SNOMED CT Implementation Overview and Approaches
Expo 2016 Tutorial

Overview

Part 1
▪ Adoption and Planning
▪ Development or Procurement
▪ Specification and Procurement
▪ Approaches to Implementation
▪ Procurement

Part 2
▪ Design and Development
▪ Implementation Guidance
  ▪ Example: Search and Data Entry
▪ Deployment & Use

Questions
SNOMED CT Implementation Stages

Adoption Planning Specification and Procurement Design and Development Deployment Use

Strategic Technical Practical

SNOMED CT Implementation Stages

Adoption

Strategic Technical Practical
Adoption Occurs at Many Levels

- National adoption
- Organizational adoption
- Adoption in standards
- Vendor adoption
- Project adoption

Adoption Depends on Delivering Value
Benefits of SNOMED CT Implementations

- A solid foundation for clinical records
- Improved access to guidelines and decision support
- Interoperable information and knowledge resources
- Improved Clinical and Business Intelligence

Approach to Successful SNOMED CT adoption
Approach to Successful SNOMED CT adoption

Building the Business Case for SNOMED CT

- Published in 2014
- Sets out the business case for SNOMED CT
  - Costs of adoption
  - Implementation stages
  - Qualitative and quantitative benefits of each stage
- Available for download from the IHTSDO website
  - www.ihtsdo.org
- Direct link
  - http://snomed.org/businesscase
SNOMED CT Implementation Stages

Planning

:: Adoption :: Planning :: Specification and Procurement :: Design and Development :: Deployment :: Use

Strategic :: Technical :: Practical

Planning

- Planning how SNOMED CT will be used
- Identifying
  - Existing systems to be modified
  - New systems required
- Determining whether to
  - Design and develop
  - Specify and procure
- Awareness of dependencies
- Setting realistic timescales
Understand Where Are You Starting From?

- A new system – a fresh start on a ‘greenfield site’
  - Addressing new requirements with SNOMED CT
  - Using SNOMED CT as part of a new development
- Replacing a relic of earlier development
  - Replacing a system without losing functionality or information
  - Including SNOMED CT as part of the new solution
- An evolving system
  - Updates to a system that includes use of SNOMED CT
  - Step by step progress to add SNOMED CT enabled functionality

Understand the Scope of Intended Implementation

- Breadth of coverage
- Specificity
- Purpose
- Functionality
- Single institution to national spread
- Single specialty to multiple disciplines
- Single use case to integrated solution
- Software component to full system
Scope: Breadth of Coverage

- National
- Single institution

Scope: Purpose

- General EHR requirements
- Single use case
Scope: Specificity

Multidisciplinary EHR  Specialty EHR

Scope: Functionality

Complete system  Software component
Plan to Make Implementation a Team Effort

SNOMED CT Implementation Stages

Develop or Procure? Perhaps a bit of both!
Development and Procurement - Different Routes to a Common Goal

SNOMED CT Implementation Stages

Clear Specification of Requirements Essential for either design or development
Pitfalls When Specifying Requirements

- It is not enough to say ‘Implement SNOMED CT’
  - Some of those responding to a procurement may interpret SNOMED CT implementation in a limited way
- SNOMED CT implementation is not all or nothing
  - There are different approaches to SNOMED CT implementation
- Benefits depend the approach
  - Choose an approach that meets your immediate requirements
    … but consider the impact on next steps …
  - A short-term solution may delay enhancements that meet future requirements and deliver additional benefits

Identifying Requirements

- Clearly document
  - Objectives – what benefits should be delivered
  - Outcomes – what measurable changes are to be achieved
  - Practical use – how current working practices will be supported
- SNOMED CT specific requirements
  - May vary depending on overall objectives
  - Should not be specified in isolation but should be considered in the context of the overall solution
  - May impact all stages of the clinical information life cycle
SNOMED CT Implementation Stages

**Specification and Procurement**

- Adoption
- Planning
- Specification and Procurement
- Deployment
- Use

Strategic  Technical  Practical

Clinical Information Life Cycle

**User Interface**

- Capture
- Display
- Decision support
- Reporting & analysis

- Storage EHR
- Communication
- Other systems or applications
Specifications Should Cover All Stages in the Clinical Information Life Cycle

- Data capture
  - Easy to use as part of clinical working practice of all intended users
- Storage
  - Structured and/or indexed to enable effective retrieval
- Display
  - Information relevant to different intended users readily accessible and displayed in ways relevant that support their work
- Communication
  - Meeting needs for sharing or transfer of required information in standard or agreed forms
- Reporting and analysis
  - Effective retrieval to meet requirements of clinical users and other stakeholders (e.g. epidemiologists, management, researchers)
- Make sure the selected solution meets your requirements
  - Include acceptance tests for all stages
  - All aspects of your requirements should be tested

Approaches to Using SNOMED CT
Common Terminology for Communication

- Existing systems using different code systems internally
- Map to and from SNOMED CT as a common terminology for communication
- New systems using SNOMED CT communicate without needing to map
Approaches to Using SNOMED CT

Indexing for Analytics

- EHR system using local codes, classification and text to represent records
- Algorithmic rules map and index data with SNOMED CT codes or expressions
  - For local analysis using SNOMED CT semantics
  - For export to data warehouse for larger scale aggregation and analysis

Data warehouse analysis using SNOMED CT features for meaning-based retrieval

Local analysis using SNOMED CT features for meaning-based retrieval

Approaches to Using SNOMED CT

Use of SNOMED CT for Internal Storage

- Data capture (and display) use a local or proprietary user interface terminology
- Interface terminology is mapped or linked to SNOMED CT
- EHR system uses SNOMED CT for storage, indexing and communication
- Reporting and analytics use SNOMED CT features including meaning-based retrieval

EHR storage, reporting and analysis all use SNOMED CT features including meaning-based retrieval

EHR system uses local or proprietary interface terminology
Approaches to Using SNOMED CT
Full Use of SNOMED CT

- Data capture (and display) uses SNOMED CT interface features including:
  - Synonyms and language reference sets
  - Subsets and ordered lists represented as SNOMED CT simple or ordered reference sets
  - Searches using subtype filtering to limit list

- EHR system uses SNOMED CT for storage, indexing and communication

- Reporting and analytics use SNOMED CT semantics to support meaning-based retrieval

Multistep Approaches and Tailor-made Solutions

- Stepwise approaches may allow your requirements to be met in stages
  - Ensure each stage delivers benefits to motivate use
  - Lack of short-term benefits may reduce enthusiasm for future steps

- A tailor made solution may meet all your stated requirements
  - But your requirements for SNOMED CT may evolve
  - Can the solution be adapted to meet emerging requirements or will you need to start again?
Warnings and Hopeful Signs in a Procurement

Warning Signs During Procurement

Does your system support SNOMED CT?

Our system can use any codes you choose. If you want SNOMED CT we will just add it to our code tables.
Warning Signs During Procurement

How do users record data using SNOMED CT?

SNOMED CT is just a long list of terms you can choose from.

Can I retrieve data using SNOMED CT?

Yes you can specify the codes you want to retrieve in any code system.
Positive Signs During Procurement

Does your system support SNOMED CT?

Yes we support SNOMED CT and we can put you in touch with a people who are using our system with SNOMED CT

Positive Signs During Procurement

What features of SNOMED CT does your system support?

Our proposal details the SNOMED CT features the system supports for data entry, retrieval, etc. It also notes features we don’t support and future planned enhancements …
Overview - Part 2

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  - Example: Search and Data Entry
- Deployment
- Use of SNOMED CT

Questions

SNOMED CT Implementation Stages

Design and Development

Adoption  Planning  Specification and Procurement  Design and Development  Deployment  Use

Strategic  Technical  Practical
Team Contributions to Specification and Design

- Clinical input to user interface design and motivation
  - Compatible with clinical practice
  - Identify benefits that will encourage use
- System architects and software designers
  - Robust system design delivering necessary performance
  - Support for SNOMED CT logical design
- Guidelines and decision support developers
  - Support use of SNOMED CT for knowledge linkage
- Management
  - Alignment with key reporting and audit requirements
- Epidemiology and Clinical Research
  - Identify key features for epidemiology and clinical research

Users, Software, Services and SNOMED CT

[Diagram showing the relationship between users, software, services, and SNOMED CT]
SNOMED CT Enabled EHR Services

SNOMED CT Enabled Terminology Services
- SNOMED CT Resources
  - Concepts
  - Descriptions
  - Relationships
  - Reference sets
- Search terms
- Query
- Get map data
- Install from files
- Update from files

SNOMED CT Enabled Record Services
- SNOMED CT Encoded Health Records
- Search / retrieve
- Enter data
- Query / extract
- Communicate
- API

SNOMED CT Enabled Services
Software services that support effective use of SNOMED CT as part of health record systems
- Record services
  - Services that directly manage patient health records
  - Data entry, display, retrieval, communication and record sharing
- Terminology services
  - Services manage and provides access to terminology resources
  - Installing, searching, navigating and using the terminology
- Knowledge resource services
  - Clinical guidelines
  - Decision support
- Analytics services
  - Data warehousing
  - Reporting and auditing
Design and Development: Recommendations for SNOMED CT Implementers

- Make use of SNOMED CT features including …
  - Synonyms and language preferences
  - Enhanced meaning-based retrieval
  - Reference sets to customize for different uses
  - Constrained searches appropriate to a particular context
  - Extensions that meet national and local requirements

- Make use of the guidance we offer
  - Refer to the Technical Implementation Guide (TIG)

- Avoid common pitfalls
  - Thinking of SNOMED CT as just a code system replacement
  - Simplistic searches that return long unstructured lists of matches
  - Failing to update to the latest SNOMED CT release

Implementation Guidance Example

Search and Data Entry
Search and Data Entry

- **Search**
  - Process by which a user finds a concept to represent a clinical idea
  - Needs to be quick and easy for users
  - SNOMED CT can make this easier

- **Data Entry**
  - Process by which a user submits information containing relevant SNOMED CT concept identifiers for storage in an EHR
  - Approach depends on the setting

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Relationship Between Search and Data Entry

- Clinical idea
- Search
  - Use a SNOMED CT search functionality.
- Result/Concept
- Entry
  - Use clinical data entry forms.
- Storage

Structured data entry forms can obviate or constrain the SNOMED CT search.
Use Cases for Searching SNOMED CT

- Select a clinical meaning for data entry at point of care
- Design a data entry template
- Create a query or report
- Bind SNOMED CT to information models
- Bind SNOMED CT to knowledge artifacts
- Develop a reference set
- Evaluate terminology content
- Author SNOMED CT content (extensions or translations)
- Develop maps from SNOMED CT to other code systems

Approaches to Searching

- Search by Terms
- Search by Identifiers
- Constrain Searches
- Extend Searches
- Improve Search Speed
- Optimize Display of Search Results
Search by Terms

- User configurable search strings:
  - Words or parts of words in any order – *usually the best option*
  - Precise matching word or phrase
  - Contains a string or pattern

Constraining Searches by Language or Dialect
Constraining Searches by Subtype

SNOMED CT

Clinical finding · Body structure · Procedure · Substance · Organism

Disorder

Shock

Constraining Searches by Subtype – Example

Unconstrained:

"renal calculus" 37 results

Only subtypes of disease:

"renal calculus" (disorders only) 12 results
Constraining Searches by Reference Sets

Imaging (procedure)

Reference Set

- MRI
- MRI of abdomen
- X-ray
- X-ray of chest wall
- Abdominal X-ray

Improving Search Speeds

- Real time searching
  - Don’t wait for the search button to be pressed
- Indicate estimated number of matches before search
  - Give the user feedback … if nothing matches their phrase they should stop typing and consider rephrasing
- Optimize indexing
  - Do not assume a generic search algorithm is the best way to search a terminology like SNOMED CT
  - Implement filters for constraints in ways that minimize impact on search performance
Order Search Results Rationally

- Shortest matching results first
- More user friendly than alphabetical ordering

Distinguishing Identical Terms for Different Concepts

Identical terms...

...but different concepts in separate hierarchies.
Avoid Displaying the Same Concept More Than Once

- Filter search results by description type
- Filter search results by closest match

Rationalize Search Results by Subsumption

Before:
- Hernia of abdominal cavity collapsed.
- Subtypes not displayed.

After:
- Hernia of abdominal cavity expanded.
- Subtypes displayed.
SNOMED CT Data Entry

- Key Requirements
  - Interfaces are easy to use
  - Must facilitate meaning based retrieval
- Data Entry Techniques
  - Structured
    - Characteristics and tools
    - Capturing Clinical Detail with Postcoordination
  - Semi-Structured
    - Combining Structured with Free Text
  - Natural Language Processing
- Consideration of Context
  - Interface Design and Data Representation

Characteristics of Structured Data Entry Interfaces

- SNOMED CT concepts or expressions can be bound to relevant fields

Select diagnosis

- Hypertension
- Diabetes Mellitus
- ....
Characteristics of Structured Data Entry Interfaces

- SNOMED CT expressions can be bound to a data entry tools such as
  - Check boxes
  - Radio buttons
  - Selection lists
  - Graphical selection
- When these tools are used to enter data, the bound SNOMED CT expressions can be stored

Capturing Clinical Detail with Postcoordination
Capturing Clinical Detail with Postcoordination

Select hip prosthesis
Sheehan total hip prosthesis

52734007 | total replacement of hip |
363699004 | direct device | = 314580008 | Sheehan total hip prosthesis

Capturing Clinical Detail with Postcoordination

Select inflammatory disorder of ear:
Otitis media
Otitis externa
Otitis media

Specify severity:
- Mild
- Moderate
- Severe

Specify episodocities:
- First episode
- Old episode
- New episode

373573001 | clinical finding present | : 246090004 | associated finding | = (65363002 | otitis media | : 246112005 | severity | = 6736007 | moderate | , 246456000 | episodicity | = 255217005 | first episode | )

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Combining Structured Data with Free Text

Physical Examination

Head: ...

Ears: Left normal
      Right blocked by wax

Eyes: Large cataract in L. eye.
      Scarred right retina ?traumatic.

Mouth and Pharynx: Loose UL3 tooth
                   Ts and As normal

This text field can be bound to 118235002 | Eye / vision finding

Bindings like this allow relevant text to be selectively retrieved

Bindings like this can also be used to support NLP techniques by restricting the possible concepts to specific hierarchies

Natural Language Processing

- Enables a computer program to analyze and extract meaning from human language
- Clinical NLP uses SNOMED CT’s concepts, descriptions and relationships analyze free text
Natural Language Processing

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Challenges

- Spelling errors, grammatical errors, abbreviations, unexpected synonyms, unusual vernacular phrases, hidden contextual information

Clinical text entered:
"Patient’s mother has history of epilepsy."

Encoded data (Expression):
243796009 | Situation with explicit context | : {408732007 | Subject relationship context | = 72705000 | Mother}, 408731000 | Temporal context | = 410513005 | Past}, 246090004 | Associated finding | = 84757009 | Epilepsy}, 408729009 | Finding context | = 410515003 | Known present}
Interface Design and Data Representation

Family history
- Select...
  - Breast Cancer
  - Hypertension
  - Pneumonia
  - Diabetes mellitus type 2

Past history
- Select...
  - Breast Cancer
  - Hypertension
  - Pneumonia
  - Diabetes mellitus type 2

Current diagnosis
- Select...
  - Breast Cancer
  - Hypertension
  - Pneumonia
  - Diabetes mellitus type 2

Family history → Past history → Current diagnosis

... in the context of...

Search and Data Entry

For more information please refer to:
- Search and Data Entry Guide: http://snomed.org/searchguide
Deployment and use of SNOMED CT Enabled Systems

- Delivery
  - Installation
  - Resolution of dependencies and integration of systems
- Configuration for specific uses and specialties
  - User interface configuration
  - Report and query configuration
- User training including
  - Clinical users
  - Reporting and analytics
- Maintenance
  - SNOMED CT version updates
**Deployment Needs Informed Users**

- Inform all users about benefits
  - Focus on key features and benefits of meaning-based retrieval
- Involve clinical users in configuration decisions
  - Adapt data capture and display to fit working practices in different departments
    - For example - ensuring searches and pick lists are relevant
- Inform data analysts about SNOMED CT semantics
  - SNOMED CT provides benefits for analytics
    - Full benefit realization requires awareness of the logical semantic definitions provided by SNOMED CT
  - Engage analysts in configuring reports that use these features to meet requirements

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**SNOMED CT Implementation Stages**

Adoption, Planning, Specification and Procurement, Design and Development, Deployment, Use

Strategic, Technical, Practical, Use
Use needs Motivated Users

- Involve ‘clinical champions’ who understand
  - The requirements that drive day to day use of an EHR
  - The way the EHR system meets those requirements
  - The contribution of SNOMED CT to delivery of benefits
- Provide users with practical benefits
  - Motivate consistent use by providing useful and interesting information derived from their use of the system
- Respond to user input
  - Address issues and emerging requirements

SNOMED CT in Use Around the World

- SNOMED CT is used in more than 50 countries
- National policy endorses use of SNOMED CT in several countries, including
  - Australia
  - Canada
  - England
  - India
  - Netherlands
  - Singapore
  - Sweden
  - United States
- Examples of SNOMED CT deployments
  - [http://snomedinaction.org/](http://snomedinaction.org/)
SNOMED in Action - Domains

- Clinical research
  - Public health
- Computerized Physician Order Entry (CPOE)
- Electronic prescriptions
- Immunization history
- Infection prevention
- Electronic health records
  - Hospital, Emergency care, Outpatient, Primary Care, Personal
- Specialties
  - Rheumatology, Pathology, Oncology, Ophthalmology, Optometry, Surgery
- And many more …

Summary

- Adoption requires identification of specific benefits
- Plan implementation taking account of key objectives
  - Plan implementation as a team effort
- A clear specification of requirements is needed for
  - Procurement
  - Design and development
- When designing and developing
  - Take note of SNOMED CT implementation guidance
- Deployment and use needs informed and motivated users
- Provide users with value from the information they record
Links to Further Information

- Technical Implementation Guide (TIG)
  - [http://snomed.org/tig](http://snomed.org/tig)
- Vendor Introduction to SNOMED CT
  - [http://snomed.org/vendorguide](http://snomed.org/vendorguide)
- Learn More using our E-Learning courses:
  - [http://snomed.org/elearning](http://snomed.org/elearning)
- SNOMED in Action
  - [http://snomedinaction.org](http://snomedinaction.org)
- SNOMED CT Presentations
  - [http://snomed.org/expo](http://snomed.org/expo)

- Any Questions?