# SNOMED Clinical Terms® User Guide

January 2007 Release

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# Document History

| Date | Version | Notes |
|---|---|---|
| January 2006 | January 2006 | User Guide revision:<br>• Modified guide organization and structure<br>• Updated descriptions and examples for SNOMED CT attributes and hierarchies<br>• Added overview of SNOMED CT structure and technology considerations<br>• Revised glossary |
| July 2006 | July 2006 | User Guide revision highlights:<br>• Added section on the use of attributes for *Event* hierarchy<br>• Updated Attributes used to define Clinical findings in section 4.2. Modifications were made to use of SEVERITY, EPISODICITY and PATHOLOGICAL PROCESS.<br>• Renamed *Context-dependent category (context-dependent category)* hierarchy to *Situation with explicit context (situation)*<br>• Updated Attributes used to define Procedure concepts in section 4.3. Added ROUTE OF ADMINISTRATION as an attribute. |
| January 2007 | January 2007 | User Guide revision highlights:<br>• Update to Attributes used to define Clinical findings in section 4.2. COURSE and ONSET were retired. CLINICAL COURSE was introduced.<br>• Update to Attributes used to define Procedure concepts in section 4.3.<br>  ▪ Retired USING and ACCESS INSTRUMENT. Replaced with USING DEVICE and USING ACCESS DEVICE.<br>  ▪ Changes to ACCESS attribute<br>  ▪ New attributes USING SUBSTANCE and USING ENERGY |

| | | • New range for LATERALITY attribute<br>• Changes to range for PROCEDURE SITE and FINDING SITE and SPECIMEN SOURCE TOPOGRAPHY<br>• Added section on use of attribute for *Physical object* hierarchy<br>• Updates to Examples |
|---|---|---|

# Inventory of Documentation

The following documentation is currently available for SNOMED licensees from SNOMED International:

## SNOMED CT Technical Reference Guide (TRG)

The TRG is intended for SNOMED CT implementers, such as software developers.  The TRG assumes an information technology background.  Clinical knowledge is not a prerequisite.

The TRG contains reference material related to the current release of SNOMED CT and includes file layouts, field sizes, required values and their meanings, and high-level data diagrams.  It can be used to install and use SNOMED.

## SNOMED CT Technical Implementation Guide (TIG)

The TIG is intended for SNOMED CT implementers, such as software designers.  The TIG assumes information technology and software development experience.  Clinical knowledge is not required, although some background is helpful to understand the application context and needs.

The TIG contains guidelines and advice about the design of applications using SNOMED CT, and covers topics such as terminology services, entering and storing information, and migration of legacy information.

## SNOMED CT User Guide

The User Guide is intended for clinical personnel, business directors, software product managers, and project leaders; information technology experience, though not necessary, can be helpful.

The User Guide is intended to explain SNOMED CT's capabilities and uses from a content perspective.  It explains the content and the principles used to model the terminology.

## SNOMED CT Subset Kit

The Subset Kit is a collection of documents for individuals and organizations intending to create a Subset of the SNOMED CT terminology.

The Subset Kit consists of the following components:

- **SNOMED CT Subset Planning Guide:**  The Planning Guide is intended to help users manage the process of creating a subset of SNOMED CT.  This guide is intended for those responsible for creating the specifications for the subset and the maintenance strategy.
- **SNOMED CT Subset Development Guide:**  The Development Guide is intended to help users create and implement a subset of SNOMED CT.  It provides guidance on the specific tasks required.
- **SNOMED CT Subset Editor User Guide:**  The User Guide is intended for individuals working hands-on with the Subset Editor software described below.  It explains how to use the software as well as its capabilities and options.

- **SNOMED CT Subset Editor:** The Subset Editor is a tool that facilitates the creation of subsets, both through the use of rules to identify subset members, and by the direct identification of subset members.
- **SNOMED CT Namespace Identifier:** This identifier is issued to an organization that wants to create SNOMED CT identifiers, such as Subset Identifiers. A Namespace Identifier may also be issued separately from the Subset Kit.

## *Additional Documentation*

Documentation is also provided with the following:

- Allergen Subset
- Anatomic Pathology Subset
- Canonical Table
- Developer Toolkit
- Namespace Identifier
- SNOMED CT-Encoded CAP Cancer Checklists
- CLUE Browser (documentation is provided in CLUE files). The CLUE Browser is Copyright of The Clinical Information Consultancy.

# 1   Introduction

## 1.1   Purpose

This document describes the content, structure and terminology of SNOMED CT.  It is intended to provide new as well as experienced users with an overview and illustrations of SNOMED CT's capabilities and uses from a content perspective.  As such, it explains the content and the principles used to model the terminology.

## 1.2   Who should read this guide?

The intended audience for the User Guide includes clinical personnel, business directors, software product managers, and project leaders who are involved in the acquisition, implementation and use of SNOMED CT and SNOMED CT enabled applications in their organizations.  While information technology background may be helpful, it is not required to benefit from this User Guide.

Technical professionals who support the implementation of SNOMED CT or who develop systems that will use SNOMED CT may find this guide helpful in providing a high-level overview of the terminology structure and content.  However, for detailed technical guidance, technical professionals should consult the SNOMED CT Technical Reference Guide (TRG) and SNOMED CT Technical Implementation Guide (TIG), as well as other applicable technical documentation described in the Inventory of Documentation.

## 1.3   Notation used in this document

The following notation is used in this User Guide to represent key types of SNOMED CT information:

- SNOMED CT Concept names are generally represented using the Fully Specified Name in italics.

  **Example:**  *Peribronchial pneumonia (disorder)*

- SNOMED CT Attributes are represented in all capital letters.

  **Example:**  FINDING SITE

## *1.4  Additional information*

Further information about SNOMED CT is available on the Internet at

http://www.snomed.org

Please send your feedback to email address:

snomed@cap.org

or contact:

SNOMED International

College of American Pathologists

325 Waukegan Road

Northfield, Illinois  60093-2750

Tel:  +1-800-323-4040; +1-847-832-7700

# 2 Overview

## 2.1 *What is SNOMED CT?*

SNOMED Clinical Terms® (SNOMED CT®) is a comprehensive clinical terminology that provides clinical content and expressivity for clinical documentation and reporting.  It can be used to code, retrieve, and analyze clinical data.  SNOMED CT® resulted from the merge of SNOMED® Reference Terminology (SNOMED® RT) developed by the College of American Pathologists (CAP) and Clinical Terms Version 3 (CTV3) developed by the National Health Service (NHS) of the United Kingdom.  The terminology is comprised of concepts, terms and relationships with the objective of precisely representing clinical information across the scope of health care.  Content coverage is divided into hierarchies, which include:

- *Clinical finding*
- *Procedure*
- *Observable entity*
- *Body structure*
- *Organism*
- *Substance*
- *Pharmaceutical/biologic product*
- *Specimen*
- *Special concept*
- *Physical object*

- *Physical force*
- *Event*
- *Environments/geographical locations*
- *Social context*
- *Situation with explicit context*
- *Staging and scales*
- *Linkage concept*
- *Qualifier value*
- *Record artifact*

## 2.2 *SNOMED CT uses*

Health care software applications focus on collection of clinical data, linking to clinical knowledge bases, information retrieval, as well as data aggregation and exchange.  Information may be recorded in different ways at different times and sites of care.

Standardized information improves analysis.  SNOMED CT provides a standard for clinical information.  Software applications can use the concepts, hierarchies, and relationships as a common reference point for data analysis.  SNOMED CT serves as a foundation upon which health care organizations can develop effective analysis applications to conduct outcomes research, evaluate the quality and cost of care, and design effective treatment guidelines.

Standardized terminology can provide benefits to clinicians, patients, administrators, software developers and payers.  A clinical terminology can aide in providing health care providers with more easily accessible and complete information pertaining to the health care process (medical history, illnesses, treatments, laboratory results, etc.) and thereby result in improved patient outcomes.  A clinical terminology can allow a health care provider to identify patients based on certain coded information in their records, and thereby facilitate follow-up and treatment.

# 3  Basic Components of SNOMED CT

## 3.1  Concepts

In the context of this document, a "concept" is a clinical meaning identified by a unique numeric identifier (ConceptID) that never changes.  Concepts are represented by a unique human-readable Fully Specified Name (FSN).  The concepts are formally defined in terms of their relationships with other concepts.  These "logical definitions" give explicit meaning which a computer can process and query on.  Every concept also has a set of terms that name the concept in a human-readable way.

### Concept granularity

"Granular" means specific or particular.  Concepts represent various levels of clinical detail.  Concepts can be very general or they can represent increasingly specific levels of detail, also referred to as increasing granularity.  Multiple levels of granularity improve the capability to code clinical data at the appropriate level of detail.
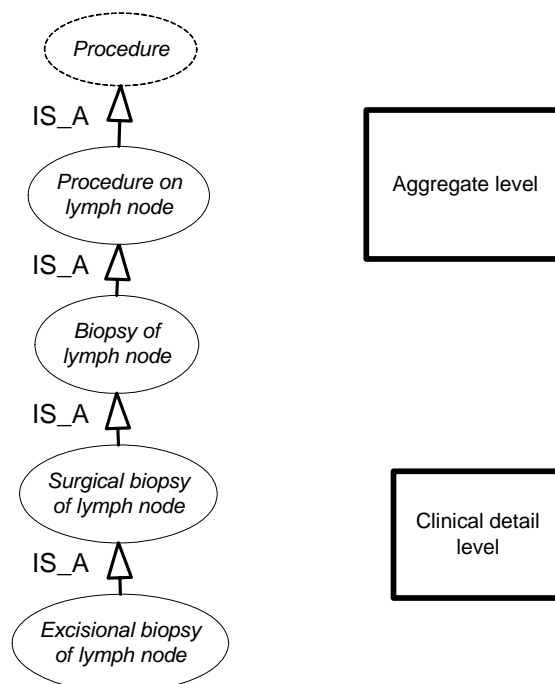


**Figure 3.1:  Multiple levels of granularity**

### Concepts and identifiers

SNOMED CT concepts have unique numeric identifiers called ConceptIDs.  ConceptIDs do not contain hierarchical or implicit meaning.  The numeric identifier does not reveal any information about the nature of the concept.

#### Example:

55679008 is the ConceptID for the concept *Peribronchial pneumonia (disorder)*.

## *3.2  Descriptions*

Concept descriptions are the terms or names assigned to a SNOMED CT concept.
"Term" in this context means a phrase used to name a concept.  A unique DescriptionID
identifies a description.  Multiple descriptions might be associated with a concept
identified by its ConceptID.

### *Example:*

Some of the descriptions associated with ConceptID 22298006:

- Fully Specified Name: *Myocardial infarction (disorder)*
  DescriptionID 751689013

- Preferred term: Myocardial infarction
  DescriptionID 37436014

- Synonym: Cardiac infarction
  DescriptionID 37442013

- Synonym: Heart attack
  DescriptionID 37443015

- Synonym: Infarction of heart
  DescriptionID 37441018

Each of the above descriptions has a unique DescriptionID, and all of these
descriptions are associated with a single Concept (and the single ConceptID
22298006).

### *Types of descriptions*

**Fully Specified Name (FSN)**

Each concept has one unique FSN intended to provide an unambiguous way to name a
concept.  The purpose of the FSN is to uniquely identify a concept and clarify its
meaning, not necessarily to present the most commonly used or natural phrase for that
concept.  Each FSN ends with a "semantic tag" in parentheses at the end of the concept.
The "semantic tag" indicates the semantic category to which the concept belongs (e.g.,
Disorder, Organism, Person, etc.).  For example, *Hematoma (morphologic abnormality)*
is a FSN that represents the description of what the pathologist sees at the tissue level,
whereas *Hematoma (disorder)* is a FSN which indicates the concept that would be used
to code the clinical diagnosis of a hematoma by a general practitioner.

**Preferred Term**

Each concept has one Preferred Term meant to capture the common word or phrase
used by clinicians to name that concept.  For example, the concept 54987000 *Repair of
common bile duct (procedure)* has the Preferred term "Choledochoplasty" to represent a
common name clinicians use to describe the procedure.

Unlike FSNs, Preferred Terms are not necessarily unique.  Occasionally, the Preferred
Term for one concept may also be a Synonym or the Preferred Term for a different
concept.

### *Example:*

*Cold sensation quality (qualifier value)* has a preferred term of "Cold."

*Common cold (disorder)* also has a synonym of "Cold."

In both cases, "cold" represents a common clinical phrase used to capture the meaning of the FSN.

**Synonym**

Synonyms represent any additional terms that represent the same concept as the FSN. Synonyms, like Preferred Terms, are not required to be unique across concepts.

### *Example:*

Some of the Synonyms associated with ConceptID 22298006 which has the Fully Specified Name: *Myocardial infarction (disorder)* are:

- Synonym: Cardiac infarction
  DescriptionID: 37442013
- Synonym: Heart attack
  DescriptionID: 37443015
- Synonym: Infarction of heart
  DescriptionID: 37441018

## 3.3 Relationships

Relationships link concepts in SNOMED CT. There are four types of relationships that can be assigned to concepts in SNOMED CT:

- Defining
- Qualifying
- Historical
- Additional

The relationships addressed in this section are known as "defining" relationships which are used to model concepts and create their logical definitions.

### *Relationships and concept definitions*

Each concept in SNOMED CT is logically defined through its relationships to other concepts.

Every active SNOMED CT concept (except the "SNOMED CT Concept" Root concept) has at least one IS_A relationship to a supertype concept.

IS_A relationships and defining attribute relationships are known as the "defining characteristics" of SNOMED CT concepts. They are considered defining because they are used to logically represent a concept by establishing its relationships with other concepts. This is accomplished by establishing IS_A relationships with one or more defining concepts (called supertypes) and modeling the difference with those supertypes through defining attributes.

### *Example:*

*Fracture of tarsal bone (disorder)*

> IS_A *Fracture of foot (disorder)*

> FINDING SITE *Bone structure of tarsus (body structure)*

> ASSOCIATED MORPHOLOGY *Fracture (morphologic abnormality)*

A relationship is assigned only when that relationship is always known to be true.  For example, Group A Streptococcus causes most cases of Streptococcal pharyngitis.  However, a small percentage of these cases are caused by other species of Streptococcus.  Consequently, when defining the concept *Streptococcal sore throat (disorder),* Streptococcus Group A was not chosen as a value for the CAUSATIVE AGENT attribute.  A more general concept, *Streptococcus (organism)*, was selected.

## IS_A relationships

IS_A relationships are also known as "Supertype-Subtype relationships" or "Parent-Child relationships."  IS_A relationships are the basis of the SNOMED CT's hierarchies.

### Example:

*Disorder of foot (disorder)*

> ⇧ IS_A

*Injury of foot (disorder)*

> ⇧ IS_A

*Fracture of foot (disorder)*

> ⇧ IS_A

*Open fracture of foot (disorder)*

A concept can have more than one IS_A relationship to other concepts.  In that case, the concept will have parent concepts in more than one sub-hierarchy of a top-level hierarchy.  Subtype relationships can be multi-hierarchical.
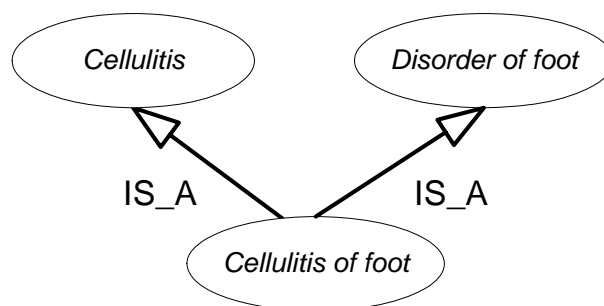


**Figure 3.2:  Example – IS_A relationships**

## Attribute relationships

Attributes relate two concepts and establish the type of relationship between them.  Together with IS_A relationships they are considered defining characteristics, since they allow the logical representation of the meaning of a concept by establishing its relationships with other concepts.  A logical concept definition includes one or more

supertypes (modeled with IS_A relationships), and a set of defining attributes that capture the semantics of a concept and help to differentiate it from the other concept definitions, including its supertypes.

In the example below, *Lumbar discitis (disorder)* (a concept in the *Clinical finding* hierarchy) is related to concepts in the *Body structure* hierarchy through two attributes: FINDING SITE and ASSOCIATED MORPHOLOGY.

### *Example:*

*Lumbar discitis (disorder)*

>> FINDING SITE *Structure of lumbar intervertebral disc (body structure)*

>> ASSOCIATED MORPHOLOGY *Inflammation (morphologic abnormality)*

The two attributes FINDING SITE and ASSOCIATED MORPHOLOGY and their assigned values provide definition for the concept *Lumbar discitis (disorder).*

### *Example:*

Part of the logical definition (a list of a concepts' relationships to other concepts) of the concept *Pneumonia (disorder)* in SNOMED CT is:

*Pneumonia (disorder)*

>> FINDING SITE *Lung structure (body structure)*

In this example, the concept *Pneumonia (disorder)* is characterized with the attribute FINDING SITE.  Since pneumonia is a disorder of the lung, FINDING SITE has the value *Lung structure (body structure).*

# 4  Attributes Used in SNOMED CT

## 4.1  Introduction

SNOMED CT currently uses over 50 defining attributes to model concept definitions.

Each SNOMED CT attribute can usually be applied to one hierarchy and for a few attributes to more than one hierarchy.  The hierarchy or hierarchies to which an attribute can be applied are referred to as the "domain" of the attribute.  Each attribute can be given a limited set of values; this set of values is called the "range" of the attribute.

### Domain

The Domain is the hierarchy to which a specific attribute can be applied.

The Domain of the attribute ASSOCIATED MORPHOLOGY is the *Clinical finding* hierarchy.

A Procedure cannot have an ASSOCIATED MORPHOLOGY.

A Procedure has a PROCEDURE MORPHOLOGY.

### Range

The Range is the set of values allowed for each attribute.

For example, the Range for ASSOCIATED MORPHOLOGY is *Morphologically abnormal structure (morphologic abnormality)* and its descendents, and the range for FINDING SITE is *Anatomical structure (body structure) or Acquired body structure (body structure)* in the *Body structure* hierarchy.
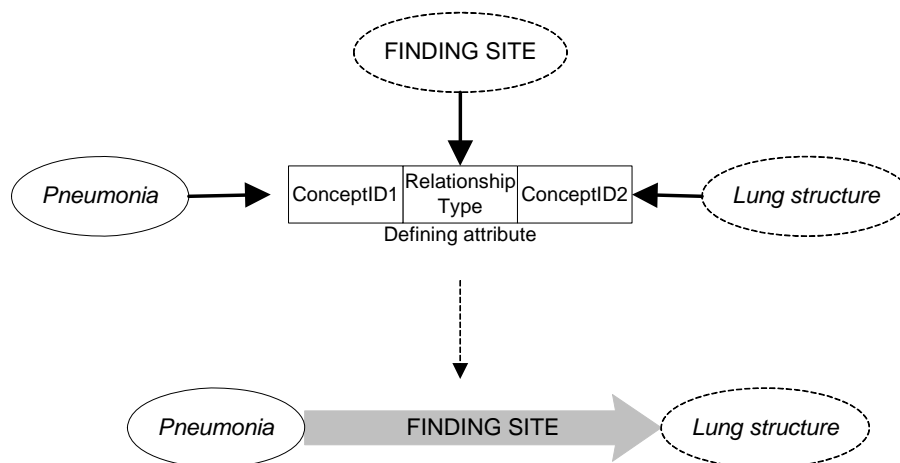


**Figure 4.1:  Example – Pneumonia FINDING SITE Lung structure**

The domain for the FINDING SITE attribute is the *Clinical finding* hierarchy.  In this example (Figure 4.1), the attribute FINDING SITE has the value *Lung structure (body structure).  Lung structure (body structure)* is found in the *Anatomical structure (body structure)* subhierarchy which is in the allowed range for FINDING SITE.

Defining attributes in SNOMED CT are assigned to the hierarchies where retrieval of clinical data is most useful and relevant (e.g., *Procedure*, *Clinical finding*, *Pharmaceutical/Biologic product*, *Situation with explicit context, Event* and *Specimen*).

In addition, LATERALITY is a defining attribute applied to *Body structure* concepts. Other hierarchies, such as *Social context*, *Substance*, *Organism*, *Observable entity*, and *Physical object*, do not take attributes and instead are considered supporting hierarchies. Concepts from the supporting hierarchies can serve as the attribute values for the concept definitions of the main hierarchies.

This section of the SNOMED CT User Guide describes the approved attributes used in SNOMED CT. Criteria have been used to evaluate approved attributes and to determine whether they should be added to the terminology.

There are many other attributes in SNOMED, subtypes of *Unapproved attribute (attribute)*, which have not yet been evaluated thoroughly and approved for use.

### *Role Hierarchies in SNOMED CT*

Selected SNOMED CT attributes have a hierarchical relationship to one another known as "role hierarchies." In a role hierarchy, one general attribute is the parent of one or more specific subtypes of that attribute. Concepts defined using the more general attribute can inherit concepts modeled with the more specific subtypes of that attribute.

**Role hierarchy used in modeling Clinical Findings**
**ASSOCIATED WITH** role hierarchy:

> **ASSOCIATED WITH**
>> AFTER
>> DUE TO
>> CAUSATIVE AGENT

**Role hierarchies used in modeling Procedures**
**PROCEDURE DEVICE** role hierarchy:

> **PROCEDURE DEVICE**
>> DIRECT DEVICE
>> INDIRECT DEVICE
>> USING DEVICE
>> USING ACCESS DEVICE

**PROCEDURE MORPHOLOGY** role hierarchy:
> **PROCEDURE MORPHOLOGY**
>> DIRECT MORPHOLOGY
>> INDIRECT MORPHOLOGY

**PROCEDURE SITE** role hierarchy:
> **PROCEDURE SITE**
>> PROCEDURE SITE - DIRECT
>> PROCEDURE SITE - INDIRECT

## *4.2  Attributes used to define Clinical Finding concepts*

*NOTE:  Permissible values for these attributes include the concepts listed and their descendants.*

**Table 4.1:  Approved Clinical Finding attributes summary table**

| *Defining Attribute* | Permissible Values (Concepts listed and their descendants) | |
|---|---|---|
| FINDING SITE | *Anatomical structure (body structure)* 91723000 | *Acquired body structure* 280115004 |
| ASSOCIATED MORPHOLOGY | *Morphologically abnormal structure* 49755003 | |
| ASSOCIATED WITH | *Clinical Finding* 404684003 <br> *Procedure* 71388002 <br> *Event* 272379006 <br> *Organism* 410607006 <br> *Substance* 105590001 | *Physical object* 260787004 <br> *Physical force* 78621006 <br> *Pharmaceutical/biologic product* 373873005 <br> *SNOMED CT Concept* 138875005* <br> * For this concept, only the concept and not all of its descendents is allowed as a value. |
| CAUSATIVE AGENT | *Organism* 410607006 <br> *Substance* 105590001 <br> *Physical object* 260787004 <br> *SNOMED CT Concept* 138875005* | *Physical force* 78621006 <br> *Pharmaceutical/biologic product* 373873005 <br> * For this concept, only the concept and not all of its descendents is allowed as a value. |
| DUE TO | *Clinical Finding* 404684003 | *Event* 272379006 |
| AFTER | *Clinical Finding* 404684003 | *Procedure* 71388002 |
| SEVERITY | *Severities* 272141005 | |
| CLINICAL COURSE | *Courses* 288524001 | |
| EPISODICITY | *Episodicities* 288526004 | |
| INTERPRETS | *Observable entity* 363787002 <br> *Laboratory Procedure* 108252007 | *Evaluation procedure* 386053000 |
| HAS INTERPRETATION | *Findings values* 260245000 | *Result comments* 281296001 |
| PATHOLOGICAL PROCESS | *Autoimmune* 263680009 | |
| HAS DEFINITIONAL MANIFESTATION | *Clinical finding* 404684003 | |
| OCCURRENCE | *Periods of life* 282032007 | |
| FINDING METHOD | *Procedure* 71388002 | |
| FINDING INFORMER | *Performer of method (person)* 420158005 <br> *Provider of history other than subject (person)* 420058008 | *Subject of record (person)* 410604004 <br> *Subject of record or other provider of history (person)* 419358007 |

1.  **FINDING SITE**
    This attribute specifies the body site affected by a condition.

    Permissible values include the following concepts and their descendants:

    - *Anatomical structure (body structure)* 91723000
    - *Acquired body structure (body structure)* 280115004

    ***Examples:***

    *(1) Kidney disease (disorder)*
        FINDING SITE *Kidney structure (body structure)*

    *(2) Appendicitis (disorder)*
        FINDING SITE *Appendix structure (body structure)*

2.  **ASSOCIATED MORPHOLOGY**
    This attribute specifies the morphologic changes seen at the tissue or cellular level that are characteristic features of a disease.

    Permissible values include the following concept and its descendants:

    - *Morphologically abnormal structure (morphologic abnormality)* 49755003

    ***Examples:***

    *(1) Bone marrow hyperplasia (disorder)*
        ASSOCIATED MORPHOLOGY *Hyperplasia (morphologic abnormality)*

    *(2) Pancreatitis (disorder)*
        ASSOCIATED MORPHOLOGY *Inflammation (morphologic abnormality)*

3.  **ASSOCIATED WITH**
    This attribute asserts an interaction between two concepts beyond simple co-occurrence in the patient.  ASSOCIATED WITH represents a clinically relevant association between concepts without either asserting or excluding a causal or sequential relationship between the two.

    Permissible values include the following concepts and their descendants:

    - *Clinical finding (finding)* 404684003
    - *Procedure (procedure)* 71388002
    - *Pharmaceutical/biologic product (product)* 373873005
    - *Substance (substance)* 105590001
    - *Organism (organism)* 410607006
    - *Physical object (physical object)* 260787004
    - *Physical force (physical force)* 78621006
    - *Event (event)* 272379006
    - *SNOMED CT Concept* 138875005 (For this concept, only the concept and not all of its descendents is allowed as a value)

ASSOCIATED WITH subsumes the following, more specific, attributes in what is called a role hierarchy (explained in the section on Role Hierarchies):

- AFTER
- DUE TO
- CAUSATIVE AGENT

**AFTER**

This attribute is used to model concepts in which a clinical finding occurs after another clinical finding or procedure.  Neither asserting nor excluding a causal relationship, it instead emphasizes a sequence of events.

Permissible values include the following concepts and their descendants:

- *Clinical finding (finding)* 404684003
- *Procedure (procedure)* 71388002

### *Example:*

*Post-viral disorder (disorder)*

> AFTER *Viral disease (disorder)*

**DUE TO**

This attribute is used to relate a *Clinical finding* directly to its cause.  If a clinical finding merely predisposes to or worsens another disorder, rather than causing it directly, then the more general attribute ASSOCIATED WITH is used instead.

Permissible values include the following concepts and their descendants:

- *Clinical finding (finding)* 404684003
- *Event (event)* 272379006

### *Example:*

*Acute pancreatitis due to infection (disorder)*

> IS_A *Acute pancreatitis (disorder)*

> DUE TO *Infectious disease (disorder)*

**CAUSATIVE AGENT**

This attribute identifies the direct causative agent of a disease.  It does not include vectors, e.g., a mosquito that transmits malaria.

Permissible values include the following concepts and their descendants:

- *Organism (organism)* 410607006
- *Substance (substance)* 105590001
- *Pharmaceutical/biologic product (product)* 373873005
- *Physical object (physical object)* 260787004
- *Physical force (physical force)* 78621006
- *SNOMED CT Concept* 138875005 (For this concept, only the concept and not all of its descendents is allowed as a value)

### *Examples:*

*(1) Bacterial endocarditis (disorder)*
> CAUSATIVE AGENT *Bacterium (organism)*

*(2) Fentanyl allergy (disorder)*
> CAUSATIVE AGENT *Fentanyl (substance)*

*(3) Electrical burn of skin (disorder)*
> CAUSATIVE AGENT *Electricity (physical force)*

## 4.  SEVERITY

This attribute can be used to represent the level of severity for a *Clinical finding* concept. Use of the SEVERITY attribute is sometimes relative. It assumes that the same weighting is used for all Clinical Findings/Disorders to which this attribute is applied, which is not necessarily the case. For instance, "severe" could be interpreted differently for the following set of values:

> Mild / Moderate / Severe
> Minimal / Mild / Moderate / Severe / Very Severe

Also, the decision of when a finding or disorder is mild, moderate or severe is somewhat subjective. The attribute cannot be relied on to retrieve all "severe" findings or disorders in SNOMED CT. Current permissible values include:

- Descendants of *Severities (qualifier value)* 272141005 which include but are not limited to:
  - *Mild (qualifier value)*
  - *Moderate (severity modifier) (qualifier value)*
  - *Severe (severity modifier) (qualifier value)*

## 5.  CLINICAL COURSE

This attribute is a new defining attribute for the January 2007 release.  It is intended to represent both the course and onset of a disease. It replaces the earlier attributes COURSE and ONSET. Many conditions with an acute onset also have an acute course. Some of the permissible values for the retired attributes COURSE and ONSET have been merged to allow a more general meaning. This general meaning is now represented using the attribute CLINICAL COURSE.

Permissible values include the following concept and its descendants:

- *Courses (qualifier value)* 288524001

### *Examples:*

*(1) Acute amebic dysentery (disorder)*

> CLINICAL COURSE *Sudden onset AND/OR short duration (qualifier value)*

*(2) Chronic fibrosing pancreatitis (disorder)*

> CLINICAL COURSE *Chronic clinical course (qualifier value)*

**NOTE:** The attributes ONSET and COURSE have been retired for the January 2007 release. While ONSET was intended to specify the period of onset or the temporal pattern of presentation for a given condition, it was easily confused with the attribute COURSE used to represent the clinical course of a condition. Because there was not consistent agreement between observers making this distinction, the two attributes were retired. The new attribute CLINICAL COURSE is used to capture information previously represented with COURSE and ONSET.

### 6. EPISODICITY
There was a change in the use/meaning of this attribute in the July 2006 release. EPISODICITY originated in the National Health Service Clinical Terms Version 3 where it was used not to specify the first episode of a disease for a patient but rather, the first time a patient presented to their general practitioner (GP) for a particular disorder. A first episode of asthma was not intended to represent the first time a patient had asthma, but rather the first time a patient presented to their GP with asthma. EPISODICITY has been removed from existing concepts and is no longer used in pre-coordinated definitions. It can still be used in post-coordination as a qualifier.

Current permissible values include the following concept and its descendants:

- *Episodicities (qualifier value)* 288526004

### 7. INTERPRETS
This attribute refers to the entity being evaluated or interpreted, when an evaluation, interpretation or "judgment" is intrinsic to the meaning of a concept.  This attribute is usually grouped with the HAS INTERPRETATION attribute.

Permissible values include the following concepts and their descendants:

- *Observable entity (observable entity)* 363787002
- *Laboratory procedure (procedure)* 108252007
- *Evaluation procedure (procedure)* 386053000

### *Example:*

*Decreased muscle tone (finding)*

INTERPRETS *Muscle tone (observable entity)*

> HAS INTERPRETATION *Decreased (qualifier value)*

8. **HAS INTERPRETATION**
   This attribute is always grouped with the attribute INTERPRETS, and designates the judgment aspect being evaluated or interpreted for a concept (e.g., presence, absence, degree, normality, abnormality, etc.).

   Permissible values include the following concepts and their descendants:

   - *Findings values (qualifier value)* 260245000
   - *Result comments (qualifier value)* 281296001

   ***Example:***

   Decreased muscle tone (finding)

         INTERPRETS *Muscle tone (observable entity)*

         HAS INTERPRETATION *Decreased (qualifier value)*

9. **PATHOLOGICAL PROCESS**
   This attribute provides information about the underlying pathological process for a disorder that is not structural and not represented by the ASSOCIATED MORPHOLOGY attribute. Permissible values include the following concept:

   - *Autoimmune (qualifier value)* 263680009

   ***Example:***

   *Autoimmune parathyroiditis (disorder)*

         PATHOLOGICAL PROCESS *Autoimmune (qualifier value)*

10. **HAS DEFINITIONAL MANIFESTATION**
    This attribute links disorders to clinical findings that are always present, by definition. It is used when an essential feature of a disorder is a clinical finding.  It can only be applied to disorders.

    Permissible values include the following concept and its descendants:

    - *Clinical finding (finding)* 404684003

11. **OCCURRENCE**
    This attribute refers to the specific period of life during which a condition first presents.  This does not mean the condition cannot persist beyond the period of life in which it first presents.

    Permissible values include the following concept and its descendants:

    - *Periods of life (qualifier value)* 282032007

    ***Example:***

    *Childhood phobic anxiety disorder (disorder)*

          OCCURRENCE *Childhood (qualifier value)*

## 12. FINDING METHOD

This attribute specifies the means by which a clinical finding was determined.  This attribute is frequently used in conjunction with FINDING INFORMER. Findings that specify that they were determined by examination of the patient (e.g., *On examination - ankle clonus (finding)*) should have a value for both FINDING METHOD and FINDING INFORMER.

 Permissible values include the following concept and its descendants:

- *Procedure (procedure)* 71388002

### Example:

*Finding by palpation (finding)*

> FINDING METHOD *Palpation (procedure)*

## 13. FINDING INFORMER

This attribute specifies the person or other entity from which the clinical finding information was obtained.  This attribute is frequently used in conjunction with FINDING METHOD.

Permissible values include the following concepts and their descendants:

- *Subject of record or other provider of history (person)* 419358007
- *Subject of record (person)* 410604004
- *Provider of history other than subject (person)* 420058008
- *Performer of method (person)* 420158005

### Examples:

*(1) On examination - ankle clonus (finding)*

> FINDING INFORMER *Performer of method (person)*

*(2) Complaining of a headache (finding)*

> FINDING INFORMER *Subject of record or other provider of history (person)*

## *4.3  Attributes used to define Procedure concepts*

**NOTE:** *Permissible values for these attributes include the concepts listed and their descendants.*

### *Table 4.2:  Approved Procedure attributes summary table*

| *Defining Attribute* | Permissible Values (Concepts listed and their descendents) | |
|---|---|---|
| PROCEDURE SITE<br>    PROCEDURE SITE - DIRECT<br>    PROCEDURE SITE - INDIRECT | *Anatomical structure (body structure)* 91723000 | *Acquired body structure* 280115004 |
| PROCEDURE MORPHOLOGY<br>    DIRECT MORPHOLOGY<br>    INDIRECT MORPHOLOGY | *Morphologically abnormal structure* 49755003 | |
| METHOD | *Action* 129264002 | |
| PROCEDURE DEVICE<br>  DIRECT DEVICE<br>  INDIRECT DEVICE<br>  USING DEVICE<br>  USING ACCESS DEVICE | *Device* 49062001 | |
| ACCESS | *Surgical access values* 309795001 | |
| APPROACH | *Procedural approach* 103379005 | |
| DIRECT SUBSTANCE | *Substance* 105590001 | *Pharmaceutical/biologic product* 373873005 |
| PRIORITY | *Priorities* 272125009 | |
| HAS FOCUS | *Clinical finding* 404684003 | *Procedure* 71388002 |
| HAS INTENT | *Intents (nature of procedure values)* 363675004 | |
| RECIPIENT CATEGORY | *Person* 125676002<br>*Family* 35359004<br>*Community* 133928008 | *Donor for medical or surgical procedure* 105455006<br>*Group* 389109008 |
| REVISION STATUS | *Primary operation* 261424001<br>*Revision-value* 255231005 | *Part of multistage procedure* 257958009 |
| ROUTE OF ADMINISTRATION*<br>*Note: See explanation below for domain of this attribute | *Route of administration value* 284009009 | |
| USING SUBSTANCE | *Substance* 105590001 | |
| USING ENERGY | *Physical force* 78621006 | |

1. **PROCEDURE SITE**
   This attribute describes the body site acted on or affected by a procedure.  This attribute subsumes, in what is called a role hierarchy (explained in Section 4.1 on Role Hierarchies), the more specific attributes (PROCEDURE SITE - DIRECT and PROCEDURE SITE - INDIRECT) that should be used if possible.  The anatomical site may be directly acted on (PROCEDURE SITE - DIRECT) or indirectly acted upon (PROCEDURE SITE - INDIRECT).

   When modeling procedures where the METHOD is *Removal-action* or one of its subtypes (e.g., *Excision*, *Surgical biopsy*, etc.), removals **of** the structure itself should use PROCEDURE SITE - DIRECT.  Removals of tissue lesions (cysts, tumors, etc.) are considered to be removals of the site, and should also use PROCEDURE SITE -

DIRECT.  Removals of devices, calculi, thrombi, foreign bodies and other non-tissue entities **from** the structure should use PROCEDURE SITE - INDIRECT.

Permissible values include the following concepts and their descendants:

- *Anatomical structure (body structure)* 91723000
- *Acquired body structure (body structure)* 280115004

**PROCEDURE SITE - DIRECT**

This attribute is used when the action of the procedure is directly aimed at an anatomical structure or site rather than at something else (such as a device) located there.

Permissible values include the following concepts and their descendants:

- *Anatomical structure (body structure)* 91723000
- *Acquired body structure (body structure)* 280115004

*Examples:*

*(1) Amputation of the foot (procedure)*
> METHOD *Amputation - action (qualifier value)*
> PROCEDURE SITE - DIRECT *Foot structure (body structure)*

*(2) Biopsy of femur (procedure)*
> METHOD *Biopsy - action (qualifier value)*
> PROCEDURE SITE - DIRECT *Bone structure of femur (body structure)*

**PROCEDURE SITE - INDIRECT**

This attribute describes the anatomical site, which is acted upon, but is not the direct object of the procedure (The site is indirectly acted on by the procedure.).  Usually in these procedures there is another value that is the direct object of the action.

Permissible values include the following concepts and their descendants:

- *Anatomical structure (body structure)* 91723000
- *Acquired body structure (body structure)* 280115004

*Examples:*

*(1) Removal of catheter from brachial vein (procedure)*
> METHOD *Removal-action (qualifier value)*
> DIRECT DEVICE *Catheter, device (physical object)*
> PROCEDURE SITE - INDIRECT S*tructure of brachial vein (body structure)*

*(2) Removal of calculus of urinary bladder (procedure)*
> METHOD *Removal-action (qualifier value)*
> DIRECT MORPHOLOGY *Calculus (morphologic abnormality)*
> PROCEDURE SITE - INDIRECT *Urinary bladder structure (body structure)*

2.  **PROCEDURE MORPHOLOGY**
    This attribute is used to specify the morphology or abnormal structure involved in the procedure.  This attribute subsumes, in what is called a role hierarchy (explained in the section 4 on Role Hierarchies), the more specific attributes (DIRECT MORPHOLOGY and INDIRECT MORPHOLOGY) that should be used if possible. DIRECT MORPHOLOGY is used when the procedure method acts directly on the morphologic abnormality.  INDIRECT MORPHOLOGY is used when the procedure method acts directly on something else (e.g., a device, substance or anatomical structure) that is associated with the morphologic abnormality.  The more general attribute PROCEDURE MORPHOLOGY is used when defining general concepts that subsume both kinds of sub-concepts.

    Permissible values include the following concept and its descendants:

    - *Morphologically abnormal structure (morphologic abnormality)* 49755003

### DIRECT MORPHOLOGY

This attribute describes the morphology to which the procedure is directed.

Permissible values include the following concept and its descendants:

- *Morphologically abnormal structure (morphologic abnormality)* 49755003

### *Example:*

*Excision of benign neoplasm (procedure)*

       METHOD *Excision - action (qualifier value)*

       DIRECT MORPHOLOGY *Neoplasm, benign (morphologic abnormality)*

### INDIRECT MORPHOLOGY

This attribute represents a morphology that is acted upon, but is not the direct target of the action being performed (i.e., the procedure's method acts directly on something else, such as a device, substance, or anatomical structure).

Permissible values include the following concept and its descendants:

- *Morphologically abnormal structure (morphologic abnormality)* 49755003

### *Example:*

*Removal of mesh from wound (procedure)*

       METHOD *Removal - action (qualifier value)*

       DIRECT DEVICE *Mesh (physical object)*

       INDIRECT MORPHOLOGY *Wound (morphologic abnormality)*

3.  **METHOD**
    This attribute represents the action being performed to accomplish the procedure.  It does not include the access (e.g., percutaneous), approach (e.g., translumbar), equipment (e.g., sutures), or physical forces (e.g., laser energy).

    Permissible values include the following concept and its descendants:

    - *Action (qualifier value)* 129264002

### Example:

*Incision of ureter (procedure)*

> METHOD *Incision-action (qualifier value)*

> PROCEDURE SITE - DIRECT *Ureteric structure (body structure)*

## 4. PROCEDURE DEVICE

This attribute describes devices associated with a procedure. This general attribute subsumes, in what is called a role hierarchy (explained in Section 4.1 on Role Hierarchies), the more specific attributes (DIRECT DEVICE, INDIRECT DEVICE, USING DEVICE, and USING ACCESS DEVICE), which should be used instead of PROCEDURE DEVICE if possible. The general attribute PROCEDURE DEVICE is mainly useful for defining high-level, general concepts that aggregate procedures according to the device involved.

### Example:

*Catheter procedure (procedure)*

> DEVICE *Catheter, device (physical object)*


Permissible values include the following concept and its descendants:

- *Device (physical object)* 49062001


When the device is the focus or direct object of the procedure, the attribute DIRECT DEVICE is used. When the action is done on something that is located in or on a device, but not directly on the device itself, the attribute INDIRECT DEVICE is used. When the device is used to carry out the procedure the attribute USING DEVICE is used. When the device is used to access the site of the procedure, the attribute USING ACCESS DEVICE is used.

*NOTE: The attributes USING and ACCESS INSTRUMENT have been retired. USING DEVICE and USING ACCESS DEVICE have been added.*


### DIRECT DEVICE

This attribute represents the device on which the method directly acts.

Permissible values include the following concept and its descendants:

- *Device (physical object)* 49062001

### Example:

*Removal of arterial stent (procedure)*

> METHOD *Removal - action (qualifier value)*

> DIRECT DEVICE *Arterial stent (physical object)*

**INDIRECT DEVICE**

This attribute models action done on something that is located in or on a device, but is not done directly on the device itself.

Permissible values include the following concept and its descendants:

- *Device (physical object)* 49062001

For the example below, the vegetation is being excised. The mitral valve prosthesis is where the excised vegetation is located but the mitral valve prosthesis itself is not excised. Thus, mitral valve prosthesis is the INDIRECT DEVICE.

### *Example:*

*Excision of vegetations from implanted mitral valve (procedure)*

       METHOD *Excision - action (qualifier value)*

       DIRECT MORPHOLOGY *Vegetation (morphologic abnormality)*

       INDIRECT DEVICE *Mitral valve prosthesis, device (physical object)*

       PROCEDURE SITE - INDIRECT *Mitral valve structure (body structure)*


*NOTE:* The attribute INDIRECT DEVICE is infrequently used.

**USING DEVICE**

This attribute refers to the instrument or equipment utilized to execute an action. USING DEVICE is used when the device is actually used to carry out the action that is the focus of the procedure. If the device is simply the means to access the site of the procedure, then USING ACCESS DEVICE is used instead of USING DEVICE.

Permissible values include the following concept and its descendants:

- *Device (physical object)* 49062001


### *Example:*

*Core needle biopsy of larynx (procedure)*

       METHOD *Biopsy - action (qualifier value)*

       USING DEVICE *Core biopsy needle, device (physical object)*

       PROCEDURE SITE - DIRECT *Laryngeal structure (body structure)*


*NOTE:* USING DEVICE replaces the attribute USING which has been retired for the January 2007 release. The retired attribute USING allowed values that included descendents of *Physical force (physical force)* 78621006 which are not actually devices. Additionally, the new DEVICE attributes are intended to clarify the inconsistency that existed over when to use the attribute USING versus ACCESS INSTRUMENT versus ACCESS, particularly for *Endoscopic procedures*.

### USING ACCESS DEVICE

This attribute specifies the instrument or equipment used to access the site of a procedure.

Permissible values include the following concept and its descendants:

- *Device (physical object)* 49062001

### *Example:*

*Arthroscopic synovial biopsy (procedure)*

METHOD *Biopsy - action (qualifier value)*

USING ACCESS DEVICE *Arthroscope, device (physical object)*

PROCEDURE SITE - DIRECT *Structure of synovial tissue of joint (body structure)*

***NOTE:*** USING ACCESS DEVICE replaces the attribute ACCESS INSTRUMENT which has been retired for the January 2007 release. When USING ACCESS DEVICE has a value of *Endoscope, device (physical object)* or one of its descendents, it no longer requires the use of ACCESS *Endoscopic approach - access (qualifier value)* as was previously required for *Endoscopic procedures*.

5. **ACCESS**
   This attribute describes the route used to access the site of a procedure.  It is used to distinguish open, closed, and percutaneous procedures. Permissible values include the following concept and its descendants:

   - *Surgical access values (qualifier value)* 309795001

   ### *Example:*

   *Open reduction of fracture (procedure)*
   
   ACCESS *Open approach-access (qualifier value)*

***NOTE:*** As of the January 2007 release, ACCESS is no longer used to capture that the route used to access a procedure was endoscopic. The information that was previously captured by ACCESS *Endoscopic approach-access (qualifier value)* is adequately captured with USING ACCESS DEVICE *Endoscope, device (physical object)*.

6. **APPROACH**
   This attribute specifies the directional, relational, or spatial access to the site of a procedure.

   Permissible values include the following concept and its descendants:

   - *Procedural approach (qualifier value)* 103379005

*Examples:*

*(1) Intranasal ethmoidectomy (procedure)*
      APPROACH *Intranasal approach (qualifier value)*

*(2) Abdominal hysterectomy (procedure)*
      APPROACH *Abdominal approach (qualifier value)*

## 7. DIRECT SUBSTANCE

This attribute describes the *Substance* or *Pharmaceutical/Biologic product* on which the procedure's method directly acts.

Permissible values include the following concepts and their descendants:

- *Substance (substance)* 105590001
- *Pharmaceutical/biologic product (product)* 373873005 (When there is a choice, the use of *Substance* is preferred over *Product*.)

### Example:

*Injection of prostaglandin (procedure)*
      METHOD *Injection - action (qualifier value)*
      DIRECT SUBSTANCE *Prostaglandin (substance)*

## 8. PRIORITY

This attribute refers to the priority assigned to a procedure.

Permissible values include the following concept and its descendants:

- *Priorities (qualifier value)* 272125009

### Example:

*Emergency cesarean section (procedure)*
      PRIORITY *Emergency (qualifier value)*

## 9. HAS FOCUS

This attribute specifies the *Clinical finding* or *Procedure* which is the focus of a procedure.

Permissible values include the following concepts and their descendants:

- *Clinical finding (finding)* 404684003
- *Procedure (procedure)* 71388002

### Example:

*Cardiac rehabilitation assessment (regime/therapy)*
      HAS FOCUS *Cardiac rehabilitation (regime/therapy)*

## 10. HAS INTENT

This attribute specifies the intent of a procedure.

Permissible values include the following concept and its descendants:

- *Intents (nature of procedure values) (qualifier value)* 363675004

### *Example:*

*Diagnostic bronchoscopy (procedure)*

> HAS INTENT *Diagnostic-procedure intent (qualifier value)*

## 11. RECIPIENT CATEGORY

This attribute specifies the recipient of a procedure, such as an individual group, when this individual or group is someone other than a patient.  For example, it can be used in blood banking procedures to differentiate between the donor and recipient.

Permissible values include the following concepts and their descendants:

- *Person (person)* 125676002
- *Family (social concept)* 35359004
- *Community (social concept)* 133928008
- *Group (social concept)* 389109008
- *Donor for medical or surgical procedure (person)* 105455006

### *Example:*

*Social service interview of family (procedure)*

> RECIPIENT CATEGORY *Family (social concept)*

## 12. REVISION STATUS

This attribute specifies whether a procedure is primary or a revision.

Permissible values include the following concepts and their descendants:

- *Primary operation (qualifier value)* 261424001
- *Revision-value (qualifier value)* 255231005
- *Part of multistage procedure (qualifier value)* 257958009

### *Examples:*

*(1) Primary repair of inguinal hernia (procedure)*

> REVISION STATUS *Primary operation (qualifier value)*

*(2) Revision of knee arthroplasty (procedure)*

> REVISION STATUS *Revision-value (qualifier value)*

## 13. ROUTE OF ADMINISTRATION

This attribute was added in the January 2006 release to allow a procedure to be more fully modeled so that its definition includes the route of administration of a given substance.

The domain for this attribute is not the entire Procedure hierarchy but rather the subhierachy of concepts that descend from *Administration of treatment via specific route (procedure)* 394898006.

Permissible values include the following concept and its descendants:

- *Route of administration value (qualifier value)* 284009009

### Example:

*Inhaled drug administration (procedure)*

> ROUTE OF ADMINISTRATION *By inhalation (route) (qualifier value)*

## 14. USING SUBSTANCE

This is a new attribute introduced in the January 2007 release. This attribute describes the *Substance* used to execute the action of a procedure, but it is not the substance on which procedure's method directly acts (the DIRECT SUBSTANCE). Permissible values include the following concepts and their descendants:

- *Substance (substance)* 105590001

### Example:

*Contrast radiography of esophagus (procedure)*

> METHOD *Radiographic imaging - action (qualifier value)*
>
> PROCEDURE SITE - DIRECT *Esophageal structure (body structure)*
>
> USING SUBSTANCE *Contrast media (substance)*

## 15. USING ENERGY
This is a new attribute introduced in the January 2007 release. This attribute describes the energy used to execute an action. USING ENERGY has been introduced because the new attribute USING DEVICE is now used only to represent the instrument or equipment used to execute the action. Unlike the attribute USING, which it replaces, USING DEVICE does not take values from the *physical force* hierarchy.

Permissible values include the following concepts and its descendants:

- *Physical force (physical force)* 78621006

### Example:

*Gamma ray therapy (procedure)*

> USING ENERGY *Gamma radiation (physical force)*

## *4.4  Attributes used to define Measurement Procedure concepts*

The following six attributes are used by the LOINC integration table but have not been fully modeled in SNOMED.

*NOTE:  Permissible values for these attributes include the concepts listed and their descendants.*

*Table 4.3:  Approved Measurement Procedure attributes summary table*

| *Defining Attribute* | Permissible Values (Concepts listed and their descendents) | |
|---|---|---|
| HAS SPECIMEN | *Specimen* 123038009 | |
| COMPONENT | *Substance* 105590001 | *Cell structure* 4421005 |
| | *Observable entity* 363787002 | *Organism* 410607006 |
| TIME ASPECT | *Time frame* 7389001 | |
| PROPERTY | *Property of measurement* 118598001 | |
| SCALE TYPE | *Quantitative* 30766002 | *Nominal value* 117362005 |
| | *Qualitative* 26716007 | *Narrative value* 117364006 |
| | *Ordinal value* 117363000 | *Text value* 117444000 |
| | *Ordinal or quantitative value* 117365007 | |
| MEASUREMENT METHOD | *Laboratory procedure categorized by method* 127789004 | |

1. **HAS SPECIMEN**
   This attribute specifies the type of specimen on which a measurement or observation is performed.

   Permissible values include the following concepts and their descendants:

   - *Specimen (specimen)* 123038009

2. **COMPONENT**
   This attribute refers to what is being observed or measured by a procedure.

   Permissible values include the following concepts and their descendants:

   - *Substance (substance)* 105590001
   - *Observable entity (observable entity)* 363787002
   - *Cell structure (cell structure)* 4421005
   - *Organism (organism)* 410607006

   ***Example:***

   *Protein measurement (procedure)*

   > COMPONENT *Protein (substance)*

3. **TIME ASPECT**
   This attribute specifies temporal relationships for a measurement procedure.

   Permissible values include the following concept and its descendants:

   - *Time frame (qualifier value)* 7389001

4. **PROPERTY**
   This attribute specifies the kind of property being measured (e.g., concentration).

   Permissible values include the following concept and its descendants:

- *Property of measurement (qualifier value)* 118598001

**5.  SCALE TYPE**

This attribute refers to the scale of the result of an observation of a diagnostic test (i.e., quantitative, qualitative, semi-quantitative).

Permissible values include the following concepts and their descendants:

- *Quantitative (qualifier value)* 30766002
- *Qualitative (qualifier value)* 26716007
- *Ordinal value (qualifier value)* 117363000
- *Ordinal or quantitative value (qualifier value)* 117365007
- *Nominal value (qualifier value)* 117362005
- *Narrative value (qualifier value)* 117364006
- *Text value (qualifier value)* 117444000

**6.  MEASUREMENT METHOD**

This attribute specifies the method by which a procedure is performed.

Permissible values include the following concept and its descendants:

- *Laboratory procedure categorized by method (procedure)* 127789004

## 4.5  Attributes used to define Specimen concepts

**NOTE:**  *Permissible values for these attributes include the concepts listed and their descendants.*

***Table 4.4:  Approved Specimen attributes summary table***

| Defining Attribute | Permissible Values (Concepts listed and their descendents) | |
|---|---|---|
| SPECIMEN PROCEDURE | *Procedure* 71388002 | |
| SPECIMEN SOURCE TOPOGRAPHY | *Anatomical structure (body structure)* 91723000 | *Acquired body structure* 280115004 |
| SPECIMEN SOURCE MORPHOLOGY | *Morphologically abnormal structure* 49755003 | |
| SPECIMEN SUBSTANCE | *Substance* 105590001 | |
| SPECIMAN SOURCE IDENTITY | *Person* 125676002 | *Donor* 261008006 |
| | *Family* 35359004 | *Device* 49062001 |
| | *Community* 133928008 | *Environments* 276339004 |

1. **SPECIMEN PROCEDURE**
   This attribute identifies the procedure by which a specimen is obtained.

   Permissible values include the following concept and its descendants:

   - *Procedure (procedure)* 71388002

   ***Examples:***

   *(1) Urine specimen obtained by clean catch procedure (specimen)*
   >  SPECIMEN PROCEDURE *Urine specimen collection, clean catch (procedure)*

   *(2) Specimen from stomach obtained by total gastrectomy (specimen)*
   >  SPECIMEN PROCEDURE *Total gastrectomy (procedure)*

2. **SPECIMEN SOURCE TOPOGRAPHY**
   This attribute specifies the anatomic site from which a specimen is obtained.

   Permissible values include the following concepts and their descendants:

   - *Anatomical structure (body structure)* 91723000
   - *Acquired body structure (body structure)* 280115004

   ***Examples:***

   *(1) Cervix cytologic material (specimen)*
   >  SPECIMEN SOURCE TOPOGRAPHY *Cervix uteri structure (body structure)*

   *(2) Omentum biopsy sample (specimen)*
   >  SPECIMEN SOURCE TOPOGRAPHY *Omentum structure (body structure)*

### 3. SPECIMEN SOURCE MORPHOLOGY

This attribute names the morphologic abnormality from which a specimen is obtained.

Permissible values include the following concept and its descendants:

- *Morphologically abnormal structure (morphologic abnormality)* 49755003

### *Example:*

*(1) Specimen from cyst (specimen)*
>   SPECIMEN SOURCE MORPHOLOGY *Cyst (morphologic abnormality)*

*(2) Specimen from wound abscess (specimen)*
>   SPECIMEN SOURCE MORPHOLOGY *Abscess of wound (morphologic abnormality)*

### 4. SPECIMEN SUBSTANCE

This attribute names the type of substance of which a specimen is comprised.

Permissible values include the following concept and its descendants:

- *Substance (substance)* 105590001

### *Example:*

*(1) Mid-stream urine sample (specimen)*
>   SPECIMEN SUBSTANCE *Urine (substance)*

*(2) Pancreatic fluid specimen (specimen)*
>   SPECIMEN SUBSTANCE *Pancreatic fluid (substance)*

### 5. SPECIMEN SOURCE IDENTITY

This attribute names the type of individual, group, or physical location from which a specimen is collected.

Permissible values include the following concepts and their descendants:

- *Person (person)* 125676002
- *Family (social concept)* 35359004
- *Community (social concept)* 133928008
- *Donor (qualifier value)* 261008006
- *Device (physical object)* 49062001
- *Environment (environment)* 276339004

### *Examples:*

*(1) Catheter tip specimen (specimen)*
>   SPECIMEN SOURCE IDENTITY *Catheter tip, device (physical object)*

*(2) Blood specimen from blood donor (specimen)*
>   SPECIMEN SOURCE IDENTITY *Blood donor (person)*

## 4.6  Attributes used to define Body structure concepts

*NOTE:  Permissible values for these attributes include the concepts listed and their descendants.*

*Table 4.5:  Attributes for Body structure concepts summary table*

| Defining Attribute | Permissible Values |
|---|---|
| LATERALITY | *Side* 182353008 |
|  | *Left* 7771000 |
|  | *Right* 24028007 |
|  | *Right and left* 51440002 |
|  | *Unilateral* 66459002 |

### LATERALITY

This attribute provides information on whether a body structure is left, right, bilateral or unilateral. It is applied only to bilaterally symmetrical body structures which exist on opposite sides of the body.

Permissible values include the following concepts:

- *Side (qualifier value)* 182353008
-  *Left (qualifier value)* 7771000
- *Right (qualifier value)* 24028007
- *Right and left(qualifier value)*  51440002
- *Unilateral (qualifier value)* 66459002

### Example:

*Left kidney structure (body structure)*
        LATERALITY *Left (qualifier value)*

## 4.7  Attributes used to define Pharmaceutical/Biologic Product concepts

*NOTE:  Permissible values for these attributes include the concepts listed and their descendants.*

*Table 4.6:  Approved Pharmaceutical/Biologic Product attributes summary table*

| Defining Attribute | Permissible Values (Concepts listed  and their descendents) |
|---|---|
| HAS ACTIVE INGREDIENT | *Substance* 105590001 |
| HAS DOSE FORM | *Type of drug preparation* 105904009 |

1. **HAS ACTIVE INGREDIENT**
   This attribute indicates the active ingredient of a drug product, linking the *Pharmaceutical/Biologic product* hierarchy to the *Substance* hierarchy.

   Permissible values include the following concept and its descendants:

   - *Substance (substance)* 105590001

### *Example:*

*Naproxen 500mg tablet (product)*

> HAS ACTIVE INGREDIENT *Naproxen (substance)*

**2. HAS DOSE FORM**

This attributes specifies the dose form of a product.

Permissible values include the following concept and its descendants:

- *Type of drug preparation (product)* 105904009

### *Example:*

*Digoxin 0.1mg capsule (product)*

> HAS DOSE FORM *Capsule dose form (product)*

## 4.8  Attributes used to define Situation with explicit context concepts

*NOTE:  Permissible values include the concepts listed and their descendants.*

***Table 4.7:  Approved Context attributes summary table***

| *Defining Attribute* | Permissible Values (Concepts listed and their descendents) |
|---|---|
| ASSOCIATED FINDING | *Clinical finding* 404684003 |
| FINDING CONTEXT | *Finding context value* 410514004 |
| ASSOCIATED PROCEDURE | *Procedure* 71388002 |
| PROCEDURE CONTEXT | *Context values for actions* 288532009 |
| TEMPORAL CONTEXT | *Temporal context value* 410510008 |
| SUBJECT RELATIONSHIP CONTEXT | *Person* 125676002 |

### *Context*

The meaning conveyed by a SNOMED CT concept in a medical record is affected by the context in which it is recorded.  For instance, "Breast cancer" might be used to indicate a Family history of breast cancer, a Past history of breast cancer, or a Current diagnosis of breast cancer.  Each of these three meanings differs in regard to the context in which breast cancer is being described.  Family history of breast cancer refers to breast cancer occurring in a family member of a patient.  Past history of breast cancer indicates that the breast cancer occurred in the patient, at some time in the past, and it is not necessarily present now.  Current diagnosis of breast cancer indicates that the breast cancer is present now, and in this patient.

### *Default context*

When a SNOMED CT concept appears in a record without any explicitly stated context, then that concept is considered to have a "soft-default" context.

The soft default context for a *Clinical finding* means that the finding has actually occurred (vs. being absent), it is occurring to the subject of record (the patient), and it is occurring currently or at a stated past time.

The soft default context for a *Procedure* means that the procedure was completed, was performed on the subject of record (the patient), and was done in the present time or at a stated past time.

## *Axis modifiers*

The six attributes used for modeling context-dependent concepts in SNOMED CT permit representation of various contexts.  When used to represent something other than the soft default context, these context-modifying attributes modify the meaning of a *Clinical finding* or *Procedure* in a way that changes the "axis" or hierarchy of the concept.  The resulting, modified concept is not a subtype of the original concept to which the attribute was applied.  This is not the case with the other attributes in SNOMED CT.  Although the non-context modifying attributes also change the meaning of concept to which they are applied, the resulting concept is still a subtype of the original concept.

For instance, if the concept *Fine needle biopsy (procedure)* is given the non-context modifying attribute PROCEDURE SITE and a value *Urinary bladder structure (body structure),* the resulting concept *Fine needle biopsy of urinary bladder (procedure)* is still a subtype of the original concept *Fine needle biopsy (procedure).*

However, the concept *Urine protein test not done (situation)* has the context-modifying attribute PROCEDURE CONTEXT and a value of *Not done (qualifier value),* and the resulting concept is not a subtype of *Urine protein test (procedure).*

## *Overview of the context attributes*

Of the six attributes applied to concepts in the *Situation with explicit context* hierarchy, two are used only in representing the context in which a *Clinical finding* is recorded, (ASSOCIATED FINDING and FINDING CONTEXT); two are used only in representing the context in which a *Procedure* is recorded (ASSOCIATED PROCEDURE and PROCEDURE CONTEXT); and two attributes are used in representing the context of both *Procedures* and *Clinical findings* (SUBJECT RELATIONSHIP CONTEXT and TEMPORAL CONTEXT).

1. **ASSOCIATED FINDING**
   This attribute links concepts in the *Situation with explicit context* hierarchy to their related *Clinical finding*.  It specifies the *Clinical finding* concept whose context is being modified.

   Permissible values include the following concept and its descendants:

   - *Clinical finding (finding)* 404684003

   ### *Example:*

   *Family history of stroke (situation)*

      ASSOCIATED FINDING *Cerebrovascular accident (disorder)*

2. **FINDING CONTEXT**
   This attribute indicates whether the associated *Clinical finding* is known or unknown, and whether it is present or absent.

   Permissible values include the following concept and its descendants:

   - *Finding context value (qualifier value)* 410514004

### *Example:*

*No cough (situation)*

> ASSOCIATED FINDING *Cough (finding)*

> FINDING CONTEXT *Known absent (qualifier value)*

**3.  ASSOCIATED PROCEDURE**

This attribute links concepts in the *Situation with explicit context* hierarchy to concepts in the *Procedure* hierarchy for which there is additional specified context.

Permissible values include the following concept and its descendants:

- *Procedure (procedure)* 71388002

### *Example:*

*Operative procedure planned (situation)*

> ASSOCIATED PROCEDURE *Surgical procedure (procedure)*

**4.  PROCEDURE CONTEXT**

This attribute indicates the degree of completion, or status, of a *Procedure*.

Permissible values include the following concept and its descendants:

- *Context values for actions (qualifier value)* 288532009

### *Example:*

*Operative procedure planned (situation)*

> ASSOCIATED PROCEDURE *Surgical procedure (procedure)*

> PROCEDURE CONTEXT *Planned (qualifier value)*

**5.  TEMPORAL CONTEXT**

This attribute indicates the time of occurrence of a *Clinical finding* or *Procedure*, expressing whether or not the *Clinical finding* or *Procedure* was current when the concept was entered into the record.

Permissible values include the following concept and its descendants:

- *Temporal context value (qualifier value)* 410510008

### *Example:*

*History of - hematuria (situation)*

> ASSOCIATED FINDING *Blood in urine (finding)*

> TEMPORAL CONTEXT *In the past (qualifier value)*

**6.  SUBJECT RELATIONSHIP CONTEXT**

This attribute is used to specify the relationship between the subject of the record and the subject of the *Clinical finding* or *Procedure* being recorded.  In the example below, the subject of the record is the patient and the subject who smokes is the patient's father.

Permissible values include the following concept and its descendants:

- *Person (person)* 125676002

### Example:

*Father smokes (situation)*

> ASSOCIATED FINDING *Smoker (finding)*

> SUBJECT RELATIONSHIP CONTEXT *Father (person)*

## 4.9 Attributes used to define Event concepts

**NOTE:** *Permissible values for these attributes include the concepts listed and their descendants.*

**Table 4.5: Attributes for Event concepts summary table**

| *Defining Attribute* | Permissible Values (Concepts listed and their descendants) | |
|---|---|---|
| ASSOCIATED WITH | *Clinical Finding* 404684003<br>*Procedure* 71388002<br>*Event* 272379006<br>*Organism* 410607006<br>*Substance* 105590001 | *Physical object* 260787004<br>*Physical force* 78621006<br>*Pharmaceutical/biologic product* 373873005<br>*SNOMED CT Concept* 138875005*<br>* For this concept, only the concept and not all of its descendents is allowed as a value. |
| CAUSATIVE AGENT | *Organism* 410607006<br>*Substance* 105590001<br>*Physical object* 260787004<br>*SNOMED CT Concept* 138875005* | *Physical force* 78621006<br>*Pharmaceutical/biologic product* 373873005<br>* For this concept, only the concept and not all of its descendents is allowed as a value. |
| DUE TO | *Clinical Finding* 404684003 | *Event* 272379006 |
| AFTER | *Clinical Finding* 404684003 | *Procedure* 71388002 |
| OCCURRENCE | *Periods of life* 282032007 | |

In January 2006, a limited number of concepts from the *Clinical finding* hierarchy were moved to the *Event* hierarchy. The attributes used to define those concepts when they were descendents of *Clinical finding* were retained after the concepts were moved to the *Event* hierarchy.  Definitive editorial policies for the use of attributes in the *Event* hierarchy have yet to be established.

## *4.10 Attributes used to define Physical object concepts*

**NOTE:** *Permissible values for these attributes include the concepts listed and their descendants.*

***Table 4.6: Attributes for Physical object concepts summary table***

| *Defining Attribute* | Permissible Values (Concept listed and its descendents) |
|---|---|
| HAS ACTIVE INGREDIENT | *Substance* 105590001 |

A limited number of concepts (drug-eluting stents) reside in both the *Pharmaceutical / biologic product* hierarchy and the *Physical object* hierarchy. Because the HAS ACTIVE INGREDIENT attribute was applied to these concepts in the *Pharmaceutical / biologic product* hierarchy, it is applied to these concepts in the *Physical object* hierarchy. Definitive editorial policies for the use of attributes in the *Physical object* hierarchy have yet to be established.

## *4.11 Role Groups in SNOMED CT*

Multiple attributes and their values can be grouped together into "Role groups" to add clarity to concept definitions. A Role group combines an attribute value pair with one or more other attribute value pairs. "Role groups" originated to add clarity to *Clinical finding* concepts where there are multiple ASSOCIATED MORPHOLOGIES and multiple FINDING SITES and to *Procedures* in which there are multiple METHODS and multiple PROCEDURE SITES.

In the case of *Procedures*, role groups associate the correct method with the correct site. In the example below, the role groups clarify that there is exploration of the bile duct, and excision of the gall bladder. Without role groups, the four attributes would be ungrouped and it would be unclear whether the excision was of the bile duct or of the gall bladder.
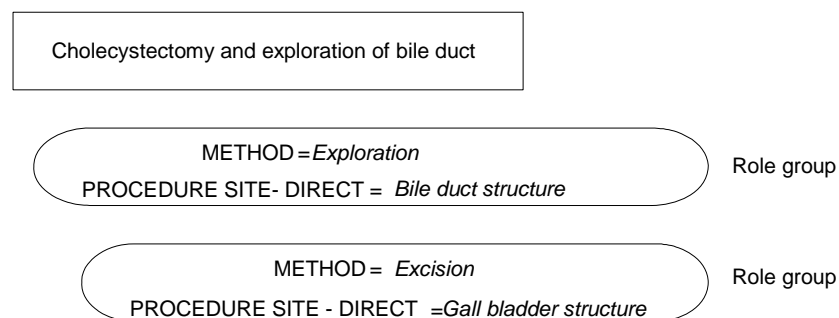


***Figure 4.2: Example – Cholecystectomy and exploration of bile duct***

# 5   Hierarchies

SNOMED CT concepts are organized into hierarchies.  The SNOMED CT Concept is the "Root concept."  The SNOMED CT Concept subsumes (is the supertype of) the top-level concepts and all the concepts beneath them (their subtypes).  As the hierarchies are descended, the concepts within them become increasingly specific (or granular).  A brief description of the content in each hierarchy is given below.

"Subtype" (or "child") concepts are the descendent concepts of "Supertype" (or "parent") concepts.

### *Example:*

*Streptococcal arthritis (disorder)* is a subtype of *Bacterial arthritis (disorder).*

"Supertype" concepts are the ancestor concepts of "Subtype" concepts.

### *Example:*

*Bacterial arthritis (disorder)* is a supertype of *Streptococcal arthritis (disorder).*

## *5.1  Top-level hierarchies in SNOMED CT*

- *Clinical finding*
- *Procedure*
- *Observable entity*
- *Body structure*
- *Organism*
- *Substance*
- *Pharmaceutical/biologic product*
- *Specimen*
- *Special concept*
- *Physical object*

- *Physical force*
- *Event*
- *Environments /geographical locations*
- *Social context*
- *Situation with explicit context*
- *Staging and scales*
- *Linkage concept*
- *Qualifier value*
- *Record artifact*

### *Clinical finding*

Concepts in this hierarchy represent the result of a clinical observation, assessment or judgment, and include both normal and abnormal clinical states.

### *Examples of Clinical finding concepts:*

- *Clear sputum (finding)*
- *Normal breath sounds (finding)*
- *Poor posture (finding)*

The *Clinical finding* hierarchy contains the sub-hierarchy of *Disease.*  Concepts that are descendants of *Disease* (or disorders) are always and necessarily abnormal clinical states.  Multi-axial subtype hierarchies allow diseases to be subtypes of other disorders as well as subtypes of findings.

### *Examples of Disease concepts:*

- *Tuberculosis (disorder)*
- *Non-Hodgkin's lymphoma (disorder)*

## *Procedure*

*Procedure* concepts represent activities performed in the provision of health care.  This hierarchy represents a broad variety of activities, including but not limited to, invasive procedures (*Excision of intracranial artery (procedure)*), administration of medicines (*Pertussis vaccination (procedure)*), imaging procedures (*Ultrasonography of breast (procedure)*), education procedures (*Low salt diet education (procedure)*), and administrative procedures (*Medical records transfer (procedure)*).

### *Examples of Procedure concepts:*

- *Removal of ureteral catheter (procedure)*
- *Intravenous steroid injection (procedure)*
- *Irrigation of oral wound (procedure)*
- *Appendectomy (procedure)*

## *Situation with explicit context*

This hierarchy was called Context-dependent Category until the July 2006 release. The hierarchy was renamed to better describe the meaning of the concepts in this hierarchy.

Concepts in the *Procedure* and *Clinical findings* hierarchies (given the appropriate record structure) can be used in a clinical record to represent:

- Conditions and procedures that have not occurred (e.g., *Endoscopy arranged (situation)*).
- Conditions and procedures that refer to someone other than the patient (e.g., *Family history: Diabetes mellitus (situation)), Discussed with next of kin (situation)).*
- Conditions and procedures that have occurred at some time other than in the present (e.g., *History of-aortic aneurysm (situation), History of-splenectomy (situation)*).

In each of these examples, clinical context is specified.  The second example, in which someone other than the patient is the focus of the concept, could be represented in an application or record structure by combining a header term "Family history" with the value "Diabetes."  The specific context (in this case, family history) would be represented using the record structure.  In this case, the pre-coordinated context-dependent concept *Family history: Diabetes mellitus (situation)* would not be used because the information model has already captured the family history aspect of the diabetes.

Concepts in the *Procedure* and *Clinical findings* hierarchy have a "default context" of the following:

- The procedure **has actually occurred** (versus being planned or cancelled) or the finding is actually present (versus being ruled out, or considered).
- The procedure or finding being recorded **refers to the patient of record** (versus, for example, a family member).
- The procedure or finding **is occurring now or at a specified time** (versus some time in the past).

In addition to using the record structure to represent context, there is sometimes a need to override these defaults and specify a particular context using the formal logic of the terminology. For that reason, SNOMED has developed a context model to allow users and/or implementers to specify context using the terminology, without depending on a particular record structure. The *Situation with explicit context* hierarchy and various attributes assigned to concepts in this hierarchy accomplish this.

### *Examples of Situation with explicit context concepts:*

- *Family history: Myocardial infarction (situation)*
- *No family history of stroke (situation)*
- *Nasal discharge present (situation)*
- *Suspected epilepsy (situation)*

## *Observable entity*

Concepts in this hierarchy can be thought of as representing a question or procedure which can produce an answer or a result. For instance, *Left ventricular end-diastolic pressure (observable entity)* could be interpreted as the question "What is the left ventricular end diastolic pressure?" or "What is the measured left ventricular end-diastolic pressure?"

Observables are elements that could be used to code elements on a checklist or any element where a value can be assigned. *Color of nail (observable entity)* is an observable. *Gray nails (finding)* is a finding, having a parent of *Nail discoloration (finding)*.

One use for *Observable entities* in a clinical record is to code headers on a template. For example, *Gender (observable entity)* could be used to code a section of a template titled "Gender" where the user would choose male or female. "Female gender" would then constitute a finding.

## *Body structure*

*Body structure* concepts include normal as well as abnormal anatomical structures. Normal anatomical structures can be used to specify the body site involved by a disease or procedure.

### *Examples of Body structure concepts:*

- *Mitral valve structure (body structure)*
- *Uterine structure (body structure)*

Morphologic alterations from normal body structures are represented in the sub-hierarchy *Body structure, altered from its original anatomical structure (morphologic abnormality).*

### *Examples of Body Structure, altered from its original anatomical structure concepts:*

- *Adenosarcoma (morphologic abnormality)*
- *Polyp (morphologic abnormality)*

## *Organism*

This hierarchy includes organisms of significance in human and animal medicine. Organisms are also used in modeling the causes of diseases in SNOMED CT. They are important for public health reporting of the causes of notifiable conditions and for use in evidence-based infectious disease protocols in clinical decision support systems. Sub-hierarchies of organism include, but are not limited to: *Animal (organism), Microorganism (organism), Plant (organism).*

### *Examples of Organism concepts:*

- *Streptococcus pyogenes (organism)*
- *Texon cattle breed (organism)*
- *Bacillus anthracis (organism)*
- *Lichen (plant) (organism)*

## *Substance*

The *Substance* hierarchy contains concepts that can be used for recording active chemical constituents of drug products, food and chemical allergens, adverse reactions, toxicity or poisoning information, and physicians and nursing orders. Concepts from this hierarchy represent general "substances" and chemical constituents of *Pharmaceutical/biologic product (product)* which are in a separate hierarchy. However, sub-hierarchies of *Substance* also include but are not limited to: *Body substance (substance)* (concepts to represent body substances)*; Dietary substance (substance); Diagnostic substance (substance).*

### Examples of Substance concepts:

- *Insulin (substance)*
- *Methane (substance)*
- *Chromatin (substance)*
- *Dental porcelain material (substance)*
- *Albumin (substance)*
- *Endorphin (substance)*
- *Acetaminophen (substance)*

## *Pharmaceutical/biologic product*

The *Pharmaceutical/biologic product* hierarchy is separate from the *Substance* hierarchy. This hierarchy was introduced as a top-level hierarchy in order to clearly distinguish drug products (products) from their chemical constituents (substances).

It contains concepts that represent the multiple levels of granularity required to support a variety of uses cases such as computerized provider order entry (CPOE), e-prescribing, decision support and formulary management.  The levels of drug products represented in the "core" include Virtual Medicinal Product (VMP), Virtual Therapeutic Moiety (VTM), and Product Category.  Additionally, US and UK drug extensions are available which represent Actual Medicinal Products (AMPs).

### Virtual Medicinal Product (VMP)

The most granular level is the Virtual Medicinal Product (VMP).  The VMP is a representation at the level of generality that would appear on a physician's prescription.  The product name, strength, and dose form are all represented in the Fully Specified Name.  This level can be used to support providers with drug ordering in CPOE and e-prescribing use cases.

### *Example:*

*Diazepam 5mg tablet (product)*

(Name, Strength, Dose form)


### Virtual Therapeutic Moiety (VTM)

The Virtual Therapeutic Moiety (VTM) level represents a more general level of granularity than the VMP level.  VTMs include the product name but not formulation, dose or strength in the Fully Specified Name.  The HAS ACTIVE INGREDIENT attribute (which relates the product to the *Substance* it contains) can be assigned to this level or to any of the subtypes of this level.

### *Example:*

*Diazepam (product)*

All Virtual Medicinal Products (VMP) have a direct link to the Virtual Therapeutic Moiety (VTM) via an IS_A relationship.

### *Example:*

*Diazepam (product)*  [This is a VTM]

⇧ IS_A

*Oral form diazepam (product)*

⇧ IS_A

*Diazepam 5mg tablet (product)* VMP

There are additional levels in the *Pharmaceutical/biologic product* hierarchy that provide structure and organization.  For example, some subtypes of VTM contain only Dose form information and not Strength.

### *Example:*

Concept with granularity between that of a VTM and VMP:

*Parenteral form epinephrine (product)*

> (Dose form, Name)

## Product category

A Product category concept supports a group of *Pharmaceutical/biologic products* related by their functionality mechanism of action or therapeutic use. *Product category* concepts typically describe common drug categories used in prescribing.

### *Examples of Product category concepts:*

- *Sex hormone product (product)*
- *Mineralocorticoid preparation (product)*
- *Beta-Blocking agent (product)*
- *Tissue plasminogen activator preparation (product)*

## Actual Medicinal Products (AMPs)

SNOMED CT offers drug extensions for the US and the UK that contain Actual Medicinal Products (AMPs). The AMP represents the single unit dose of a medicinal product that is (or has been) made or marketed by a specific manufacturer (trademarked brand name pharmaceutical products). Its description requires product name, strength, dosage form, flavor (where applicable) and manufacturer, but it does not include explicit information about packaging.

Because AMP concepts contain brand and country-specific information, they are not represented within the core of SNOMED CT, but instead exist within an identified domain extension. Actual Medicinal Products in an extension have a direct link to their virtual equivalent in the core via the IS_A relationship.
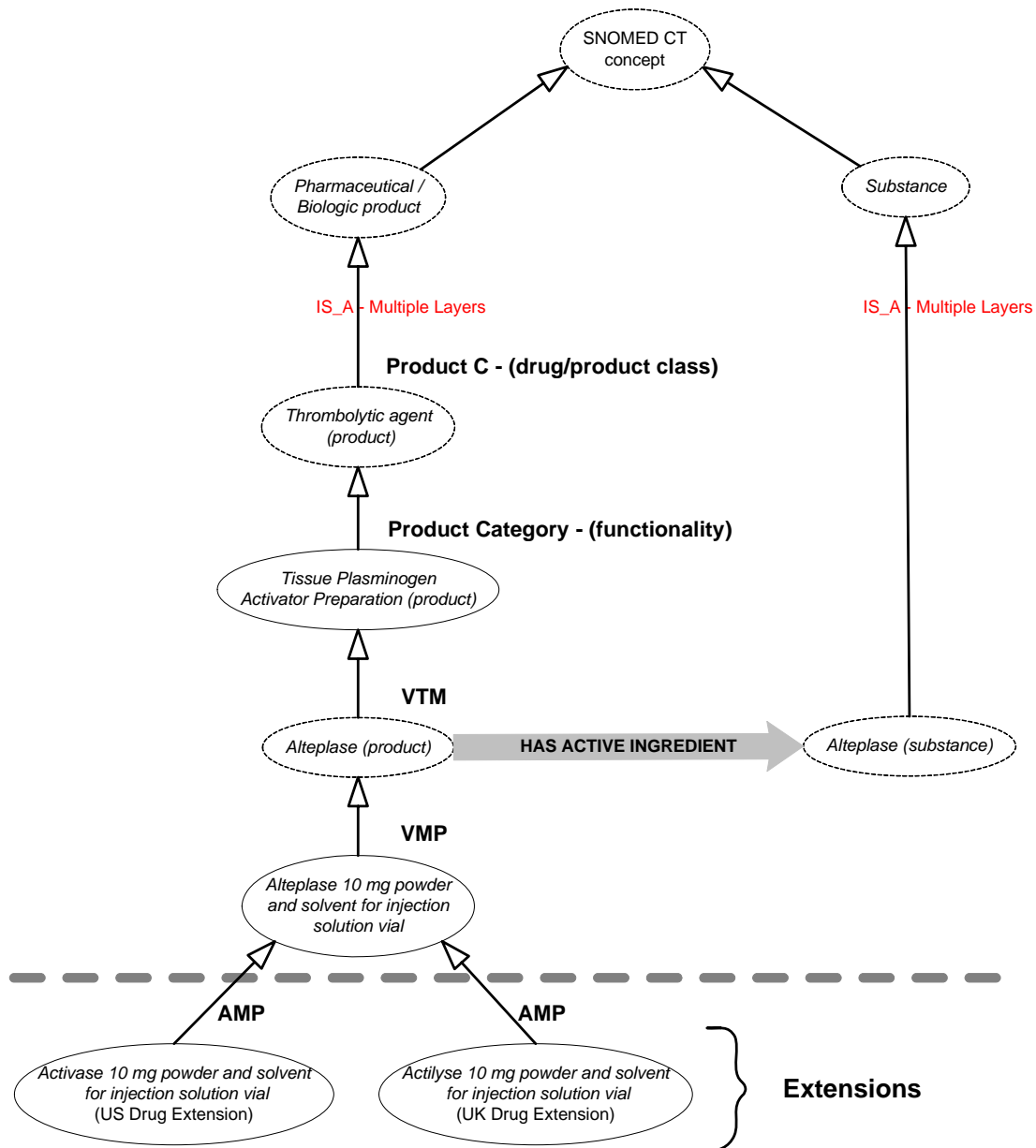
### *Example:*

*Cetirizine hydrochloride 10mg tablet (product)* VMP found in the core

> ⇧ IS_A

> *Zyrtec 10mg tablet (product)* [This is an AMP found in the extension]

All concepts in the *Pharmaceutical/biologic product* hierarchy have a FSN "tag" of "(product)" regardless of their level of granularity.

**Figure 5.1:  Pharmaceutical/Biologic Product hierarchy structure**

### Specimen

The *Specimen* hierarchy contains concepts representing entities that are obtained (usually from a patient) for examination or analysis. *Specimen* concepts can be defined by attributes which specify: the normal or abnormal body structure from which they are obtained; the procedure used to collect the specimen; the source from which it was collected; and the substance of which it is comprised.

#### Examples of Specimen concepts:

- *Specimen from prostate obtained by needle biopsy (specimen)*
- *Urine specimen obtained by clean catch procedure (specimen)*
- *Calculus specimen (specimen)*
- *Cerebroventricular fluid cytologic material (specimen)*

### Physical object

Concepts in the *Physical object* hierarchy include natural and man-made objects. One use for these concepts is modeling procedures that use devices (e.g., catheterization).

#### Examples of Physical object concepts:

- *Military vehicle (physical object)*
- *Implant, device (physical object)*
- *Artificial kidney, device (physical object)*
- *Latex rubber gloves (physical object)*
- *Book (physical object)*
- *Pressure support ventilator (physical object)*
- *Vena cava filter (physical object)*

### Physical force

The concepts in the *Physical force* hierarchy are directed primarily at representing physical forces that can play a role as mechanisms of injury.

#### Examples of Physical force concepts:

- *Spontaneous combustion (physical force)*
- *Alternating current (physical force)*
- *Friction (physical force)*

### Event

The *Event* hierarchy includes concepts that represent occurrences (excluding procedures and interventions).

### *Examples of Event concepts:*

- *Flood (event)*
- *Bioterrorist attack (event)*
- *Earthquake (event)*

## Environments and geographic locations

The *Environments and geographic locations* hierarchy includes types of environments as well as named locations such as countries, states, and regions.

### *Examples of Environments and geographic locations concepts:*

- *Canary islands (geographic location)*
- *California (geographic location)*
- *Rehabilitation department (environment)*
- *Intensive care unit (environment)*

## Social context

The *Social context* hierarchy contains social conditions and circumstances significant to healthcare.  Content includes such areas as family status, economic status, ethnic and religious heritage, life style, and occupations.  These concepts represent social aspects affecting patient health and treatment.  Some sub-hierarchies of *Social context* and concepts typical of those sub-hierarchies are shown in the following examples.

### *Examples:*

- *Ethnic group (ethnic group)*:
    - *Afro-Caribbean (ethnic group)*
    - *Estonians (ethnic group)*
- *Occupation (occupation)*:
    - *Bank clerk (occupation)*
    - *Carpenter, general (occupation)*
- *Persons (person)*:
    - *Employer (person)*
    - *Boyfriend (person)*
    - *Caregiver (person)*
- *Religion / philosophy (religion/philosophy)*:
    - *Hinduism (religion/philosophy)*
    - *Orthodox Christian religion (religion/philosophy)*
- *Economic status (social concept)*:
    - *Middle class economic status (social concept)*

## Staging and scales

This hierarchy contains such sub-hierarchies as *Assessment scales (assessment scale),* which names assessment scales; and *Tumor staging (tumor staging),* which names tumor staging systems.

### *Examples of Assessment scales (assessment scale) concepts:*

- *Glasgow coma scale (assessment scale)*
- *Stanford Binet intelligence scale (assessment scale)*

### *Examples of Tumor staging (tumor staging) concepts:*

- *International Federation of Gynecology and Obstetrics (FIGO) staging system of gynecological malignancy (tumor staging)*
- *Dukes staging system (tumor staging)*

## *Linkage concept*

This hierarchy includes concepts used for linkage.

The *Linkage concept* hierarchy contains the sub-hierarchies:

- *Link assertion*
- *Attribute*

### *Link assertion*

The Link assertion sub-hierarchy enables the use of SNOMED CT concepts in HL7 statements that assert relationships between statements.  Currently this content supports the UK NHS Connecting for Health requirements for encoding of Statement relationships for the implementation of HL7 Version 3 messaging in the UK realm.

#### *Examples of Link assertion concepts:*

- *Has reason (link assertion)*
- *Has explanation (link assertion)*

### *Attribute*

Concepts that descend from this sub-hierarchy are used to construct relationships between two SNOMED CT concepts, since they indicate the relationship type between those concepts.  Some attributes (relationship types) can be used to logically define a concept (defining attributes).  This sub-hierarchy also includes non-defining attributes (like those used to track historical relationships between concepts) or attributes that may be useful to model concept definitions but which have not yet been used in modeling pre-coordinated concepts in SNOMED CT.

#### *Examples of Defining attributes:*

- *IS_A (attribute)*
- *Concept model attribute (attribute)*:
    - *Laterality (attribute)*
    - *Procedure site (attribute)*
    - *Finding site (attribute)*
    - *Associated morphology (attribute)*

### *Examples of Non-defining attributes:*

- *Concept history attribute (attribute)*
    - *Replaced by (attribute)*
    - *Was a (attribute)*
- *Unapproved attribute (attribute)*
    - *Relieved by (attribute)*
    - *Has assessment (attribute)*

## *Qualifier value*

The *Qualifier value* hierarchy contains some of the concepts used as values for SNOMED CT attributes that are not contained elsewhere in SNOMED CT. However, the values for attributes are not limited to this hierarchy and are also found in hierarchies other than *Qualifier value*.

For example, the value for the attribute LATERALITY in the concept shown below is taken from the *Qualifier value* hierarchy:

- *Left kidney structure (body structure)* LATERALITY *Left (qualifier value)*

However, the value for the attribute FINDING SITE in the concept shown below is taken from the *Body structure* hierarchy, not the *Qualifier value* hierarchy.

- *Pneumonia (disorder)* FINDING SITE *Lung structure (body structure)*

### *Examples of Qualifier value concepts:*

- *Unilateral (qualifier value)*
- *Left (qualifier value)*
- *Mild (qualifier value)*

## *Special concept*

One sub-hierarchy of *Special concept* is *Inactive concept,* which is the supertype for all concepts that have been retired and point to an active concept in the terminology.

## *Record Artifact*

A *Record artifact* is an entity that is created by a person or persons for the purpose of providing other people with information about events or states of affairs. In general, a record is virtual, that is, it is independent of its particular physical instantiation(s), and consists of its information elements (usually words, phrases and sentences, but also numbers, graphs, and other information elements). *Record artifacts* need not be complete reports or complete records. They can be parts of larger *record artifacts*. For example, a complete health record is a *record artifact* that also may contain other *record artifacts* in the form of individual documents or reports, which in turn may contain more finely granular *record artifacts* such as sections and even section headers.

# 6  SNOMED CT Structure and Technology Considerations

## 6.1  Introduction

The structure and technology behind SNOMED CT enable organizations to implement it and integrate it into their own clinical and business processes and applications. SNOMED CT offers additional capabilities to facilitate customization of an implementation to meet the unique requirements of an organization.

This section provides an introduction to SNOMED CT structure and technology, highlighting its core and extended capabilities.  This overview is intended to provide project managers and others involved with SNOMED CT implementations a better understanding of technology requirements and support considerations for SNOMED CT implementation and maintenance.  Topics addressed include:

- SNOMED CT data structure:  SNOMED CT data components and their relationships, including the core table structure, as well as:
  - History
  - Subsets
  - Cross Mapping
  - Extensions
- SNOMED CT applications and services

Detailed information for each topic is available in the SNOMED CT Technical Reference Guide (TRG), Technical Implementation Guide (TIG), Developer Toolkit, and other related SNOMED CT reference documents.  See the Inventory of Documentation section of this guide for descriptions of the content and target audiences for each available document.

## 6.2  SNOMED CT tables

SNOMED CT is distributed as a set of tab-delimited text files that can be imported into a relational database. The three tables shown below, the Concepts table, the Descriptions table, and the Relationships table, are commonly referred to as the "core" tables.

The association of a set of Descriptions and a set of Relationships to each Concept is implemented using the ConceptID which is the primary or foreign key in the three tables.

| Relationship | | | Concept | | | Description |
|---|---|---|---|---|---|---|
| -RelationshipId<br>-ConceptId1<br>-RelationshipType<br>-ConceptId2<br>-CharacteristicType<br>-Refinability<br>-RelationshipGroup | 0..*  1..1<br><br>0..*  1..1<br><br>0..*  1..1 | | -ConceptId<br>-ConceptStatus<br>-FullySpecifiedName<br>-CTV3ID<br>-SNOMEDID<br>-IsPrimitive<br>- | -Has<br><br>1   2..* | | -DescriptionId<br>-DescriptionStatus<br>-ConceptId<br>-Term<br>-DescriptionType<br>-InitialCapitalStatus<br>-LanguageCode |

**Figure 6.1:  SNOMED CT table structure**

## *The Concepts Table*

The Concepts Table contains all the concepts in SNOMED CT.  Each concept is represented by one row of the table.  Each row of the Concepts Table contains the following fields:

SNOMED CT concepts are identified by their ConceptIDs, and all information about a SNOMED CT concept is ultimately linked to the ConceptID.  ConceptID is the primary key of the Concepts Table.

- The original SNOMED RT identifier and original CTV3 identifier for each concept that originated in those terminologies.  Any newly created SNOMED CT concept is assigned a SNOMED RT identifier and a CTV3 identifier.  This allows users of SNOMED CT to work with legacy data coded with SNOMED RT or CTV3 codes.
- The FullySpecifiedName field appears in both the Concepts Table and the Descriptions Table.  In the Concepts Table, it serves to provide a human-readable name for each concept.
- The ConceptStatus field indicates whether a concept is in active use or retired.  This field flags concepts that have been retired so that data encoded with these concepts can be properly accessed and retrieved long after it has been coded.
- The IsPrimitive field indicates whether or not a concept has been flagged as primitive during the modeling process.  This flag can be useful in advanced applications that take advantage of the description logic features of SNOMED CT (A more detailed description of fully defined and primitive concepts can be found in the glossary in Appendix B).

## *The Descriptions Table*

This table relates the various terms used to name a single SNOMED CT concept.  The Descriptions Table includes the following fields:

- DescriptionID:  Each description has a unique DescriptionID, which serves as the primary key of this table.
- DescriptionType:  This field indicates if the description is one of three types:
  - The Fully Specified Name (FSN):  A term that uniquely and unambiguously identifies each concept in a human-readable way, just as the ConceptID uniquely identifies each term in a machine-readable way.  There is only one Fully Specified Name for each concept in each edition.
  - The Preferred Term:  Intended to represent the common way a concept is expressed in natural language by clinicians.  In many cases it is a shortened version of the Fully Specified Name
  - Synonyms:  Other terms that can be used to name a concept.  The large numbers of synonyms in SNOMED CT provide flexibility of expression.
- LanguageCode:  This field in the Descriptions Table associates each description with a particular language or dialect, such as UK English, Spanish, etc.

See the Technical Reference Guide for more information about the Descriptions Table.

### *The Relationships Table*

This table contains the relationships between SNOMED CT concepts.  A Relationship in the table is stored as a combination of three concepts in the order:  ConceptID1 – RelationshipType – ConceptID2.  This is represented in the table by the following fields:

- RelationshipID:  The RelationshipID uniquely identifies each set of three concepts in a relationship, and serves as the primary key of this table.
- ConceptID1:  The first concept in the relationship
- RelationshipType:  This is the type of relationship (either the IS_A relationship or an attribute or a Historical or Additional relationship) that exists between two concepts.
- ConceptID2:  The "target" concept in the relationship.  Either the Parent concept in an IS_A relationship or the concept that represents the value assigned in an attribute relationship.

The most common RelationshipType used in SNOMED is the IS_A relationship (a.k.a. "subsumption relationship," "hierarchical relationship," "supertype-subtype relationship," or "parent-child relationship").  When an IS_A relationship is listed in the Relationships Table, it indicates that Concept1 is a subtype of Concept2.

See the Technical Reference Guide for more information about SNOMED CT tables.
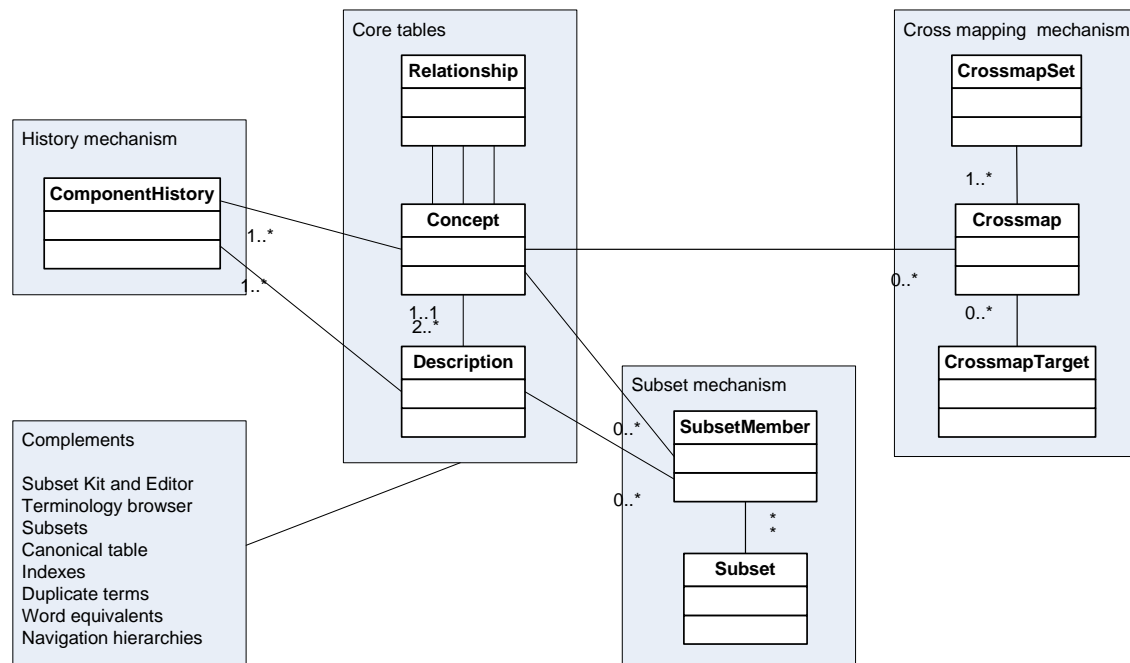


***Figure 6.2:  SNOMED CT data structure summary***

## 6.3  History

### *Introduction*

The content of SNOMED CT evolves with each release. The types of changes made include new Concepts, new Descriptions, new Relationships between Concepts, new Cross Maps, and new Subsets, as well as updates and retirement of any of these Components.  Drivers of these changes include changes in understanding of health and

disease processes; introduction of new drugs, investigations, therapies and procedures; and new threats to health, as well as proposals and work provided by SNOMED partners and licensees.

The Component History includes any changes to SNOMED CT Components (Concepts, Descriptions, Subsets, Cross Maps). "Significant" changes generally require retirement of the component and addition of replacement component(s). The retirement and addition are recorded in the history records. Changes designated as minor require only a history record to record the change.

### History Mechanism

The history mechanism involves the following tables:

- Component History Table
- Component History References Table

## 6.4  SNOMED CT Subsets

### Introduction

A Subset refers to a set of Concepts, Descriptions, or Relationships that are appropriate to a particular language, dialect, country, specialty, organization, user or context.

In its simplest form, the Subset Mechanism is a list of SNOMED identifiers (SCTIDs). Each SCTID refers to one component of SNOMED CT, that is, a member of the Subset (called a "Subset Member"). As an analogy, think of SNOMED CT as a book. A Subset is like an index entry pointing to a set of pages relevant to a particular topic.

The Subset Mechanism may be used to derive tables that contain only part of SNOMED CT. In some cases, these derived tables may also be centrally distributed (e.g., a release table containing only Descriptions for a particular International Edition).

A Subset is a value-added feature of SNOMED CT. Subsets provide important information for the use and implementation of SNOMED CT. The fact that a SNOMED CT Component belongs to a particular subset provides information above and beyond the Component itself.

SNOMED CT is a large terminology and subsets can define portions of the terminology for use by specific audiences. For example, a UK dialect subset for English may direct the user to descriptions for UK terms rather than all descriptions for English. Note that it is up to the implementer to determine if a subset is used dynamically or statically, and whether the subset contents are given precedence or used exclusively. Refer to the SNOMED CT Technical Implementation Guide for more information.

Note that Subsets are not necessarily mutually exclusive. The contents of Subsets may overlap.

### Subset table and file structures

A common file structure is used for all Subsets. This approach simplifies the release structure and installation process for all SNOMED users.

Subsets are released using two tables:

- Subsets Table

- Each row in this table describes one release of a Subset.
- This table includes SNOMED CT Subsets that are packaged together in the Subset Members table.

- Subset Members Table
  - Each row in this table represents one member of a Subset.
  - The member may be a Concept or a Description.
  - One or more Subsets may be packaged together in this table.

## 6.5  Cross Mappings

### Introduction

Cross Mappings enable SNOMED CT to effectively reference other terminologies and classifications.  Each cross map matches SNOMED concepts with another coding scheme that is called the "target scheme."  The Cross Mapping mechanism enables the distribution of Cross Maps from SNOMED Clinical Terms in a common structure.

The cross mapping structure enables:

- Automatic mapping from one SNOMED CT Concept to a single appropriate matching code in the Target Scheme.
- Automatic mapping from one SNOMED CT Concept to a single collection of codes in a Target Scheme that together represent the same Concept.
- Manual choice from a set of options for mapping a SNOMED CT Concept to a Target Scheme with several possible ways of representing the same or similar Concepts (For Future Use).

The cross mapping structure does **not** enable:

- Mapping from post-coordinated collections of SNOMED CT Concepts to a single Target Code or a specific collection of Target Codes (e.g., mapping a combination of a disorder qualified by severity or a procedure qualified by urgency).
- Mapping from multiple fields in a patient record to a specific Target Code that represents a combination of characteristics (e.g., mapping a combination of a disorder, procedure and the age and sex of the patient to a single group code).

This structure is based on the practical experience of the Cross Mapping tables of Clinical Terms Version 3 (CTV3), one of SNOMED CT's sourcing terminologies.

### Cross Mapping tables

The SNOMED CT structure to support Cross Mapping includes three tables:

- Cross Map Sets Table:  Each row in this table represents a Target Scheme for which Cross Maps are available.
- Cross Maps Table:  Each row in this table represents one option for mapping a SNOMED CT Concept to a target code or set of codes in the Target Scheme.
- Cross Map Targets Table:  Each row in this table represents a code or set of codes in the Target Scheme, which provides a mapping for one or more SNOMED CT Concepts.

## *6.6  Extensions*

### *Introduction*

SNOMED CT is a deep and detailed clinical terminology with a broad scope. However, some groups of users will need additional Concepts, Descriptions or Subsets to support national, local or organizational needs.

The Extension mechanism is a structure that enables authorized organizations to add Concepts, Descriptions, Relationships and Subsets to complement the core content of SNOMED CT.   One example of the Extension mechanism is for extensibility of SNOMED CT for the specialized terminology needs of an organization.

Goals of Extensions are to:

- Provide a structure where these Extensions maintain unique identification across organizations for data transmission and sharing, but share a common structure for ease in application development, and so that subsets can be constructed over a combination of core and extension content.
- Define a structure so that it is easy to submit, include, use, and migrate terminology developed as part of an extension into the core content.

When content overlaps the scope of SNOMED CT, it should be submitted to the SNOMED International team for consideration for the core content, so that other SNOMED CT licensees can also take advantage of this work.  The preferred way to do this is by the web-based SNOMED CT Request Submission system.  Another technique is to assemble the terminology into an extension so it can be transferred.

Using the extension structure can also help organizations transfer responsibility for terminology not only to SNOMED International, but also to another organization as appropriate.

## *6.7  SNOMED CT applications and services*

SNOMED Clinical Terms is a terminological resource that can serve many roles in healthcare software applications.  The SNOMED International organization supplies content that can be loaded into these applications, but it does NOT supply any of the software itself.

User requirements for these software applications will vary according to way in which they are used.  Healthcare software applications usually address a particular set of requirements associated with one or more clinical and/or business processes.  Detailed requirements for integrating SNOMED CT into a particular application inevitably depend upon intended uses, the perceptions of users and the technical environments in which they are implemented.

The following examples illustrate a few possible types of implementation:

- A SNOMED CT enabled clinical record system incorporating clinical data entry, decision support, links to knowledge bases, sophisticated analysis, order-report message interfaces, support for record communication or sharing, etc.
- A data warehouse storing and analyzing records expressed with SNOMED CT encoded concepts.

- A diagnostic departmental system sending reports that include SNOMED CT encoded concepts to other systems.

- A hand-held data collection device used for input of a limited range of frequently used coded concepts.

- A decision support system using SNOMED CT concepts to represent guidelines and protocols for distribution to other systems.

- A system designed to enable the creation of queries for use in analysis of data held by various other systems, some of which contain SNOMED CT encoded data.

- A coding system mapping SNOMED CT encoded concepts (entered manually or read from an electronic record) to administrative groupings or classifications such as DRGs or ICD10.

- A system designed to support design and/or implementation of messages that convey specified information using a specified set of SNOMED CT concept identifiers.

The SNOMED CT Technical Implementation Guide (TIG) provides information and guidance for software professionals responsible for designing, developing and implementing SNOMED CT enabled software applications.  The TIG describes the technical requirements and design issues for integrating SNOMED CT into new and existing applications.

# Appendix A:   Concepts Prefaced with Symbols

There are some concepts in SNOMED CT that are prefaced with a symbol in square brackets.  These concepts were inherited from CTV3 and were used to facilitate mapping to ICD-10.  Most have been assigned a limited concept status and are not recommended for use in clinical records.

Explanations of these concepts are as follows:

## [X]

Concepts starting with [X] were initially used in the Read codes in the 1995 release, in order to identify ICD-10 concepts that were not present in ICD-9.

## [D]

Concepts starting with [D] are also from CTV3, and identify concepts contained in ICD-9 chapter XVI Symptoms; signs and ill-defined conditions and ICD-10 chapter XVIII Symptoms; signs and abnormal clinical and laboratory findings, not elsewhere classified.

## [V]

A concept starting with [V] identifies concepts contained in ICD-9 Supplementary classification of factors influencing health status and contact with health services (V codes), and ICD-10 chapter XXI Factors influencing health status and contact with health services (Z codes).

## [M]

A concept starting with [M] identifies Morphology of Neoplasm concepts present in ICD9 and ICD 10.

## [SO]

A concept starting with [SO] identifies the concepts contained in OPCS-4 (Office of Population, Censuses and Surveys - Classification of Surgical Operations and Procedures - 4th Revision) chapter Z subsidiary classification of sites of operation in CTV3.

## [Q]

A concept starting with [Q] identifies temporary qualifying terms inherited from CTV3.

# Appendix B:   Glossary

| | |
|---|---|
| **Attribute** | Express characteristics of concepts.  SNOMED CT concepts form relationships to other SNOMED CT concepts through attributes.<br><br>*Example:*  FINDING SITE<br><br>All of the attributes used in modeling SNOMED CT concepts are themselves SNOMED CT concepts and can be found in the *Linkage concept* hierarchy. |
| **Attribute-value pair** | The combination of an attribute with a value that is appropriate for that attribute.<br><br>*Example:*  FINDING SITE = *Lung structure* |
| **Browser** | A tool for exploring and searching the terminology content.  A browser can display hierarchy sections and concept details (relationships between concepts, descriptions and Ids, etc.). |
| **Check-digit** | SNOMED CT uses integers up to 18 digits in length as component identifiers known as SNOMED CT Identifiers (SCTIDs).  The check-digit is the last digit of the SNOMED CT Identifier.  It can be used to check the validity of SCTIDs.  Clinical information systems can use the check-digit to identify SNOMED CT codes that have been entered incorrectly (typo errors, etc). |
| **Component** | Refers to anything in SNOMED CT identified by an SCTID.  The part of the SCTID called the partition identifier indicates the type of component referred to by that SCTID.  Examples of Components include Concepts, Relationships, Descriptions, Subsets, Cross Map Sets and Cross Map Targets. |
| **Concept** | A clinical idea to which a unique ConceptID has been assigned in SNOMED CT.  Each Concept is represented by a row in the Concepts Table. |
| **Concept equivalence** | When two SNOMED CT concepts or post-coordinated expressions have the same meaning.  Concept equivalence can occur when a post-coordinated expression has the same meaning as a pre-coordinated Concept; or when two different post-coordinated expressions have the same meaning. |
| **ConceptID** | The unique identifier (code) for each SNOMED CT concept.  Refer to the SNOMED Technical Reference Guide for a full explanation of how this identifier is structured.<br><br>*Example:*  For the concept *Pneumonia (disorder)*, the ConceptID is 233604007 |
| **Concepts Table** | A table that includes all SNOMED CT concepts.  Each concept is represented by a row. |
| **Core** | A SNOMED CT Component released by SNOMED International. |
| **Cross Map** | A Cross Map links a single SNOMED CT concept to one or more codes in a target classification (such as ICD-9-CM) or terminology.  Each Cross Map is represented as a row in the Cross Maps Table. |

**CTV3ID**          A five-character code allocated to a concept or term in CTV3.  For data compatibility and mapping purposes, SNOMED CT concepts include a record of the corresponding concept codes from the Clinical Terms Version 3 (CTV3, previously known as Read Codes) and SNOMED RT.

**Description**     The human-readable phrases or names associated with SNOMED CT concepts.  All of the concept descriptions in SNOMED CT are listed in the Descriptions Table.

**DescriptionID**   An SCTID that uniquely identifies a Description.  Refer to the SNOMED Technical Reference Guide for a full explanation of how this identifier is structured.

**Descriptions Table**   A table including all SNOMED CT descriptions.

**Dialect**         A language modified by the vocabulary and grammatical conventions applied in a particular geographical or cultural environment.

**Extension**       Extensions are complements to a released version of SNOMED CT. Extensions are components that are created in accordance with the data structures and authoring guidelines applicable to SNOMED CT.

**Fully defined concept**   SNOMED CT concepts are either primitive or fully defined.

Fully defined concepts can be differentiated from their parent and sibling concepts by virtue of their relationships. Primitive concepts do not have the unique relationships needed to distinguish them from their parent or sibling concepts. A concept is primitive when its modeling (attributes and parents) does not fully express its meaning.

**Fully Specified Name (FSN)**   A description that names a Concept in a manner intended to be unambiguous.

**Hierarchy**       An ordered organization of concepts. General concepts are at the top of the hierarchy; at each level down the hierarchy, concepts become increasingly specialized.

SNOMED CT concepts are arranged into Top-level hierarchies.  Each of these hierarchies subdivides into smaller sub-hierarchies. Concepts are related by IS_A relationships to their more general parent concepts directly above them in a hierarchy.  There is one concept from which the Top-level hierarchies descend called *SNOMED CT concept* or the "Root concept."

**History Mechanism**   SNOMED CT includes some information about the history of changes to concepts and descriptions.

**Language**        For purposes of SNOMED CT translations, a language is a vocabulary and grammatical form that has been allocated an ISO639-1 language code.  See also Dialect.

| | |
|---|---|
| **Language subset** | SNOMED CT can be translated into any language or dialect. These translations use existing SNOMED CT concepts, along with new language-specific descriptions. A language subset is a set of references to the descriptions that are members of a language edition of SNOMED CT. Additionally, this subset specifies the type of description (FSN, Preferred Term or synonym). |
| **Mapping Mechanism** | SNOMED CT provides a mechanism for mapping concepts to other terminologies and classifications. This mapping mechanism consists of three tables: Cross Map Sets Table, Cross Maps Table and Cross Map Targets Table |
| **Modeler** | The SNOMED CT content developers who model the terminology. Also referred to as "Clinical Editors" or "Authors." |
| **Modeling** | The process of editing concepts to reflect their unique definition and meaning. |
| **Namespace or Namespace-identifier** | When an organization creates an extension to SNOMED CT, the new components in the extension need to be identified as part of that particular organization's extension. SNOMED CT does this by allocating an identifier to the organization (the Namespace-identifier). The organization would include its namespace-identifiers as part of the identifiers originated in its namespace. The Namespace identifier is part of the SCTID. If no namespace is identified in a SCTID, it is assumed that the component is part of the core of SNOMED CT. In these cases, SCTIDs can be used in an abbreviated form, without the seven-digit namespace identifier. |
| **Partition-identifier** | The partition identifier is a two-digit number just to the left of the check digit in the SCTID. The first of these two digits indicates whether the SCTID refers to a SNOMED CT Component in the core (indicated by a 0 as the first digit in the partition identifier), or a Component in an extension (indicated by a 1 as the first digit in the partition identifier). |
| | The second of the two digits in the partition identifier indicates which of the partitions of SNOMED CT the SCTID is identifying. |
| | The partitions of SNOMED CT are indicated by the partition ID as follows: |

|     |                     |
|-----|---------------------|
| 00  | A Concept           |
| 01  | A Description       |
| 02  | A Relationship      |
| 03  | A Subset            |
| 04  | A Cross Map Set     |
| 05  | A Cross Map Target  |

| | |
|---|---|
| **Post-coordination** | Post-coordination describes representation of a clinical meaning using a combination of two or more codes. SNOMED CT allows many concepts to be represented in a post-coordinated form. One form of post-coordination involves creating a single expression consisting of several concepts related by attributes. |

**Pre-coordination**   When a single concept identifier is used to represent a clinical idea. SNOMED CT also allows the use of post-coordinated expressions (see post-coordination) to represent a meaning using a combination of two or more concept identifiers.

Including commonly used concepts in a pre-coordinated form makes the terminology easier to use.

**Primitive Concept**   A concept is primitive when its modeling (roles and parents) does not fully express its meaning. A concept definition is the list of its relationships to other concepts. Primitive concepts do not have the unique relationships needed to distinguish them from their parent or sibling concepts.

**Qualifying attribute**   Some SNOMED CT concepts can have Qualifying attributes, which are optional non-defining relationships that may be applied by a user or implementer in post-coordination. The qualifier value mechanism in SNOMED CT constrains the possible values an implementer can select in assigning a qualifying characteristic to a concept.

**Read Codes Version 2**   The second version of the clinical coding scheme developed by Dr. James Read. Read Codes Version 2 is UK Crown Copyright.

**Realm**   A sphere of authority, expertise, or preference that influences the range of Components required, or the frequency with which they are used. A Realm may be a nation, an organization, a professional discipline, a specialty, or an individual user.

**Relationship**   An association between two Concepts. The nature of the association is indicated by a Relationship Type. Each Relationship is represented by a row in the Relationships Table.

**Relationship Type**   The nature of a Relationship between two Concepts. The RelationshipType field indicates the ConceptID for the concept in SNOMED that forms the relationship between two other concepts (ConceptID1 and ConceptID2)

SNOMED CT has four types of relationships:

- Defining characteristics are IS_A relationships and defining attributes.
  *Example:* "PROCEDURESITE-DIRECT = *Liver*" is a defining characteristic of *Biopsy of liver (procedure)*.

- Qualifying characteristics are non-defining, qualifying attributes.

- Historical relationships relate inactive concepts to active concepts. For example, a concept may be inactivated because it is a duplicate. In this example a relationship is created when one concept is inactivated and stated to be the "same-as" another concept.

- Additional relationships are other non-defining characteristics, like PART OF which is retained for backward compatibility with SNOMED RT.

**RelationshipID**   A SCTID that uniquely identifies a Relationship between three concepts: a source concept (ConceptID1), a target concept (ConceptID2), and a relationship type.

Each row in the Relationships Table represents a relationship "triplet" (ConceptID1 – RelationshipType - ConceptID2) identified by a RelationshipID.

Refer to the SNOMED Technical Reference Guide for a full explanation of how this identifier is structured.

**Relationships Table**   A data table consisting of rows, each of which represents a Relationship.

**Release Version**   A version of SNOMED CT released on a particular date. Except for the initial release of SNOMED CT that was called "SNOMED CT First Release," subsequent releases use the release date.

*Examples:*

"SNOMED CT July 2003 Release"

"SNOMED CT Spanish Edition April 2003."

**Role**   Another name for Attribute.

**Root Concept**   The single Concept "SNOMED CT Concept" that is at the top of the entire SNOMED CT hierarchy of concepts.

**SCT Enabled Application**   A software application designed to support the use of SNOMED CT.

**SNOMED**   An acronym for the **S**ystematized **No**menclature of **Med**icine developed by the College of American Pathologists.

**SNOMED Clinical Terms (SNOMED CT)**   The clinical terminology maintained and distributed by the SNOMED International Authority under the editorial guidance of the SNOMED International Standards Board. The First Release of SNOMED Clinical Terms was the result of the merger of the CTV3 and SNOMED RT.

**SNOMED Clinical Terms Identifier (SCTID)**   A unique identifier applied to each SNOMED CT component (Concept, Description, Relationship, Subset, etc.). The SCTID can include an item identifier, namespace identifier, a check-digit and a partition identifier. It doesn't always include a namespace identifier.

**SNOMED International Authority**   The body responsible for policy and overall management of SNOMED Clinical Terms.

**SNOMED International Standards Board (SISB)**   The body with primary responsibility for the clinical content of SNOMED Clinical Terms. The Standards Board is responsible to the SNOMED International Authority.

**SNOMED Reference Terminology (SNOMED RT)**   The last version of SNOMED® prior to the collaboration between CAP and the NHS to develop SNOMED Clinical Terms.

**Subset**          A group of Components (e.g., Concepts, Descriptions or Relationships) that share a specified common characteristic or common type of characteristic.

*Examples:*

UK English Subset

Non-Human Subset

**Synonym**         A term that is an acceptable alternative to the Preferred Term as a way of expressing a Concept.  Synonyms allow representations of the various ways a concept may be described.  Synonyms and Preferred Terms (unlike FSNs) are not necessarily unique.  More than one concept might share the same Preferred term or Synonym.

**Top-Level Concept**    A Concept that is an immediate child of the root concept "SNOMED CT Concept" which is at the top of the entire SNOMED CT hierarchy of concepts.

# Appendix C:   SNOMED CT Guiding Principles, Development Process and Acknowledgements

## C.1 SNOMED CT:  A comprehensive terminology for health care

In 1999, the College of American Pathologists (CAP) and the U.K. formed a strategic alliance to create a convergence of SNOMED® Reference Terminology (SNOMED® RT) and Clinical Terms Version 3 (CTV3).  The resulting work, SNOMED Clinical Terms® (SNOMED CT®) combines the robust strength of SNOMED RT in the basic sciences and laboratory and specialty medicine with the primary care content of CTV3 (formerly known as the Read Codes).  SNOMED CT is a comprehensive clinical reference terminology that provides clinical content and expressivity for clinical documentation and reporting.  The terminology enables clinicians, researchers and patients to share comparable data. SNOMED CT was founded on four basic principles that have guided development activities related to the distribution table structure and clinical content:

- Development efforts encompass broad, inclusive involvement of diverse clinical groups and medical informatics experts.
- Clinical content is quality focused and adheres to editorial policies.
- A quality improvement process open to public scrutiny and vendor input, to ensure that the terminology is useful within healthcare applications.
- There should be minimal barriers to adoption and use.

The design has been driven by the expressed needs of software developers for features that improve their ability to develop useful applications.

SNOMED CT provides a standardized clinical terminology that is essential for effective collection of clinical data, its retrieval, aggregation and re-use, as well as interoperability.

## C.2 SNOMED CT quality development process

The SNOMED CT development process incorporates the efforts of internal and external modelers.  Content is edited by clinical editors who follow formal modeling guidelines. The integration of SNOMED RT and Clinical Terms Version 3 to create the first release was a three-year process that involved several stages of review and quality assurance:

- **Description mapping:**  NHS editors evaluated each SNOMED concept and term and mapped it to the Clinical Terms Version 3 terminology; SNOMED editors performed the same task mapping primarily disorders and procedures from Clinical Terms Version 3 to SNOMED RT.
- **Description mapping conflict resolution:**  Mapping discrepancies that occurred between NHS and SNOMED editors underwent a conflict resolution process to definitively place each concept within the merged hierarchy.
- **Autoclassification:**  The merged database, following description mapping conflict resolution, underwent a series of quality control checks including autoclassification to identify and eliminate cycle errors (e.g., Concept A "IS_A" B and Concept B "IS_A" A) and equivalency errors (where two defined concepts have the exact same definition).
- **Ongoing refinement:** The quality control process is supplemented by feedback from users involved in adoption of SNOMED Clinical Terms. Parallel to domain specialist review, U.S. and U.K. editors continue to review and edit content as needed.

## *Expert input*

The following entities and groups contribute to SNOMED CT content.

*Table C.1:  Roles of college committees, staff and volunteers in development and review of SNOMED*

| Entity | Role |
|---|---|
| **SNOMED International Authority** | Within the governance structure of the College of American Pathologists (CAP), the SNOMED International Authority has the direct responsibility for terminology related activities.  It establishes strategic direction for SNOMED's medical terminology activities, strategic alliances and support requirements.  The Authority consists of CAP leadership, the SNOMED Scientific Director, key internal staff directors and external stakeholders from within and outside the U.S.  These individuals bring expertise in the following areas: national and international standards, medical informatics, software, database licensing, biotechnology, clinical and academic medicine, and managed care. |
| **SNOMED International Standards Board** | The SNOMED International Standards Board guides the scientific direction, editorial processes and scientific validity of the terminology.  The Standards Board consists of clinical content experts and medical informatics experts, half of whom come from the United Kingdom's National Health Service.  In addition, liaisons from numerous associations reflect the vision of an integrated clinical vocabulary.  Participation of liaisons allows scientific input from a range of clinical specialties and government agencies. |
| **SNOMED Working Groups** | The SNOMED Working Groups utilize the quality standards to structure terminology related to specific clinical domains.  The Working Group for Nursing, for example, is comprised of domain experts external to CAP and supported by the SNOMED International operations team.  The Working Groups advise the SNOMED Standards Board regarding scope of coverage, creation of new content, concept modeling, and scientific accuracy of the concepts and terms within a specific clinical domain. |
| **SNOMED Team: Operations, Terminology Modelers, Consulting and Licensing** | SNOMED International brings extensive experience in development and use of SNOMED.  Its multi-disciplinary team in the US and UK comprises individuals with backgrounds in medical informatics, clinical medicine, laboratory medicine, pharmacy, nursing, and education, as well as database services. |

### *Extent of review*

The quality processes used in the development of SNOMED CT were complemented with external review.

- **Technical review:**  The technical specifications for SNOMED CT were published for comment on both the SNOMED and NHS websites.
- **Alpha test review:**  Forty-two organizations in six countries tested the SNOMED CT alpha test file and completed a structured assessment instrument.
- **Alpha test feedback:**  Debriefing sessions were conducted in the U.S., in the U.K. and in Australia, at which time test sites shared their positive experiences and recommendations for improvement.

Early adopters of SNOMED RT were debriefed on their implementation experience in order to identify the key issues to be addressed in the SNOMED CT Technical Implementation Guide.

### *Continuous quality improvement*

Quality improvement is focused on updating the breadth and scope of the content to reflect changes in clinical care and advances in medical science; refining the content to deliver greater precision for data collection, retrieval and aggregation; and enhancing the functionality to serve users better.

## *C.3 Acknowledgements*

### *Contributors to SNOMED CT®*

SNOMED CT has been created by combining SNOMED RT and a computer-based nomenclature and classification known as Clinical Terms Version 3, formerly known as the Read Codes Version 3, which was created on behalf of the U.K. Department of Health and is Crown copyright.

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