Using SNOMED CT in an International Clinical Information System

SNOMED CT Implementation Showcase 2014

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Objectives

• Describe the benefits of using SNOMED CT within an international clinical information system (CIS)
• Describe how SNOMED CT can be incorporated into an international clinical information system
• Describe the challenges of using SNOMED CT in an international clinical information system
Clinical Information System Overview

- For the care of critical care patients, including neonates
- International: more than 20 countries and 15 languages
- Multidisciplinary: nurses, physicians, and others
- Extensive system interfaces: labs, ADT, orders, etc.
- Functionality: documentation, decision support, and CPOE
- Highly configurable – customers define their own data dictionary elements as needed
- Third generation product
History with Terminologies

• Why a reference terminology?
  • Learned from past experiences
  • Want to compare data across customers as a benchmarking service
  • Highly configurable product to adapt to patient populations and locales
  • Reference terminology is not displayed to the clinician at the bedside

• Reference terminology framework was part of the initial architecture.
  • First reference terminology was provided by a third party terminology vendor
  • Gaps and inconsistencies existed in that terminology

• Changed to SNOMED CT about 2004
  • Recognized that SNOMED CT met the product requirements
  • After Read codes from the UK were incorporated into SNOMED CT
  • Around the time US government purchased the nationwide license
  • After lengthy licensing discussions with the College of American Pathologists
Why SNOMED CT?

- Multidisciplinary
- Extensive clinical scope: problems, orders, drugs, results, and others
- International
- Dedication to maintenance and improvements
- Terminology architecture
- Positive future
Main Components of the CIS

- **Applications:**
  - Used for patient record charting by clinicians

- **Configuration editors:**
  - Data Dictionary Elements
  - Documents
  - Drugs and others materials
  - Administrative information
  - Used by senior clinicians and field organization to modify/define the data dictionary items

- **Data Access Repository:**
  - A separate database
  - All patient data
  - Used by senior clinicians for quality analysis and clinical research
Main Approach to Incorporate SNOMED CT

• Purpose: to tag all components of data dictionary with a reference terminology concept, whether it was defined by the vendor or by the customer

• Data dictionary contains the following:
  • Data Elements have 1..N attributes
  • Data Elements are orders, interventions, problems, etc.
  • Dictionaries of coded items are used in selection lists
  • Includes materials/drugs

• SNOMED CT codes are assigned during the configuration of the data dictionary items using the configuration editors
Use in the System

- Every item in the data dictionary is tagged with a SNOMED CT concept

Non-Invasive Blood Pressure [Intervention]
17146006 Arterial pressure monitoring, non-invasive method (regime/therapy)

Systolic [Attribute]
271649006 Systolic blood pressure (observable entity)

Diastolic [Attribute]
271650006 Diastolic blood pressure (observable entity)

Where taken [Attribute]
10546003 Site (attribute)

Left Arm [Coded Term]
72098002 Entire left upper arm (body structure)

mmHg [Unit of Measure]
259018001 Millimeter of mercury (qualifier value)
Configuration Editors

Launches the SNOMED CT Picker

M. Hendrickson
Selecting a SNOMED CT Concept

Anywhere
Beginning
End
Exact
Keywords (all)
Keywords (any)
Database Structure

- Terminologies are maintained in a separate terminology database
- Database tables for SNOMED CT are similar in structure to the content provided by IHTSDO
- All data dictionary items have a mapping to a SNOMED CT concept in the database. More than 40,000 items are mapped in the starter configuration
- SNOMED CT tables are only accessed with the configuration editors
- Use the non-human subset to eliminate veterinary specific terms
Benefits

• The full potential is yet to be realized
• HL7 interfaces
• Data Access Repository
Outbound HL7 Interfaces

• Export of patient data via the HL7 interface (ORU)

MSH|^~\&|20041019172122|SECURITY|ORU^R01|MSG001-1|P|2.4||NE|NE|
PID||123456||Smith^Anne|19630625|F|
PV1|1||Unit1^Bed1|VN765|
OBR|2||386534000^Arterial BP^SNM3||200410191720
NTE|1|O|30 minutes after start of vasopressin drip|RE
OBX|1|NM|72313002^Systolic^SNM3||259018001^mmHg^SNM3|N|||F||200410191720
OBX|2|NM|271650006^Diastolic^SNM3||259018001^mmHg^SNM3|N|||F||200410191720
OBX|3|NM|6797001^Mean^SNM3||259018001^mmHg^SNM3|N|||F||200410191720
Inbound HL7 Interfaces

• Interfaces:
  • ADT
  • Laboratory
  • Orders

• Approach:
  • Depends on mappings between inbound data and the CIS data dictionary
  • Explicit mapping is defined in the interface configuration editors
  • SNOMED CT is used as a secondary level of mapping
Data Access Repository

- All patient data is tagged with SNOMED CT concepts
- SNOMED CT concepts identifies the data to be used in quality reports
- SNOMED CT concepts are used for database queries
- Includes
  - Customer’s configured data dictionary
  - Can include data from multiple systems
Other Benefits

• Most items can be assigned appropriate SNOMED CT concepts
  • SNOMED CT provides good coverage
  • Critical care CIS concepts and drugs

• Easy installation and implementation
  • One international version of SNOMED CT
  • Licensing
    • One licensing arrangement for all installations
    • Licensing model matches product licensing

• Future needs most likely will be met
  • SNOMED CT is expanding to cover other clinical domains
  • SNOMED CT is expanding to other locales/countries
Future Benefits?

• Benchmarking across customers
  • Master Data Access Repository
  • Quality reports comparing customers clinical practice and outcomes

• Research database
  • Clinical patient data across multiple customers
  • Similar to the MIMIC II database [https://mimic.physionet.org](https://mimic.physionet.org)
Challenges of Using SNOMED CT in a CIS

• Handling SNOMED CT Updates
• Gaps in concept coverage
• Country specific versions of SNOMED CT
• Customers’ configuration practices
Handling SNOMED CT updates

• Customers expect the product to use a recent version of SNOMED CT
• SNOMED CT content in the product’s terminology database is updated with every major release
• Upon customer site upgrades to the new software version, SNOMED CT content is updated as well as data dictionary assignments.
Handling SNOMED CT updates

• During product development within R&D
  • Latest version of SNOMED CT is loaded into a development system
  • Sql queries identify data dictionary items referencing retired SNOMED CT concepts
  • Clinicians use the configuration editors to change SNOMED CT codes
  • Database migration scripts are developed
SNOMED CT Content Gaps

• Recognize that extensive efforts have been made to address gaps
• We have a responsibility to help to address the gaps
• Examples of gaps:
  • SNOMED CT gaps for HL7 messages
    • Message segments and items
      • Example from the PID segment: birth order, patient account number
    • Entries in the HL7 tables including state transitions
    • Ideally, want a SNOMED CT concept for every clinically relevant message field, message segment, and entry in an HL7 table.
  • Infusion base solutions such as D/10/LR and Amino Acid 15%.
  • Scores: Aldrete, SAPS, CAM score, IMPROVE bleeding risk, Padua thrombosis risk, WAKE, etc.
How Gaps are Handled

• Non-clinical items are assigned a single SNOMED CT
  “Chart Group Failure” 360307003 Computer equipment (physical object)
  • Assigned a more general concept if clinically acceptable
  “ABD Binder Premium Sm-Med” 21944004 Abdominal binder, device (physical object)

• Create company proprietary concepts – avoid if possible

• For pre-coordinated definitions – assign the concept of the main idea
  “Accurate urine output monitoring” 444990003 Measurement of urine output (procedure)

• Attempt to make the assignment unique within the context if clinically relevant
Country Specific Versions of SNOMED CT

• Concerned that country specific versions have conflicting or duplicate content
• Product is designed to handle one version of SNOMED CT for all customers
• Different versions impair the ability to benchmark across countries
• Prefer country specific concepts are merged into the international version through a formal process
Customers’ Configuration Practices

- Customers do not consistently assign appropriate SNOMED CT values to their configuration.
  - Takes time
  - Lack of SNOMED CT experience
  - English is not their primary language
  - Do not recognize the benefits
Thank You

Questions?

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