tr>
<td><strong>Social History</strong></td>
<td>2.16.840.1.113883.10.20.1.15</td>
<td>Include: 365949003</td>
</tr>
<tr>
<td><strong>Allergies, Adverse Reactions &amp; Alerts</strong></td>
<td>2.16.840.1.113883.10.20.1.2</td>
<td>Include: 281647001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Include: 420134006</td>
</tr>
<tr>
<td><strong>Medications</strong></td>
<td>2.16.840.1.113883.10.20.1.8</td>
<td>Include: 373873005</td>
</tr>
<tr>
<td><strong>Medical Equipment</strong></td>
<td>2.16.840.1.113883.10.20.1.7</td>
<td>Include: 303607000</td>
</tr>
<tr>
<td><strong>Immunisations</strong></td>
<td>2.16.840.1.113883.10.20.1.6</td>
<td>Include: 127785005</td>
</tr>
<tr>
<td><strong>Vital Signs</strong></td>
<td>2.16.840.1.113883.10.20.1.16</td>
<td>Include: 118227000</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td>2.16.840.1.113883.10.20.1.14</td>
<td>Include: 442618008</td>
</tr>
<tr>
<td><strong>Procedures</strong></td>
<td>2.16.840.1.113883.10.20.1.12</td>
<td>Include: 387713003</td>
</tr>
<tr>
<td><strong>Plan of Care</strong></td>
<td>2.16.840.1.113883.10.20.1.10</td>
<td>Include: 243120004</td>
</tr>
<tr>
<td><strong>Plan of Care</strong></td>
<td>2.16.840.1.113883.10.20.1.16</td>
<td>Include: 118227000</td>
</tr>
</tbody>
</table>

## Completeness of Clinical Summaries Results

<table>
<thead>
<tr>
<th>Summary Purpose</th>
<th>Payers</th>
<th>Advance Directive (30)</th>
<th>Functional Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>304253006</td>
<td>Not for resuscitation (finding)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problems (*)</th>
<th>Family History (80)</th>
<th>Social History (4.2k)</th>
<th>Allergies, Adverse Reactions &amp; Alerts (130)</th>
</tr>
</thead>
<tbody>
<tr>
<td>73211009</td>
<td>Diabetes mellitus (disorder)</td>
<td>312824007</td>
<td>Family history of cancer of colon (situation)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medications</th>
<th>Medical Equipment (100)</th>
<th>Immunisations (2.4k)</th>
<th>Vital Signs (500)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>87405001</td>
<td>Cane, device (physical object)</td>
<td>61086009</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results (70)</th>
<th>Procedures (800)</th>
<th>Encounters</th>
<th>Plan of Care (2.2k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>313172000</td>
<td>Colonoscopy abnormal (finding)</td>
<td></td>
<td>67516001</td>
</tr>
<tr>
<td>52734007</td>
<td>Total replacement of hip (procedure)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Sample Encounter Diagnoses

- **66590003** | Alcohol dependence (disorder)
- **128869009** | Infestation by Sarcoptes scabiei var hominis (disorder)
- **223475005** | Consulting with (procedure)
- **54150009** | Upper respiratory infection (disorder)
- **34014006** | Viral disease (disorder)
- **225358003** | Wound care (regime/therapy)
- **117640007** | Review by pathologist (procedure)
- **48532005** | Muscle strain (disorder)
- **18070006** | Impacted cerumen (disorder)
- **16932000** | Nausea and vomiting (disorder)
- **62315008** | Diarrhea (finding)
- **103742009** | Renewal of prescription (procedure)
- **228281002** | Problem drinker (finding)
- **271823003** | Tachypnea (finding)
- **89362005** | Weight loss finding (finding)
- **55464009** | Systemic lupus erythematosus (disorder)
- **292055008** | Codeine adverse reaction (disorder)
- **26306005** | Hypovolemia (disorder)
- **33688009** | Cholestasis (finding)
- **43275000** | Otitis (disorder)
- **37610005** | Inflammation of cervix (disorder)
- **281255004** | Small bowel obstruction (disorder)
- **271739002** | Wax in ear canal (finding)
- **235494005** | Chronic pancreatitis (disorder)
- **83414005** | Macrocytic anemia (disorder)
- **48813009** | Lymphocytopenia (disorder)
- **243114000** | Support (regime/therapy)
- **281032009** | Well woman health check (procedure)
- **385955003** | Foot care (regime/therapy)
- **385955003** | Foot care (regime/therapy)
- **363490007** | Macrocytic anemia (disorder)
- **3135009** | Otitis externa (disorder)
- **414521009** | Internal hordeolum (disorder)
- **20928004** | Ulcer of anus (disorder)
- **68653001** | Anal pain (finding)
- **77880009** | Rectal pain (finding)
- **86198006** | Influenza vaccination (procedure)
- **88336001** | Influenza vaccination (procedure)
- **12866006** | Pneumococcal vaccination (procedure)
- **33610005** | Proctitis (disorder)
- **44800001** | Pyuria (finding)
Improved Organisation

- Allergies, Adverse Reactions and Alerts
  - 292055008|Codeine adverse reaction (disorder)|
  - 426232007|Environmental allergy (disorder)|

- Social History
  - 228281002|Problem drinker (finding)|

- Immunisation
  - 86198006|Influenza vaccination (procedure)|
  - 12866006|Pneumococcal vaccination (procedure)|

- Vital Signs
  - 271823003|Tachypnea (finding)|

- Plan of Care
  - 225358003|Wound care (regime/therapy)|
  - 385955003|Foot care (regime/therapy)|

- Problem (Sample)
  - 54150009|Upper respiratory infection (disorder)|
  - 19943007|Cirrhosis of liver (disorder)|
  - 10743008|Irritable bowel syndrome (disorder)|
  - 371088008|Reactive airways dysfunction syndrome (disorder)|
  - 68566005|Urinary tract infectious disease (disorder)|
  - 281255004|Small bowel obstruction (disorder)|
Summary of Clinical Value of SNOMED CT

- Improved Completeness
  - Data Capture

- Simplified Retrieval
  - Data Retrieval

- Improved Organisation
  - Data Sharing