INTERNATIONAL HEALTH TERMINOLOGY STANDARDS DEVELOPMENT ORGANISATION



SNOMED CT® User Guide January 2013 International Release (US English)

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Directory of available documents: www.snomed.org/doc

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Chapter

1

1 Preface



1.1 Purpose



This document provides an introductory overview of 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 CTs capabilities and uses from a content perspective. The detailed structures are documented more fully in the Technical Implementation Guide, and the details of the content model and principles used to edit the terminology are documented more fully in the Editorial Guide.

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 an 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 Implementation Guide* (TIG).

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 mixed case formatted as in the following example:

Example: | Peribronchial pneumonia (disorder) |

SNOMED CT attribute names are preceded and followed by a vertical bar. In some cases, to make them stand out they are presented in all capital letters as in the following example, though this is not to be considered a standard form for rendering attribute names:

Example: | FINDING SITE |



Notes
 Modified guide organization and structure Updated <i>Descriptions</i> and examples for <i>SNOMED CT</i> attributes and hierarchies Added overview of <i>SNOMED CT</i> structure and technology considerations Revised glossary
 Added section on the use of attributes for <i>Event</i> hierarchy Updated Attributes used to define Clinical findings: modifications were made to use of SEVERITY, EPISODICITY and PATHOLOGICAL PROCESS. Renamed <i>Context-dependent category (context-dependent category)</i> hierarchy to <i>Situation with explicit context (situation)</i> Updated Attributes used to define Procedure <i>concepts</i>: added ROUTE OF ADMINISTRATION as an attribute
 Update to Attributes used to define Clinical findings: COURSE and ONSET were retired; CLINICAL COURSE was introduced Update to Attributes used to define Procedure concepts
 Retired USING and ACCESS INSTRUMENT and replaced with USING DEVICE and USING ACCESS DEVICE Changes to ACCESS attribute New attributes USING SUBSTANCE and USING ENERGY
 New range for LATERALITY attribute Changes to range for PROCEDURE SITE and FINDING SITE and SPECIMEN SOURCE TOPOGRAPHY Added section on use of attribute for <i>Physical object</i> hierarchy Updates to Examples
 Updates to reflect transfer of IP to the International Health Terminology Standards Development Organization Removal of references to College of American Pathologists (CAP) derivative products Information provided on anticipated changes to Attributes used to define Procedure concepts: ACCESS APPROACH Changes to value for HAS DOSE FORM for Pharmaceutical / biologic products
 Changes to Attributes used to define Procedure concepts New attribute SURGICAL APPROACH Retired APPROACH Changes to Description for attribute RECIPIENT CATEGORY Changes to the range for ASSOCIATED FINDING and additional guidance on the use of

Version	Notes
July 2008	 Changes to domain for Attribute ROUTE OF ADMINISTRATION Discussion on the <i>References Table</i> Update on [D], [M], [X], [V], [SO], [Q], and [EDTA] <i>concepts</i> in an appendix Discussion of Negation was added to an appendix
January 2009	 Changes to the range for attributes in the ASSOCIATED WITH role hierarchy for precoordinated content Changes to the range for DIRECT SUBSTANCE for precoordinated content Clarification of the range for attributes in the PROCEDURE DEVICE role hierarchy Change to the range for SPECIMEN SOURCE IDENTITY
July 2009	 Changes to the range of attributes that take an anatomical value: Changes to the range for FINDING-SITE Changes to the range for PROCEDURE SITE attributes Changes to the range for SPECIMEN SOURCE TOPOGRAPHY Changes to the range for INTERPRETS and HAS INTERPRETATION Changes to the range for PATHOLOGICAL PROCESS Changes to the domain for the six attributes previously identified for use with Measurement procedures Changes to the range for LATERALITY
October 2009 - guide update	 Updated presentation of attribute ranges (allowable values) to reflect machine-readable concept model work Changed method of generating document from MS Word to DITA Overall appearance change and revised order of front matter Revised figures and diagrams so they can be shared SVG images Added appendix "Changes and historical notes" Changed "Role hierarchies" to "Attribute hierarchies" Updated and clarified wording in several sections
January 2010	 Added information about the metadata hierarchy and related changes, which are part of the January 2010 Technology Previews and will be incorporated into a future <i>International Release</i> Added paragraph on allowable domains in <i>post-coordinated expressions</i> Revised several glossary entries and aligned them to be identical with <i>Technical Reference Guide</i> glossary entries Expanded scope of User Guide to include new editorial policies that are currently being implemented in the <i>International Release</i>, but with which the terminology may not yet be fully compliant Improved formatting and layout of the <i>DITA</i>-generated document

Version	Notes
July 2010	 Updated information about the metadata hierarchy and related changes that will support implementation of the RF2 <i>Release Format</i> Incorporated formatting changes and example changes resulting from integrating the work on the Technical Implementation Guide Removed outdated historical sections from the appendix regarding the original merger of <i>SNOMED</i> and the <i>Read Codes</i> and content development processes; for current information about quality processes and content development procedures, users should refer to updated materials from the various <i>IHTSDO</i> Committees.
January 2011	 Added status icons to indicate status of individual sections Added section numbering In addition to pdf document, the guide is released in html and help format.
July 2011	Added reference to draft Pharmacy model.
January 2012	 Revised to reflect current inventory of documentation, and note that Release Format 2 (RF2) now supersedes the original Release Format 1 (RF1).
July 2012	Minor changes, e.g. inventory of documentation - note to reflect the fact that documentation accompanies but is not strictly part of the <i>International Release</i> .

1.5 Status



This guide contains parts and sections which differ in terms of the authority and status of their content. Each section of the guide is marked to indicate its publication type and status using the symbols shown in *Table 1* and *Table 2*.

Table 1: Document Types

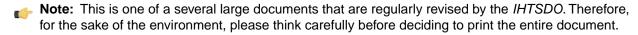
Type Name and Description	Draft	Review	Current
Standard A document or other resource that is intended to be authoritative. This includes specifications of SNOMED CT content and release files. Normative requirements for particular functions are also standards.	S	S	S
Guidance A document or other resource that is intended to provide advice or suggest possible approaches to particular requirement or subject area.	G	G	G

Table 2: Document Status

Status Name and Description	Standard	Guidance
Current Indicates that the document or resource is considered to be up-to-date and complete for the current release of SNOMED CT (indicated by an explicitly stated version date or by the publication date).	S	G
Review Indicates that the document or resource has been released for review and comments from <i>SNOMED CT</i> users and other stakeholders. It is intended to be complete but has not been formally approved as a final version.	S	G
Draft Indicates that the document or resource is a draft version. It may be incomplete and has not been approved in a final version.	S	G

This edition of the document is configured to use US English.

The PDF version of this draft is formatted to be printed on US Letter paper.



1.6 Referencing and Commenting



This document contains a way to reference topics a way that is not dependent on changes to the structure of the document as new versions are released including additional topics. These references are web addresses that will point to the latest version of and topic in the document.

If you are using the PDF version of the document there are three icons to the right of each title which provide useful information and relevant links.

The icon indicates the status of the topic (see *Status*).

The icon provides a link to the web address to accessing and referencing this topic online. Please use these reference to identify or share references to the topic as section and page numbers change between versions.

The icon links direct to a page where you can submit comments or error report about this topic. The comment tracker is an online resource that requires you to login to an IHTSDO CollabNet. If you do not have an account, there is an option to create an account available on the login page.

If you are using the online web version of this document then there is a single bookmark icon which when clicked, opens a small form with an easy copy and paste option for access to the topic reference and button to click to take you direct to the comment tracker.

1.7 Additional information



Further information about SNOMED CT is available by contacting IHTSDO:



Web:

www.ihtsdo.org

Email:

• support@ihtsdo.org

Address:

- IHTSDO
- Gammeltorv 4, 1.
- 1457 Copenhagen K
- Denmark

•

Tel: +45 3644 8736

Fax: +45 4444 8736

1.8 Inventory of Documentation



The following SNOMED CT documentation is made available to accompany the International Release of SNOMED CT from the International Health Terminology Standards Development Organization (IHTSDO). In the following listing hyperlinks are provided which will be maintained to point to the latest version of each of these documents.

A list of documents, including a wider range of versions, is available from: www.ihtsdo.org/doc.

SNOMED CT Technical Implementation Guide (TIG)

- On line HTML version: www.ihtsdo.org/tig
- PDF version US English Letter page size: www.ihtsdo.org/tig.pdf
- PDF version UK English A4 page size: www.ihtsdo.org/tig_gb.pdf

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 Editorial Guide

- On line HTML version: www.ihtsdo.org/eg
- PDF version US English Letter page size: www.ihtsdo.org/eg.pdf
- PDF version UK English A4 page size: www.ihtsdo.org/eg_gb.pdf

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

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

SNOMED CT User Guide

- On line HTML version: www.ihtsdo.org/ug
- PDF version US English Letter page size: www.ihtsdo.org/ug.pdf
- PDF version UK English A4 page size: www.ihtsdo.org/ug_gb.pdf

The User Guide provides a less detailed introduction to the topics covered in the Technical Implementation and Editorial Guides.

IHTSDO Glossary (DRAFT)

- On line HTML version: www.ihtsdo.org/glossary
- PDF version US English Letter page size: www.ihtsdo.org/glossary.pdf
- PDF version UK English A4 page size: www.ihtsdo.org/glossary_gb.pdf

The Glossary is a general resource used to support all the other documents in this inventory.

SNOMED CT Release Format 1 Guide

- On line HTML version: www.ihtsdo.org/rf1
- PDF version US English Letter page size: www.ihtsdo.org/rf1.pdf
- PDF version UK English A4 page size: www.ihtsdo.org/rf1_gb.pdf

The RF1 Guide provides technical information relevant to those using the original SNOMED CT Release Format. Although this format was replaced by RF2 in January 2012, the old format is being maintained for a transitional period.

SNOMED CT Non-Human Refset Guide

PDF version US English Letter page size: www.ihtsdo.org/guide/non_human_rs.pdf

A guide to use of the "Non-Human" Simple *Reference Set* that contains *concepts* and terms that are only used in veterinary medicine.

SNOMED CT Developer Toolkit Guide

PDF version US English Letter page size: www.ihtsdo.org/guide/toolkit.pdf

A guide to use of value-added files and scripts that are provided as a toolkit available as part of the SNOMED CT International Release.

- Additional Documentation: The following materials previously published in separate documents are now integrated as part of the Technical Implementation Guide.
 - Technical Reference Guide
 - Namespace Identifier Guide
 - Namespace Identifier Registry
 - File Naming Convention
 - RF2 Data Structures Specification
 - RF2 Reference Set Specifications
 - RF2 Update Guide
 - Stated Relationships Guide
 - Canonical Table Guide (previously included in RF1)

1.9 Where is the Glossary?



Some versions of documents may contain a glossary section. However, we are also developing a separate *IHTSDO* Glossary document which is currently available in a draft form. The intention is to move toward using this single common resource make it easier to ensure consistency across the *IHTSDO* community.

The current version of the IHTSDO Glossary is available as follows:

- On line HTML version: www.ihtsdo.org/glossary
- PDF version US English Letter page size: www.ihtsdo.org/glossary.pdf
- PDF version UK English A4 page size: www.ihtsdo.org/glossary_gb.pdf
- You can create links that query the glossary use the following web address pattern
 "www.ihtsdo.org/define/word or phrase". The following examples can be tested and you can include these
 types of reference in your documents to make it easy to refer to the IHTSDO glossary definitions:
 - www.ihtsdo.org/define/ihtsdo
 - www.ihtsdo.org/define/snomed ct
 - www.ihtsdo.org/define/affiliate licence

1.10 Copyright Notice





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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 Read Codes Version 3, which was created on behalf of the UK Department of Health and is Crown copyright.

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Chapter

2

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 merger 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:

Table 3: Top Level Concepts

- | Clinical finding |
- | Procedure |
- | Observable entity |
- | Body structure |
- | Organism |
- | Substance |
- | Pharmaceutical / biologic product |
- | Specimen |
- | Special concept |
- | Linkage concept |

- | Physical force |
- | Event |
- | Environment or geographical location |
- | Social context |
- | Situation with explicit context |
- | Staging and scales |
- | Physical object |
- | 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 aid 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.

2.3 Current content scope



The terminology domains covered by SNOMED include:

- Clinical findings, including disorders
- Procedures, broadly defined as including all health related activities such as history taking, physical
 examination, testing, imaging, surgical procedures, disease-specific training and education, counseling,
 and so forth.
- Observable entities which, when given a value, provide a specific finding or assertion about health related information. Examples include the names of lab tests, physical exam tests, dates of significant events, and so forth.
- Anatomy, morphology, and other body structures
- Chemicals and other substances of relevance to health and health care, including generic drug ingredient names, generic drug products (virtual medicinal products)
- Generic physical devices relevant to health care, or to broad categories of injury or accident
- Organisms relevant to health and health care of humans and animals
- Other etiologies of disease, including external forces, harmful events, accidents, genetic abnormalities,
- Functions and activities
- Social contexts relevant to health, including general categories of status of employment, education, housing, care provision, family *Relationships*, and so forth.
- Types of clinical records, documents, certificates and other records and record components relevant to health care.
- Staging, scales, classifications, and other miscellaneous health information
- Attributes and values necessary to organize and structure the terminology
- Note: Non-human and human concepts: There have been errors in implementing SNOMED CT where non-human concepts have mistakenly been included in published value sets intended for human-only use. It is a mistake to assume that SNOMED CT applies to human medicine only. Many codes are applicable to both human and non-human subjects. Some codes are applicable to non-human subjects only, and these non-human codes are identified in the non-human subset provided with the International Release. For human-only applications, the non-human subset can be removed.

Chapter

3

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.

3.1.1 Concept granularity



The meaning represented by a *Concept* can be general (for example | procedure |), specific (for example | excisional biopsy of lymph node |) or somewhere in between (for example | biopsy of lymph node |).

- More specific Concepts:
 - Have finer granularity (more granular);
 - · Represent clinical detail.
- More general Concepts:
 - · Have coarser granularity (less granular);
 - Represent less clinical detail;
 - · Aggregate similar Concepts.

Support for multiple levels of granularity allows *SNOMED CT* to be used to represent clinical data at a level of detail that is appropriate to a range of different uses.

Concepts with different levels of granularity are linked to one another by | is a | relationships. This enables appropriate aggregation of specific information within less detailed categories.

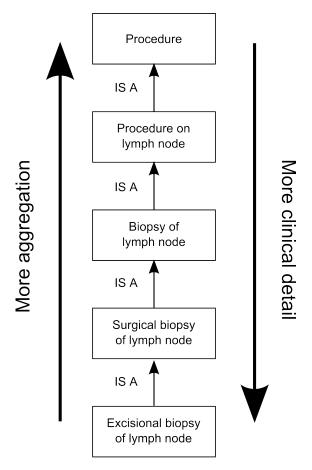


Figure 1: Multiple levels of granularity

3.1.2 Concept Identifiers



Each SNOMED CT Concept has a permanent unique numeric Identifier which is known as the ConceptId.

The sequence of digits in a *ConceptId* does not convey any information about the meaning or nature of the *Concept*¹. The meaning of *Concept* is represented in human-readable forms by *Descriptions* and in a computer processable form by *Relationships* with other *Concepts*.

The advantages of meaningless *Identifiers* include:

- *Identifier* permanence without undermining interpretation:
 - In contrast, to maintain consistency, a meaningful code may need to change to reflect revised understanding of the nature of a disorder.
- Enabling multiple aspects of meaning to be represented in the same way:
 - A meaningful code can only represent part of meaning of a complex *concept*. For example, |staphylococcal pneumonia| is an |infection|, a |respiratory disorder| and a |disorder| caused by |staphylococcus| but only one of these aspects can be represented by a code based *hierarchy*. Thus in the 'J' in the *ICD-10* code 'J152: Pneumonia due to staphylococcus' represents that fact that this is a respiratory disorder but does not represent the fact that it is an infection (codes starting with 'A') or that it is due to staphylococcus ('A490: Staphylococcal infection, unspecified').

¹ The use of meaningless identifiers differs from the approach taken by some other coding systems and classifications. For example, the first character of an ICD-10 code indicates the general classification that it falls within.

- No artificial limitation on concept granularity:
 - Typical approaches to meaningful coding impose limits on both the number of levels of specificity (i.e.
 the length of the code) and the number of options at each level (i.e. the number of different symbols
 that can be used in each character position).

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 a ConceptId.

Example:

Some of the *Descriptions* associated with *Conceptld* 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).

3.2.1 Types of descriptions







Each *concept* has one *Fully Specified Name* (FSN) intended to provide an unambiguous way to name a *concept*. The purpose of the FSN is to uniquely describe a *concept* and clarify its meaning. The FSN is not a commonly used term or natural phrase and would not be expected to appear in the human-readable representation of a clinical record.

Note: The term in each FSN is unique across the entire active content of a SNOMED CT release.

Each FSN term ends with a "semantic tag" in parentheses. The semantic tag indicates the semantic category to which the *concept* belongs (e.g. clinical finding, disorder, procedure, organism, person, etc.). The "semantic tag" helps to disambiguate the different *concept* which may be referred to by the same commonly used word or phrase.

Example: | Hematoma (morphologic abnormality) | is the FSN of the *concept* that represents the "hematoma" that a pathologist sees at the tissue level. In contrast, | Hematoma (disorder) | is the FSN of the *concept* that represents the clinical diagnosis that a clinician makes when they decide that a person has a "hematoma".

3.2.1.2 Preferred Term



Each *concept* has one *Preferred Term* in a given language *dialect*. The *Preferred Term* is a common word or phrase used by clinicians to name that *concept*.

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.

Note: Unlike the *Fully Specified Name* (FSN) the *Preferred Terms* need not be unique. Occasionally, the *Preferred Term* for one *concept* may also be a *Synonym* or the *Preferred Term* for a different *concept*. Interpretation in these cases will depend on context of use.

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 concept.

Note: Selection of one term over another as "preferred" in a given language *dialect* depends entirely on whose preferences are being expressed. Different users are likely to have different preferences, and implementers are encouraged to select or create terms that properly represent the *concept* and meet the preferences of users. There is no expectation that the *Preferred Term* distributed with a given language *dialect* will meet all use cases; nor is there anything sacrosanct about the term. The U.S. English *Preferred Term* is not guaranteed to have any special status relative to other terms. Rather, it is merely one term that properly represents the *concept* and can be used as a starting point.

3.2.1.3 Synonym



A *synonym* represents a *term*, other than the FSN or *Preferred Term*, that can be used to represent a *concept* in a particular language or *dialect*.

- **Example:** Synonyms of the concept 22298006 | myocardial infarction (disorder) | in English include:
 - | cardiac infarction | (Description.id: 37442013);
 - | heart attack | (Description.id: 37443015);
 - | infarction of heart | (Description.id: 37441018).

The Preferred Term for this concept in English is: | myocardial infarction | (Description.id: 37436014).

Note: Synonyms, like Preferred Terms, are not required to be unique.

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.

3.3.1 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 defined as:
 - | is a | subtype of | Fracture of foot (disorder) |
 - and has | finding site | | Bone structure of tarsus (body structure) |;
 - and has | associated morphology | | Fracture (morphologic abnormality)
 | .
- Note: A relationship is assigned only when that relationship is always known to be true.
- **Example:** Group A Streptococcus causes most cases of Streptococcal pharyngitis. However, a small percentage of these cases are caused by other species of Streptococcus. Therefore, it would be incorrect to define | Streptococcal sore throat (disorder) | as having | causative agent | | Streptococcus pyogenes (organism) |. Instead it is correctly defined as having the more general | causative agent | | Genus Streptococcus (organism) |.

3.3.2 IS A Relationships



is a | relationships are also known as "Supertype - Subtype relationships" or "Parent - Child relationships". is a | relationships are the basis of SNOMED CT's hierarchies, as illustrated below.

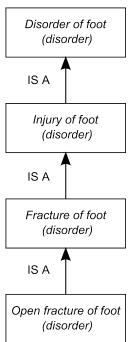


Figure 2: Example IS A hierarchy

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.

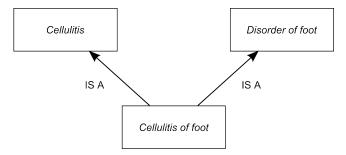


Figure 3: Example IS A Relationships

3.3.3 Attribute Relationships



An attribute Relationship is an association between two concepts that specifies a defining characteristic of one of the concepts (the source of the Relationship). Each Attribute Relationship has a name (the type of Relationship) and a value (the destination of the Relationship). For example

The combination of the *attribute Relationships* and | is a | *relationships* associated with a *concept* represent the logical definition of that *concept*. The logical *concept* definition includes one or more supertypes (represented by | is a | *relationships*), and a set of defining *Attributes* that differentiate it from the other *concept* definitions.

Example:

Since pneumonia is a disorder of the lung, the logical definition of the *concept* | Pneumonia (disorder) | in *SNOMED CT* includes the following *Relationship*. The *Attribute* | Finding site | is assigned the value | Lung structure (body structure) |.

| Finding site | = | Lung structure (body structure) |

The full definitions of the *concepts* | Pneumonia (disorder) |,|Infective pneumonia (disorder)| and |Bacterial pneumonia (disorder)| are shown below. Each line represents a defining *Attribute* with a value.

- | is a | = | pneumonitis |
- , | is a | = | lung consolidation |
- , { | associated morphology | = | inflammation |
- , | associated morphology | = | consolidation |
- , | finding site | = | lung structure | }

Figure 4: Definition of |Pneumonia (disorder)|

- | is a | = | infectious disease of lung |
- , | is a | = | pneumonia |
- , | pathological process | = | infectious process |
- , { | associated morphology | = | inflammation |
- , | associated morphology | = | consolidation |
- , | finding site | = | lung structure | }

Figure 5: Definition of |Infective pneumonia (disorder)|

- | is a | = | bacterial lower respiratory infection |
- , | is a | = | infective pneumonia |
- , | causative agent | = | bacteria |
- , | pathological process | = | infectious process |
- , { | associated morphology | = | inflammation |
- , | associated morphology | = | consolidation |

Figure 6: Definition of |Bacterial pneumonia (disorder)|

Figure 7 illustrates some of these Relationships graphically. | is a | Relationships relate a concept to more general concepts of the same type. In contrast, Attribute Relationships (such as | Finding site | and | Causative agent |) relate a concept to relevant values in other branches of the subtype hierarchy.

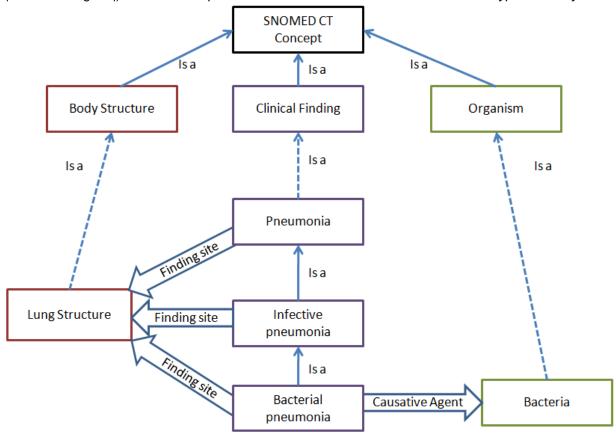


Figure 7: Illustration of Defining Relationships

4

4 Attributes Used in SNOMED CT



This part of the guide provides an overview of the defining attributes used by the SNOMED CT Concept Model. Further details are provided in the chapters dedicated to each hierarchy.

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.

4.1.1 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 |.

4.1.2 Allowable domains in post-coordinated expressions



The concept model provides constraints for attributes that are used as defining relationships, both in distributed SNOMED CT content (so-called pre-coordinated definitions) and in post-coordinated expressions, as described in the document Abstract Logical Models and Representational Forms (available at www.ihtsdo.org/our-standards/technical-documents/). The domain (or starting concept) to which qualifying relationships are applied in post-coordinated expressions may be more general than the domain of defining relationships defined in the concept model, as long as the resulting post-coordinatedexpression as a whole satisfies the concept model constraints.

For example, the *concept model constraint* for | SURGICAL APPROACH | requires that its domain be | Surgical procedure (procedure) | 387713003. When | SURGICAL APPROACH | is used in a qualifying *relationship* in *post-coordinated expressions*, the starting domain may be a general procedure, if the resulting *expression* satisfies the *concept model constraint*. In other words, when | SURGICAL APPROACH | is added to a general procedure as a qualifying *relationship*, the *post-coordinated expression* should also have a METHOD with a value of | Surgical action (qualifier value) | or one of its *subtypes*, so that the resulting *concept* becomes a *subtype* of | Surgical procedure (procedure) |.

4.1.3 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 descendants, and the Range for | FINDING SITE | is | Anatomical or acquired body structure (body structure) | and its descendants in the | Body structure | hierarchy.

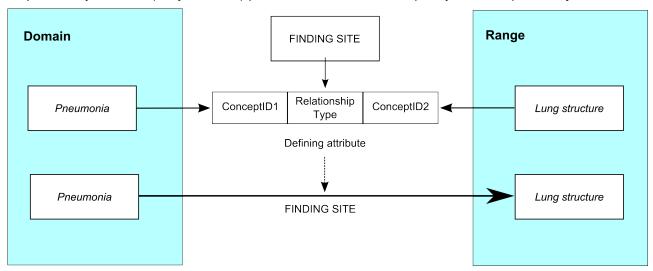


Figure 8: Example Pneumonia FINDING SITE Lung structure

The Domain for the | FINDING SITE | attribute is the | Clinical finding | hierarchy. In the above example, 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 |, | Specimen | and | Physical object |). In addition, | LATERALITY | is a defining attribute applied to | Body structure | concepts. Other hierarchies, such as | Social context |, | Substance |, Organism |, and | Observable entity |, are not assigned 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 describes the approved attributes used in SNOMED CT. There are many other attributes in SNOMED CT, subtypes of | Unapproved attribute (attribute) |, which have not yet been evaluated thoroughly and approved for use.

4.2 Attribute Hierarchies in SNOMED CT



Selected SNOMED CT attributes have a hierarchical relationship to one another known as "attribute hierarchies". In an attribute 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.

4.2.1 Attribute hierarchies used in modeling Procedures



Three groups of attributes are organized as a simple two-level hierarchy. The three top level attributes are | PROCEDURE SITE |, | PROCEDURE DEVICE |, and | PROCEDURE MORPHOLOGY |. Each has a sub-attribute to represent the direct object, and another to represent the indirect object. In addition, PROCEDURE DEVICE | can be specialized by the attributes | USING DEVICE | and | USING ACCESS DEVICE |.

| PROCEDURE DEVICE | attribute hierarchy:

- | PROCEDURE DEVICE |
 - | DIRECT DEVICE |
 - | INDIRECT DEVICE |
 - | USING DEVICE |
 - | USING ACCESS DEVICE |

| PROCEDURE MORPHOLOGY | attribute *hierarchy*:

- | PROCEDURE MORPHOLOGY |
 - | DIRECT MORPHOLOGY |
 - | INDIRECT MORPHOLOGY |

| PROCEDURE SITE | attribute *hierarchy*:

- | PROCEDURE SITE |
 - | PROCEDURE SITE DIRECT |
 - | PROCEDURE SITE INDIRECT |

4.2.2 Attribute hierarchy used in modeling Clinical Findings



| ASSOCIATED WITH | attribute hierarchy:

- | ASSOCIATED WITH |
 - | AFTER |
 - | DUE TO |
 - | CAUSATIVE AGENT |

4.3 Attributes used to define Clinical Finding concepts



Table 4: Approved Clinical Finding attributes summary

Defining Attribute	Subsumed Attribute	Allowable Values
FINDING SITE		Anatomical or acquired body structure 442083009 (<<)
ASSOCIATED MORPHOLOGY		Morphologically abnormal structure 49755003 (<<)

Defining Attribute	Subsumed Attribute	Allowable Values
ASSOCIATED WITH		Clinical Finding 404684003 (<<) Procedure 71388002 (<<) Event 272379006 (<<) Organism 410607006 (<<) Substance 105590001 (<<) Physical object 260787004 (<<) Physical force 78621006 (<<) Pharmaceutical / biologic product 373873005 (<< Q only)
	CAUSATIVE AGENT	SNOMED CT Concept 138875005 (==) Organism 410607006 (<<) Substance 105590001 (<<) Physical object 260787004 (<<) Physical force 78621006 (<<) Pharmaceutical / biologic product 373873005 (<< Q only) SNOMED CT Concept 138875005 (==)
	DUE TO	Clinical Finding 404684003 (<=) Event 272379006 (<=)
	AFTER	Clinical Finding 404684003 (<<) Procedure 71388002 (<<)
SEVERITY		Severities 272141005 (<=)(< Q)
CLINICAL COURSE		Courses 288524001 (<=)(< Q)
EPISODICITY		Episodicities 288526004 (<=)(< Q)
INTERPRETS		Observable entity 363787002 (<<) Laboratory procedure 108252007 (<<) Evaluation procedure 386053000 (<<)
HAS INTERPRETATION		Findings values 260245000 (<<)
PATHOLOGICAL PROCESS		Autoimmune 263680009 (==) Infectious process 441862004 (<<) Hypersensitivity process 472963003 (< <)

Defining Attribute	Subsumed Attribute	Allowable Values
HAS DEFINITIONAL MANIFESTATION		Clinical finding 404684003 (<<)
OCCURRENCE		Periods of life 282032007 (<)
FINDING METHOD		Procedure 71388002 (<=)
FINDING INFORMER	₹	Performer of method 420158005 (<<) Subject of record or other provider of history 419358007 (<<)

Note:

Meaning of Allowable Values (Range) notations:

- (<<) this code and descendants,
- (<) descendants only,
- (<=) descendants only (stated) except for supercategory groupers,
- (==) this code only,
- (< Q) descendants only when in a qualifying Relationship,
- (< Q only) descendants only, and only allowed in a qualifying Relationship.



4.3.1 FINDING SITE



This attribute specifies the body site affected by a condition.

Table 5: Permissible values for FINDING SITE

Attribute Values	Examples
Anatomical or acquired body structure 442083009 (<<)	Kidney disease (disorder) • FINDING SITE Kidney structure (body structure)
	Appendicitis (disorder) • FINDING SITE Appendix structure (body structure)

4.3.2 ASSOCIATED MORPHOLOGY



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

Table 6: Permissible values for ASSOCIATED MORPHOLOGY

Attribute Values	Examples
Morphologically abnormal structure 49755003 (<<)	Bone marrow hyperplasia (disorder) ASSOCIATED MORPHOLOGY Hyperplasia (morphologic abnormality)
	Pancreatitis (disorder) • ASSOCIATED MORPHOLOGY Inflammation (morphologic abnormality)

4.3.3 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.

Table 7: Permissible values for ASSOCIATED WITH

Attribute Values	Examples
Clinical Finding 404684003 (<<)	
Procedure 71388002 (<<)	
Event 272379006 (<<)	
Organism 410607006 (<<)	
Substance 105590001 (<<)	
Physical object 260787004 (<<)	
Physical force 78621006 (<<)	
Pharmaceutical / biologic product 373873005 (<< Q only)	
SNOMED CT Concept 138875005 (==)	

| ASSOCIATED WITH | subsumes the following, more specific, attributes in what is called an attribute hierarchy (explained in Attribute Hierarchies in SNOMED CT on page 25):

- | AFTER |
- | DUE TO |
- | CAUSATIVE AGENT |

4.3.4 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.

Table 8: Permissible values for AFTER

Attribute Values	Examples
Clinical Finding 404684003 (<<)	Post-viral disorder (disorder)
Procedure 71388002 (<<)	AFTER Viral disease (disorder)

This example can be paraphrased as: "every post-viral disorder occurs after some viral disease".

4.3.5 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.

Table 9: Permissible values for DUE TO

Attribute Values	Examples
Clinical Finding 404684003 (<=) Event 272379006 (<=)	Cheilitis due to atopic dermatitis (disorder) • IS A Cheilitis (disorder) • DUE TO Atopic dermatitis (disorder)

4.3.6 CAUSATIVE AGENT



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

Table 10: Permissible values for CAUSATIVE AGENT

Attribute Values	Examples
Organism 410607006 (<<)	Bacterial endocarditis (disorder)
Substance 105590001 (<<)	CAUSATIVE AGENT Superkingdom Bacteria Carganiam
Physical object 260787004 (<<)	(organism)
Physical force 78621006 (<<)	Fentanyl allergy (disorder)
Pharmaceutical / biologic product 373873005 (<< Q only)	CAUSATIVE AGENT Fentanyl (substance)
SNOMED CT Concept 138875005 (==)	Electrical burn of skin (disorder)
	CAUSATIVE AGENT Electricity (physical force)

4.3.7 SEVERITY



This attribute is used to subclass a | Clinical finding | *concept* according to its severity; however, caution is encouraged because this use is said to be *relative*. By relative, it is meant that it is incorrect to assume that the same degree of disease intensity or hazard is implied for all | Clinical finding | to which this attribute is applied. There are three *reasons*.

First, "severe" could be interpreted differently depending on what other values are available to choose for severity. Thus severity is relative to the other values in the value set presented to users. Consider the different meaning of severity in each of the following three sets of values:

- mild / moderate / severe
- minimal / mild / moderate / severe / very severe
- mild / mild to moderate / moderate / moderate to severe / severe / life threatening / fatal

Second, the severity is defined relative to the expected degree of intensity or hazard of the | Clinical finding I that is being qualified. A common cold has a baseline intensity or hazard much less than that of a more serious disease like lupus erythematosus or pneumonia; thus a severe cold might be considered less intense or hazardous than a mild pneumonia.

Third, some disorders that are life-threatening do not ordinarily have a severity assigned to them. Cancer, for example, is generally not subclassed according to mild, moderate and severe types, but rather is subclassed according to stage or grade.

For these reasons, the | SEVERITY | attribute cannot be relied on to retrieve all Clinical findings with serious or life-threatening import. Nevertheless, it is still useful for subclassing certain concepts and differentiating between different severities of a single disorder. SEVERITY is not used to model any concepts pre-coordinated in the International Release but it can still be used in post-coordination as a qualifier.

Table 11: Permissible values for SEVERITY

Attribute Values	Examples
Severities 272141005 (<=)(< Q)	

4.3.8 CLINICAL COURSE



This attribute is used to represent both the course and onset of a disease. Many conditions with an acute (sudden) onset also have an acute (short duration) course. Few diseases with a chronic (long - term) course would need to have their onset sub-divided into rapid or gradual subtypes, and thus there is no clear need for separating the rapidity of onset from the duration of a disease; based on testing by implementers and modelers, a single attribute with values that combine these meanings has clearly been more reproducible and useful than two attributes that attempt to separate the meanings.

Table 12: Permissible values for CLINICAL COURSE

Attribute Values	Examples
Courses 288524001 (<=)(< Q)	Acute amebic dysentery (disorder)
	CLINICAL COURSE Sudden onset AND/OR short duration (qualifier value)
	Chronic fibrosing pancreatitis (disorder)
	CLINICAL COURSE Chronic (qualifier value)

The word acute has more than one meaning, and the meanings are often overlapping or unclear. The word acute may imply rapid onset, short duration, or high severity; in some circumstances it might be used to mean all of these. For morphological terms it may also imply the kind of morphology associated with the speed of onset. | Acute inflammation (morphologic abnormality) | does not necessarily have CLINICAL COURSE | Sudden onset AND/OR short duration |, but rather implies polymorphonuclear infiltration; likewise | Chronic

inflammation (morphologic abnormality) | implies mononuclear cell infiltration, not necessarily a chronic course, although inflammation with a chronic course is highly correlated with a lymphocytic infiltration.

4.3.9 EPISODICITY



| EPISODICITY | is used to represent episodes of care provided by a physician or other care provider, typically a general practitioner, *not* episodes of disease experienced by the patient. See *EPISODICITY no longer modeled in active content* on page 81, regarding the origin of the attribute. For example, asthma with | EPISODICITY |=| first episode | represents the first *time* the patient presents to their health care provider with asthma. EPISODICITY is not used to model any *concepts pre-coordinated* in the *International Release* but it can still be used in *post-coordination* as a *qualifier*.

Table 13: Permissible values for EPISODICITY

Attribute Values	Examples
Episodicities 288526004 (<=)(< Q)	

4.3.10 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.

Table 14: Permissible values for INTERPRETS

Attribute Values	Examples
Observable entity 363787002 (<<) Laboratory procedure 108252007 (<<) Evaluation procedure 386053000 (<<)	Decreased muscle tone (finding) • INTERPRETS muscle tone (observable entity) • HAS INTERPRETATION Decreased (qualifier value)
	 Abnormal glucose level (finding) INTERPRETS Glucose measurement (procedure) HAS INTERPRETATION Outside reference range (qualifier value)

Note: For *concepts* in the Measurement finding subhierarchy, the value for | INTERPRETS |should be an Evaluation procedure or a Laboratory procedure rather than an Observable entity.

4.3.11 HAS INTERPRETATION



This attribute is 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.).

Table 15: Permissible values for HAS INTERPRETATION

Attribute Values	Examples
Findings values 260245000 (<<)	Decreased muscle tone (finding)
	INTERPRETS Muscle tone (observable entity)
	HAS INTERPRETATION Decreased (qualifier value)
	Abnormal glucose level (finding)
	 INTERPRETS Glucose measurement (procedure) HAS INTERPRETATION Outside reference range (qualifier value)

4.3.12 PATHOLOGICAL PROCESS



This attribute provides information about the underlying pathological process for a disorder, but only when the results of that process are not structural and cannot be represented by the | ASSOCIATED MORPHOLOGY attribute.

The values | Infectious process (qualifier value) | and its subtype | Parasitic process (qualifier value) | are included in the range for | PATHOLOGICAL PROCESS |. These were added to accommodate the change in the modeling of concepts in the | Infectious disease (disorder) | subhierarchy where the infectious aspect of the disease is represented using | PATHOLOGICAL PROCESS |.

Table 16: Permissible values for PATHOLOGICAL PROCESS

Attribute Values	Examples
Autoimmune 263680009 (==) Infectious process 441862004 (<<) Hypersensitivity process 472963003 (< <)	Autoimmune parathyroiditis (disorder) • PATHOLOGICAL PROCESS Autoimmune (qualifier value)
	Disease caused by parasite (disorder) • PATHOLOGICAL PROCESS Parasitic process (qualifier value)

Pathological process must not be used for values that could overlap with | ASSOCIATED MORPHOLOGY I. Inflammatory processes result in inflammation (by definition), but these disorders should be defined using their morphology.

4.3.13 HAS DEFINITIONAL MANIFESTATION



This attribute links disorders to the manifestations (observations) that define them. It can only be applied to disorders.

Table 17: Permissible values for HAS DEFINITIONAL MANIFESTATION

Attribute Values	Examples
Clinical finding 404684003 (<<)	Seizure disorder (disorder)
	HAS DEFINITIONAL MANIFESTATION Seizure (finding)
	Hypertensive disorder, systemic arterial (disorder)
	HAS DEFINITIONAL MANIFESTATION Finding of increased blood pressure (finding)

4.3.14 OCCURRENCE



This attribute refers to the specific period of life during which a condition first presents. Multiple values of | OCCURRENCE | for a single *concept* are not desirable, and these will be addressed in a future release. This does not mean the condition cannot persist beyond the period of life in which it first presents.

Table 18: Permissible values for OCCURRENCE

Attribute Values	Examples
Periods of life 282032007 (<)	Childhood phobic anxiety disorder (disorder)
	OCCURRENCE Childhood (qualifier value)

4.3.15 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 |.

Table 19: Permissible values for FINDING METHOD

Attribute Values	Examples
Procedure 71388002 (<=)	Finding by palpation (finding)
	FINDING METHOD Palpation (procedure)

4.3.16 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 |.

Table 20: Permissible values for FINDING INFORMER

Attribute Values	Examples
Performer of method 420158005 (<<)	Complaining of a headache (finding)
Subject of record or other provider of history 419358007 (<<)	FINDING INFORMER Subject of record or other provider of history (person)
	On examination - ankle clonus (finding)
	FINDING INFORMER Performer of method (person)

It is accepted that an information model should permit identification of a particular individual who provides information; | FINDING INFORMER | is not about the particular individual. It is about the category or type of informer, which is used to differentiate self-reported symptoms from provider-observed signs. Granted, this permits inclusion of epistemology-loaded terms (cf. Bodenreider el al., FOIS 2004), but health care is full of such terms, and they are (or at least can be) understandable, reproducible and useful.

4.4 Attributes used to define Procedure concepts



Table 21: Approved Procedure attributes summary

Defining Attribute	Subsumed Attribute	Allowable Values
PROCEDURE SITE		Anatomical or acquired body structure 442083009 (<<)
	Procedure site - Direct	Anatomical or acquired body structure 442083009 (<<)
	Procedure site - Indirect	Anatomical or acquired body structure 442083009 (<<)
PROCEDURE MORPHOLOGY		Morphologically abnormal structure 49755003 (<<)
	Direct morphology	Morphologically abnormal structure 49755003 (<<)
	Indirect morphology	Morphologically abnormal structure 49755003 (<<)
METHOD		Action 129264002 (<<)

Defining Attribute	Subsumed Attribute	Allowable Values
PROCEDURE DEVICE		Device 49062001 (<<)
	DIRECT DEVICE	Device 49062001 (<<)
	INDIRECT DEVICE	Device 49062001 (<<)
	USING DEVICE	Device 49062001 (<<)
	USING ACCESS DEVICE	Device 49062001 (<<)
ACCESS		Surgical access values 309795001 (<=)(< Q)
DIRECT SUBSTANCE		Substance 105590001 (<<) Pharmaceutical / biologic product 373873005 (<<)
PRIORITY		Priorities 272125009 (<=)(< Q)
HAS FOCUS		Clinical finding 404684003 (<<) Procedure 71388002 (<<)
HAS INTENT		Intents (nature of procedure values) 363675004 (<=)
RECIPIENT CATEGORY		Person 125676002 (<<) Family 35359004 (<<) Community 133928008 (<<) Donor for medical or surgical procedure 105455006 (<<) Group 389109008 (<<)
REVISION STATUS		Primary operation 261424001 (<<) Revision - value 255231005 (<<) Part of multistage procedure 257958009 (<<)
ROUTE OF ADMINISTRATION		Route of administration value 284009009 (<<)
SURGICAL APPROACH		Procedural approach 103379005 (<=)(< Q)
USING ENERGY		Physical force 78621006 (<<)
USING SUBSTANCE		Substance 105590001 (<<)

Note:

Meaning of Allowable Values (Range) notations:

- (<<) this code and descendants,
- (<) descendants only,
- (<=) descendants only (stated) except for supercategory groupers,
- (==) this code only,
- (< Q) descendants only when in a qualifying Relationship,
- (< Q only) descendants only, and only allowed in a qualifying Relationship.

Note:

Attributes should be grouped with the | METHOD | attribute to which they apply; in the absence of a | METHOD | attribute, attributes that are related to each other should be grouped. The one exception is | RECIPIENT CATEGORY |, because a single procedure code should not be pre-coordinated in situations where more than one recipient category is involved. Such complex statements should utilize two or more procedure codes that are placed into an appropriately structured information model.

Note: See also Procedure.

4.4.1 PROCEDURE SITE



The | PROCEDURE SITE | attribute describes the body site acted on or affected by a procedure. This attribute subsumes, in an attribute hierarchy (see Attribute Hierarchies in SNOMED CT on page 25), 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 |.

Table 22: Permissible values for PROCEDURE SITE

Attribute Values	Examples
Anatomical or acquired body structure 442083009 (<<)	Procedure on colon (procedure) • PROCEDURE SITE colon structure (body structure)

Procedures need not necessarily be categorized by site. | Human body structure | should not be assigned as a default value of this attribute because many procedures can be performed on non-human subjects, and because this attribute does not necessarily need to be present in a procedure concept definition in order for classifier algorithms to work properly.

The general | PROCEDURE SITE | attribute is used to model the site for high-level grouper type procedure concepts. It is most likely to be used for concepts that do not require a | METHOD | (action) attribute. Relatively few concepts will be modeled using | PROCEDURE SITE |, rather than the more specific direct and indirect site attributes (see below).

4.4.1.1 PROCEDURE SITE DIRECT



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

Table 23: Permissible values for PROCEDURE SITE DIRECT

Attribute Values	Examples
Anatomical or acquired body structure 442083009	Amputation of the foot (procedure)
(<<)	METHOD Amputation - action (qualifier value)
	Procedure site - Direct Foot structure (body structure)
	Biopsy of femur (procedure)
	 METHOD Biopsy - action (qualifier value) Procedure site - Direct Bone structure of femur (body structure)

4.4.1.1.1 Multiple values for PROCEDURE SITE DIRECT



When the | METHOD | (action) acts directly on a morphological abnormality (more simply, a lesion) arising from, or existing in, the cells of the tissue in which it occurs [e.g. a tumor (including metastatic tumors), granuloma, polyp, or cyst] the attribute | DIRECT MORPHOLOGY | is used to model the morphological abnormality. Most concept definitions where | DIRECT MORPHOLOGY | is used, which also require a site in the definition, will use | Procedure site - Direct |. Thus, there can be more than one direct object of the | METHOD | for a concept. For example, the | DIRECT MORPHOLOGY | and the | Procedure site - Direct | can both be direct objects of the | METHOD |. An example of an exception to this rule would be removal of a calculus from the ureter. In this case, the calculus is the direct object, but there is no procedure site that is that direct object, since the ureter is an indirect object.

The most common concepts that have more than one direct object of the | METHOD | are Subtypes of | Removal (procedure) | where the object of the removal (e.g. a neoplasm) can be considered to be a part of the tissue at the anatomical site in which it occurs. When a part of an anatomical structure (however abnormal) has been removed, both the morphological abnormality and the anatomical structure in which it is located are to be modeled as direct objects for the | METHOD | | Removal - action (qualifier value) |. Grafts that become attached via in-growth of capillaries, fibroblasts, and/or other cells or tissues would also be regarded as biologically connected, and therefore modeling their removal would include the anatomical structure as a direct object of the action. The anatomical structure is not to be modeled as a direct object of a removal only when the procedure does not necessarily involve removal also of part of the anatomy; examples include removals of things such as a foreign body, a catheter, a renal calculus, or a mechanical implant like a pacemaker.

4.4.1.2 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. Exceptions (concepts that do not specify a direct object, but only an indirect object) are usually general groupers such as | Arm implantation (procedure) | (meaning implantation of something into the arm), since the thing implanted could be either a device or a substance (material).

Table 24: Permissible values for PROCEDURE SITE INDIRECT

Attribute Values	Examples
Anatomical or acquired body structure 442083009 (<<)	Removal of catheter from brachial vein (procedure)
	Removal of calculus of urinary bladder (procedure)

4.4.2 PROCEDURE MORPHOLOGY



PROCEDURE MORPHOLOGY | is the attribute used to specify the morphology or abnormal structure involved in a procedure. This attribute subsumes the more specific attributes | DIRECT MORPHOLOGY | and | INDIRECT MORPHOLOGY | that should be used if possible (see below). | 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.

Table 25: Permissible values for PROCEDURE MORPHOLOGY

Attribute Values	Examples
Morphologically abnormal structure 49755003 (<<)	

Hematoma, calculus, foreign body, blood clot, embolus, and some other entities are not strictly body structures, but are in the body structure hierarchy under morphologically abnormal structure, and are valid values for the | PROCEDURE MORPHOLOGY | attributes.

4.4.2.1 DIRECT MORPHOLOGY



This attribute describes the morphologically abnormal structure that is the direct object of the METHOD action.

Table 26: Permissible values for DIRECT MORPHOLOGY

Attribute Values	Examples
Morphologically abnormal structure 49755003 (<<)	 Excision of benign neoplasm (procedure) METHOD Excision - action (qualifier value) DIRECT MORPHOLOGY Neoplasm, benign (morphologic abnormality)

4.4.2.2 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).

Table 27: Permissible values for INDIRECT MORPHOLOGY

Attribute Values	Examples
Morphologically abnormal structure 49755003 (<<)	Removal of mesh from wound (procedure) • METHOD Removal - action (qualifier value) • DIRECT DEVICE Mesh (physical object) • INDIRECT MORPHOLOGY Wound (morphologic abnormality)

4.4.3 METHOD



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

Table 28: Permissible values for METHOD

Attribute Values	Examples
Action 129264002 (<<)	Incision of ureter (procedure) • METHOD Incision - action (qualifier value) • Procedure site - Direct Ureteric structure (body structure)

The | METHOD | can be considered the anchor of each *relationship group* that defines a procedure; if there are two methods, there should be two different *relationship groups*. It is correct to regard each *relationship* group as a kind of sub-procedure that defines the overall procedure. Each method can be regarded as the verb of a sentence, and the verbs direct and indirect objects are specified by the site, morphology, device, substance or energy attributes (below) that are grouped with it.

4.4.4 PROCEDURE DEVICE



| PROCEDURE DEVICE | is a general attribute used to model devices associated with a procedure. It subsumes 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.

Table 29: Permissible values for PROCEDURE DEVICE

Attribute Values	Examples
Device 49062001 (<<)	Catheter procedure (procedure)

When the device is the direct object of the action (| METHOD |), the attribute | DIRECT DEVICE | is used. If the action is done indirectly to the device, that is, the action is done to something that is located in or on a device, but is not done directly to the device itself, then the attribute | INDIRECT DEVICE | is used. If the device is used to carry out the action, then the attribute | USING DEVICE | is used. If the device is used to access the site of the action, then the attribute | USING ACCESS DEVICE | is used.

Note: The permissible values for attributes in the | PROCEDURE DEVICE | role hierarchy include | Device (physical object) | and its descendants. However, there are a limited number of products in SNOMED CT which are devices that also deliver drugs. These concepts descend from | Drug-device combination product (product) | which is a descendant of both | Device (physical object) | and | Pharmaceutical / biologic product (product) |. Therefore, although they carry the hierarchy tag of (product), they are valid values for attributes in the | PROCEDURE DEVICE | role hierarchy.

Example:

| Removal of drug coated stent (procedure) |

- | METHOD | | Removal action (qualifier value) |
- | DIRECT DEVICE | | Drug coated stent (product) |

4.4.4.1 DIRECT DEVICE

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



Table 30: Permissible values for DIRECT DEVICE

Attribute Values	Examples
Device 49062001 (<<)	Removal of arterial stent (procedure)
	 METHOD Removal - action (qualifier value) DIRECT DEVICE Arterial stent (physical object)

4.4.4.2 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.

Table 31: Permissible values for INDIRECT DEVICE

Attribute Values	Examples
Device 49062001 (<<)	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:

In the above example, 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 |.

Note:

The attribute | INDIRECT DEVICE | is infrequently needed. When using this attribute, a second look is advisable to be sure it is needed.

4.4.4.3 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 |.

Table 32: Permissible values for USING DEVICE

Attribute Values	Examples
Device 49062001 (<<)	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)

4.4.4.4 USING ACCESS DEVICE



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

Table 33: Permissible values for USING ACCESS DEVICE

Attribute Values	Examples
Device 49062001 (<<)	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)

4.4.5 ACCESS



This attribute describes the route used to access the site of a procedure. It is used to distinguish open, closed, and percutaneous procedures.

Table 34: Permissible values for ACCESS

Attribute Values	Examples
Surgical access values 309795001 (<=)(< Q)	Open removal of bile duct stent (procedure) ACCESS Open approach - access (qualifier value)

4.4.6 DIRECT SUBSTANCE



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

Table 35: Permissible values for DIRECT SUBSTANCE

Attribute Values	Examples
Substance 105590001 (<<) Pharmaceutical / biologic product 373873005 (<<)	Injection of prostaglandin (procedure) • METHOD Injection - action (qualifier value) • DIRECT SUBSTANCE Prostaglandin (substance)

Note: As an editorial policy, in the distribution form of the International Release, | Pharmaceutical / biologic product (product) | and its descendants are not used as values for | DIRECT SUBSTANCE |.

4.4.7 PRIORITY



This attribute refers to the priority assigned to a procedure.

Table 36: Permissible values for PRIORITY

Attribute Values	Examples
Priorities 272125009 (<=)(< Q)	Emergency cesarean section (procedure)
	PRIORITY Emergency (qualifier value)

4.4.8 HAS FOCUS



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

Table 37: Permissible values for HAS FOCUS

Attribute Values	Examples
Clinical finding 404684003 (<<) Procedure 71388002 (<<)	Cardiac rehabilitation assessment (procedure) • HAS FOCUS Cardiac rehabilitation (regime/therapy)

4.4.9 HAS INTENT



This attribute specifies the intent of a procedure.

Table 38: Permissible values for HAS INTENT

Attribute Values	Examples
Intents (nature of procedure values) 363675004 (<=)	Diagnostic bronchoscopy (procedure) • HAS INTENT Diagnostic intent (qualifier value)

4.4.10 RECIPIENT CATEGORY



This attribute specifies the type of individual or group upon which the action of the procedure is performed. For example, it can be used in blood banking procedures to differentiate whether the procedure was performed on the donor or the recipient of a blood product. In other words, | RECIPIENT CATEGORY | is | Donor for medical or surgical procedure (person) | if the subject of the record is the donor.

It is not used for a procedure where the subject of the procedure is someone other than the subject of record.

Table 39: Permissible values for RECIPIENT CATEGORY

Attribute Values	Examples
Person 125676002 (<<)	Social service interview of family (procedure)
Family 35359004 (<<)	RECIPIENT CATEGORY Family (social concept)
Community 133928008 (<<)	Control (
Donor for medical or surgical procedure 105455006 (<<)	
Group 389109008 (<<)	

4.4.11 REVISION STATUS



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

Table 40: Permissible values for REVISION STATUS

Attribute Values	Examples
Primary operation 261424001 (<<) Revision - value 255231005 (<<) Part of multistage procedure 257958009 (<<)	Primary repair of inguinal hernia (procedure) Primary repair of inguinal hernia (procedure) REVISION STATUS Primary operation (qualifier value)
	Revision of knee arthroplasty (procedure) • REVISION STATUS Revision - value (qualifier value)

4.4.12 ROUTE OF ADMINISTRATION



This attribute allows representation of the route by which a procedure introduces a given substance into the body.

The domain for this attribute is the sub-hierarchy below | Administration of substance via specific route (procedure) | 433590000.

Table 41: Permissible values for ROUTE OF ADMINISTRATION

Attribute Values	Examples
Route of administration value 284009009 (<<)	Inhaled drug administration (procedure) • ROUTE OF ADMINISTRATION By inhalation (route) (qualifier value)

4.4.13 SURGICAL APPROACH



This attribute specifies the directional, relational, or spatial access to the site of a surgical procedure. The domain for | SURGICAL APPROACH | is descendants of | Surgical procedure (procedure) | 387713003.

Table 42: Permissible values for SURGICAL APPROACH

Attribute Values	Examples
Procedural approach 103379005 (<=)(< Q)	Intranasal ethmoidectomy (procedure) • SURGICAL APPROACH Intranasal approach (qualifier value)
	Abdominal hysterectomy (procedure) • SURGICAL APPROACH Abdominal approach (qualifier value)

4.4.14 USING SUBSTANCE



This attribute describes the | Substance | used to execute the action of a procedure, but it is not the substance on which the procedure's method directly acts (the | DIRECT SUBSTANCE |).

Table 43: Permissible values for USING SUBSTANCE

Attribute Values	Examples
Substance 105590001 (<<)	Contrast radiography of esophagus (procedure) • METHOD Radiographic imaging - action (qualifier value)
	 Procedure site - Direct Esophageal structure (body structure) USING SUBSTANCE Contrast media (substance)

4.4.15 USING ENERGY



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.

Table 44: Permissible values for USING ENERGY

Attribute Values	Examples
Physical force 78621006 (<<)	Gamma ray therapy (procedure) • USING ENERGY Gamma radiation (physical force)

4.4.16 Direct and indirect objects



Procedures that have a | METHOD | *attribute* can be described using an action verb that corresponds to the method. The direct object(s) of the action verb should be represented using (at least) one of the four direct object *attributes*, depending on whether the direct object on which the method acts is a device (| DIRECT

DEVICE |), anatomical structure (| Procedure site - Direct |), morphologic abnormality (| DIRECT MORPHOLOGY |) or substance (| DIRECT SUBSTANCE |).

When the type (body structure, device, or substance) of direct object is indeterminate, the direct-object attributes should not be used.

4.5 Attributes used to define Evaluation Procedure concepts



Table 45: Approved Evaluation Procedure attributes summary

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

Note:

Meaning of Allowable Values (Range) notations:

- (<<) this code and descendants,
- (<) descendants only,
- (<=) descendants only (stated) except for supercategory groupers,
- (==) this code only,
- (< Q) descendants only when in a qualifying Relationship,
- (< Q only) descendants only, and only allowed in a qualifying Relationship.

Note: See also Observable entity.

4.5.1 HAS SPECIMEN



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

Table 46: Permissible values for HAS SPECIMEN

Attribute Values	
Specimen 123038009 (<=)(< Q)	

4.5.2 COMPONENT



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

Table 47: Permissible values for COMPONENT

Attribute Values	Example
Substance 105590001 (<=)(< Q)	Protein measurement (procedure)
Observable entity 363787002 (<=)(< Q)	COMPONENT Protein (substance)
Cell structure 4421005 (<=)(< Q)	
Organism 410607006 (<=)(< Q)	

4.5.3 TIME ASPECT



This attribute specifies temporal *relationships* for a measurement procedure.

Table 48: Permissible values for TIME ASPECT

Attribute Values	
Time frame 7389001 (<=)(< Q)	

4.5.4 PROPERTY



This attribute specifies the kind of property being measured (e.g. concentration).

Table 49: Permissible values for PROPERTY

Attribute Values	
Property of measurement 118598001 (<=)(< Q)	

4.5.5 SCALE TYPE



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

Table 50: Permissible values for SCALE TYPE

	Attribute Values
	Quantitative 30766002 (<<)
	Qualitative 26716007 (<<)
	Ordinal value 117363000 (<<)
	Ordinal or quantitative value 117365007 (<<)
	Nominal value 117362005 (<<)
	Narrative value 117364006 (<<)
	Text value 117444000 (<<)
- 1	

4.5.6 MEASUREMENT METHOD



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

Table 51: Permissible values for MEASUREMENT METHOD

Attribute Values	
Laboratory procedure categorized by method 127789004(<=)	

For measurement procedures, the attribute | METHOD | is given the value | Measurement - action (qualifier value) |. The attribute | MEASUREMENT METHOD | can be used to provide additional specificity.

4.6 Attributes used to define Specimen concepts



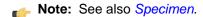
Table 52: Approved Specimen attributes summary

Defining Attribute	Allowable Values
SPECIMEN PROCEDURE	Procedure 71388002 (<)
SPECIMEN SOURCE TOPOGRAPHY	Anatomical or acquired body structure 442083009 (<<)
SPECIMEN SOURCE MORPHOLOGY	Morphologically abnormal structure 49755003 (<<)
SPECIMEN SUBSTANCE	Substance 105590001 (<<)

Note:

Meaning of Allowable Values (Range) notations:

- (<<) this code and descendants,
- (<) descendants only,
- (<=) descendants only (stated) except for supercategory groupers,
- (==) this code only,
- (< Q) descendants only when in a qualifying Relationship,
- (< Q only) descendants only, and only allowed in a qualifying Relationship.



4.6.1 SPECIMEN PROCEDURE



This attribute identifies the procedure by which a specimen is obtained.

Table 53: Permissible values for SPECIMEN PROCEDURE

Attribute Values	Examples
Procedure 71388002 (<)	Urine specimen obtained by clean catch procedure (specimen)
	SPECIMEN PROCEDURE Urine specimen collection, clean catch (procedure)
	Specimen from stomach obtained by total gastrectomy (specimen)
	SPECIMEN PROCEDURE Total gastrectomy (procedure)

4.6.2 SPECIMEN SOURCE TOPOGRAPHY



This attribute specifies the body site from which a specimen is obtained.

Table 54: Permissible values for SPECIMEN SOURCE TOPOGRAPHY

Attribute Values	Examples
Anatomical or acquired body structure 442083009 (<<)	Cervix cytologic material (specimen) • SPECIMEN SOURCE TOPOGRAPHY Cervix uteri structure (body structure)
	Omentum biopsy sample (specimen)
	SPECIMEN SOURCE TOPOGRAPHY Omentum structure (body structure)

4.6.3 SPECIMEN SOURCE MORPHOLOGY



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

Table 55: Permissible values for SPECIMEN SOURCE MORPHOLOGY

Attribute Values	Examples
Morphologically abnormal structure 49755003 (<<)	Specimen from cyst (specimen) • SPECIMEN SOURCE MORPHOLOGY Cyst (morphologic abnormality)
	Specimen from wound abscess (specimen) • SPECIMEN SOURCE MORPHOLOGY Abscess of wound (morphologic abnormality)

4.6.4 SPECIMEN SUBSTANCE



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

Table 56: Permissible values for SPECIMEN SUBSTANCE

Attribute Values	Examples
Substance 105590001 (<<)	Mid-stream urine sample (specimen) • SPECIMEN SUBSTANCE Urine (substance)
	Pancreatic fluid specimen (specimen) • SPECIMEN SUBSTANCE Pancreatic fluid (substance)

4.6.5 SPECIMEN SOURCE IDENTITY



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

Table 57: Permissible values for SPECIMEN SOURCE IDENTITY

Attribute Values	Examples
Person 125676002 (<<) Family 35359004 (<<) Community 133928008 (<<)	Blood specimen from blood donor (specimen) • SPECIMEN SOURCE IDENTITY Blood donor (person)
Device 49062001 (<<) Environment 276339004 (<<)	Catheter tip specimen (specimen) • SPECIMEN SOURCE IDENTITY Catheter tip, device (physical object)

4.7 Attributes used to define Body structure concepts



Just one attribute is used in Anatomy, namely, | Laterality | .

Note: See also Body structure.

4.7.1 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.

Table 58: Permissible values for LATERALITY

Attribute Values	Examples
Side 182353008 (<=)	Left kidney structure (body structure)
	LATERALITY Left (qualifier value)



Note:

Permissible values for this attribute include the descendants of the concept listed, except for super category grouper concepts.

4.8 Attributes used to define Pharmaceutical/Biologic Product concepts



Table 59: Approved Pharmaceutical/Biologic Product attributes summary

Defining Attribute	Allowable Values
HAS ACTIVE INGREDIENT	Substance 105590001 (<<)
HAS DOSE FORM	Type of drug preparation 105904009 (<<)

Note:

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

Note: See also Pharmaceutical/biologic product.

4.8.1 HAS ACTIVE INGREDIENT



This attribute indicates the active ingredient of a drug product, linking the | Pharmaceutical / biologic product | hierarchy to the | Substance | hierarchy.

Table 60: Permissible values for HAS ACTIVE INGREDIENT

Attribute Values	Examples
Substance 105590001 (<<)	Naproxen 500mg tablet (product) • HAS ACTIVE INGREDIENT Naproxen (substance)

4.8.2 HAS DOSE FORM



This attribute specifies the dose form of a product.

Table 61: Permissible values for HAS DOSE FORM

Attribute Values	Examples
Type of drug preparation 105904009 (<<)	Digoxin 0.1mg capsule (product) • HAS DOSE FORM Oral capsule (qualifier value)





Table 62: Approved Situation attributes summary

Defining Attribute	Allowable Values
ASSOCIATED FINDING	Clinical finding 404684003 (<=)(< Q) Event 272379006 (<=)(< Q) Observable entity 363787002 (< Q only) Link assertion 416698001 (< Q only) Procedure 71388002 (< Q only)
FINDING CONTEXT	Finding context value 410514004 (<=)(< Q)
ASSOCIATED PROCEDURE	Procedure 71388002 (<=)(< Q) Observable entity 363787002 (< Q only)
PROCEDURE CONTEXT	Context values for actions 288532009 (<=)(< Q)
TEMPORAL CONTEXT	Temporal context value 410510008 (<=)(< Q)
SUBJECT RELATIONSHIP CONTEXT	Person 125676002 (<=)(< Q)

Note:

Meaning of Allowable Values (Range) notations:

- (<<) this code and descendants,
- (<) descendants only,
- (<=) descendants only (stated) except for supercategory groupers,
- (==) this code only,
- (< Q) descendants only when in a qualifying Relationship,
- (< Q only) descendants only, and only allowed in a qualifying Relationship.

Note: See also Situation with explicit context.

4.9.1 Context



The meaning conveyed by a SNOMED CT code in a medical record is affected by the context in which it is recorded. For instance, the code for "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. These differences are important for data retrieval, because it would be incorrect when searching for patients with breast cancer to retrieve those who merely have a family history of breast cancer.

4.9.2 Default Context



When a SNOMED CT code appears in a record without any explicitly stated context, that code is considered to have a default context. The default is "soft" in that it can be over-ridden by information carried in the structure of the record or its information model.

The default context for a clinical finding code implies that the finding has actually occurred (vs. being absent), that it applies to the subject of the record (the patient), and that it is occurring currently or occurred at a past time that is given by a date - time record linked to the code.

The default context for a procedure code implies that the procedure was completed, that it was performed on the subject of the record (the patient), and that it was done at the present time or in the past at a time that is given by a date - time record linked to the code.

4.9.3 Axis Modifiers



The six attributes used to define situation codes permit explicit (rather than default) representation of various contexts. These attributes can change the meaning of a clinical finding or procedure code in a way that changes the hierarchy (or "axis") of the code from | Clinical finding | or | Procedure | to | Situation with explicit context |. The resulting modified meaning is not a subtype of the original meaning of the code, and therefore the axis-modifying attributes are not used to qualify the code, but instead are used to qualify a "situation" code.

For instance, if | Fine needle biopsy (procedure) | is given the non-context modifying attribute | Procedure site - Direct | and a value of | 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) | uses 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) |. Its axis (hierarchy) has been modified.

4.9.4 Overview of 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 | Procedure | and | Clinical finding | (| SUBJECT RELATIONSHIP CONTEXT | and | TEMPORAL CONTEXT |).

4.9.5 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.

Table 63: Permissible values for ASSOCIATED FINDING

Attribute Values	Examples
Clinical finding 404684003 (<=)(< Q)	Family history of stroke (situation)
Event 272379006 (<=)(< Q)	ASSOCIATED FINDING Cerebrovascular accident (disorder)
Observable entity 363787002 (< Q only)	accident (disorder)
Link assertion 416698001 (< Q only)	
Procedure 71388002 (< Q only)	

Note:

When | ASSOCIATED FINDING | is used in post-coordinated expressions, its range is broader than when used in distributed content.

| ASSOCIATED FINDING | must not reference concepts that already have pre-coordinated context themselves.

For example, the following definition uses | FH: Thyroid disorder | incorrectly:

| History of thyroid disease in father |:

- | SUBJECT RELATIONSHIP CONTEXT |= | father |
- | ASSOCIATED FINDING |= | FH: Thyroid disorder |.

The following is the correct definition:

| History of thyroid disease in father |:

- | SUBJECT RELATIONSHIP CONTEXT |= | father |
- | ASSOCIATED FINDING |=| thyroid disease |.

4.9.6 FINDING CONTEXT



The FINDING CONTEXT attribute is used to represent a situation in which a Clinical finding is known or unknown, and if known, whether it is present, absent, or uncertain (possible); and also to express the meaning that the finding is not actual but instead an anticipated or possible future finding.

Table 64: Permissible values for FINDING CONTEXT

Attribute Values	Examples
Finding context value 410514004 (<=)(< Q)	No cough (situation) • ASSOCIATED FINDING Cough (finding) • FINDING CONTEXT Known absent (qualifier value)

4.9.7 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.

Table 65: Permissible values for ASSOCIATED PROCEDURE

Attribute Values	Examples
Procedure 71388002 (<=)(< Q) Observable entity 363787002 (< Q only)	Operative procedure planned (situation) • ASSOCIATED PROCEDURE Surgical procedure (procedure)

4.9.8 PROCEDURE CONTEXT



This attribute indicates the degree of completion, or status, of a | Procedure |, as well as its various possible future states prior to its being initiated or completed.

Table 66: Permissible values for PROCEDURE CONTEXT

Attribute Values	Examples
Context values for actions 288532009 (<=)(< Q)	 Operative procedure planned (situation) ASSOCIATED PROCEDURE Surgical procedure (procedure) PROCEDURE CONTEXT Planned (qualifier value)

4.9.9 TEMPORAL CONTEXT



This attribute indicates the time of occurrence of the situation, indicating whether the procedure or finding that it represents is actual and therefore occurred in the present, in the past, or at a specified time; or that it is planned or expected, that is, temporally located in the future. The most general value is simply | Current or past (actual) |, meaning that the concept was actual (not planned or expected), but not specifying anything further about its time. The word "specified" in the | TEMPORAL CONTEXT | values means that there is a date - time stamp associated with the code in the record, that gives a date and/or time, as a point and/or interval, that applies to the concept.

Table 67: Permissible values for TEMPORAL CONTEXT

Attribute Values	Examples
Temporal context value 410510008 (<=)(< Q)	History of - hematuria (situation)
	ASSOCIATED FINDING Blood in urine (finding)
	TEMPORAL CONTEXT In the past (qualifier value)

4.9.10 SUBJECT RELATIONSHIP CONTEXT



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

Concept Values	Examples
Person 125676002 (<=)(< Q)	Father smokes (situation) • ASSOCIATED FINDING Smoker (finding) • SUBJECT RELATIONSHIP CONTEXT Father of subject (person)

4.10 Attributes used to define Event concepts



Table 69: Approved Event attributes summary

Defining Attribute	Subsumed Attribute	Allowable Values
ASSOCIATED WITH		Clinical Finding 404684003 (<<)
		Procedure 71388002 (<<)
		Event 272379006 (<<)
		Organism 410607006 (<<)
		Substance 105590001 (<<)
		Physical object 260787004 (<<)
		Physical force 78621006 (<<)
		Pharmaceutical / biologic product 373873005 (<< Q only)
		SNOMED CT Concept 138875005 (==)
	CAUSATIVE	Organism 410607006 (<<)
	AGENT	Substance 105590001 (<<)
		Physical object 260787004 (<<)
		Physical force 78621006 (<<)
		Pharmaceutical / biologic product 373873005 (<< Q only)
		SNOMED CT Concept 138875005 (==)
	DUE TO	Clinical Finding 404684003 (<=)
		Event 272379006 (<=)
	AFTER	Clinical Finding 404684003 (<<)
		Procedure 71388002 (<<)
OCCURRENCE		Periods of life 282032007 (<)

Note:

Meaning of Allowable Values (Range) notations:

- (<<) this code and descendants,
- (<) descendants only,
- (<=) descendants only (stated) except for supercategory groupers,
- (==) this code only,
- (< Q) descendants only when in a qualifying Relationship,
- (< Q only) descendants only, and only allowed in a qualifying Relationship.

For guidance and examples on the use of these attributes and value ranges to define events, see the section on clinical findings.

Note: See also Event.

4.11 Attributes used to define Physical Object concepts



Table 70: Approved Physical Object attributes summary

Defining Attribute	Allowable Values
HAS ACTIVE INGREDIENT	Substance 105590001 (<<)



Allowable values for this attribute includes the concept listed and its descendants.

A limited number of concepts (e.g. drug-eluting stents) reside in the Pharmaceutical/biologic product hierarchy and the Physical object hierarchy. These concepts are all under | Drug-device combination product (product) I. This is the domain of I HAS ACTIVE INGREDIENT | within the Physical Object hierarchy. Editorial policies for the use of other attributes in the Physical object hierarchy generally, outside this particular domain, have yet to be established.

Note: See also Physical object.

4.12 Relationship groups in SNOMED CT



Multiple attributes and their values can be grouped together into "Relationship groups" to add clarity to concept definitions. A Relationship group combines an attribute-value pair with one or more other attribute-value pairs. Relationship groups originated to add clarity to | Clinical finding | concepts which require multiple | ASSOCIATED MORPHOLOGY | attributes and multiple | FINDING SITE | attributes and to | Procedure | which require multiple | METHOD | attributes and multiple | PROCEDURE SITE | attributes. However, Relationship groups are not limited to | Clinical finding | and | Procedure | concepts.

In the case of | Procedure |, Relationship groups generally associate the correct method with the correct site. In the example below, the Relationship groups clarify that there is exploration of the bile duct, and excision of the gall bladder. Without Relationship 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.

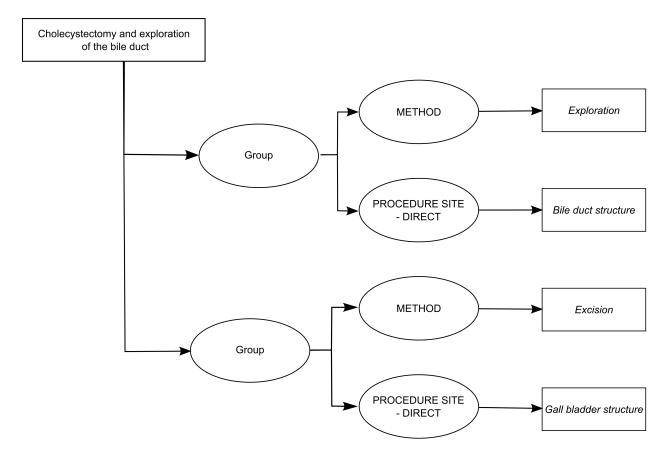


Figure 9: Example Cholecystectomy and exploration of bile duct

Chapter

5 Hierarchies



SNOMED CT concepts are organized into hierarchies. There is one special concept referred to as the | Root Concept Code | . It represents the "root" of the hierarchy that contains all Concepts in SNOMED CT. The root named "SNOMED CT Concept" subsumes (is the supertype of) the top-level concepts (hierarchies parents) 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 descendant 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 Summary of Top Level Hierarchies



5.1.1 Top Level Concepts



Table 71: Top Level Concepts

- | Clinical finding | | Procedure |
- | Observable entity |
- | Body structure |
- | Organism |
- | Substance |
- | Pharmaceutical / biologic product |
- | Specimen |
- | Special concept |
- | SNOMED CT Model Component |

- | Physical force |
- | Event |
- | Environment or geographical location |
- | Social context |
- | Situation with explicit context |
- | Staging and scales |
- | Physical object |
- | Qualifier value |
- | Record artifact |

5.1.2 Top Level Metadata



Table 72: Top Level Metadata

- | Core metadata concept |
- | Foundation metadata concept |
- Linkage concept |
- Namespace concept |

5.2 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) | .

Note: See also Attributes used to define Clinical Finding concepts.

5.3 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 (e.g. | Excision of intracranial artery (procedure) |), administration of medicines (e.g. | Pertussis vaccination (procedure) |), imaging procedures (e.g. | Ultrasonography of breast (procedure) |), education procedures (e.g. | Low salt diet education (procedure) |), and administrative procedures (e.g. | Medical records transfer (procedure) |).

Examples of Procedure concepts:

- Removal of urethral catheter (procedure) | ;
- Intravenous steroid injection (procedure) | ;
- | Irrigation of oral wound (procedure) | ;
- | Appendectomy (procedure) | .
- Note: See also Attributes used to define Procedure concepts.

5.4 Situation with explicit context



Concepts in the | Situation with explicit context | hierarchy (given the appropriate record structure) can be used in a clinical record to represent:

- Conditions and procedures that have not yet 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 prior to the time of the *current* entry in the record (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 finding | hierarchy have a default context of the following:

- The procedure has actually occurred (versus being planned or canceled) 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 CT 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) | .
- Note: See also Attributes used to define Situation with Explicit Context concepts.

5.5 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 entities 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.

One use for | Observable entity | 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.

Note: See also Attributes used to define Evaluation Procedure concepts.

5.6 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) |.



5.7 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) |, | Kingdom Plantae (organism) |.

Examples of Organism concepts:

- | Streptococcus pyogenes (organism) | ;
- | Texon cattle breed (organism) | ;
- | Bacillus anthracis (organism) | ;
- | Lichen (plant) (organism) | .

5.8 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) | .

5.9 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 International Release include Virtual Medicinal Product (VMP), Virtual Therapeutic Moiety (VTM), and Product Category. Additionally, US and UK drug extensions have been developed, which represent Actual Medicinal Products (AMPs).

Note: See also Attributes used to define Pharmaceutical/Biologic Product concepts.

5.9.1 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).

5.9.2 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.

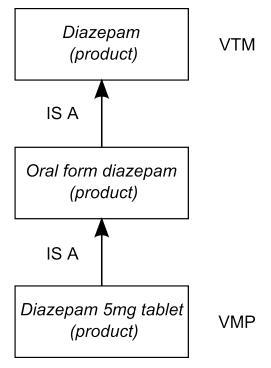


Figure 10: Example

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).

5.9.3 Product category



A Product category *concept* supports a group of | Pharmaceutical / biologic product | 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) | .

5.9.4 Actual Medicinal Products (AMPs)

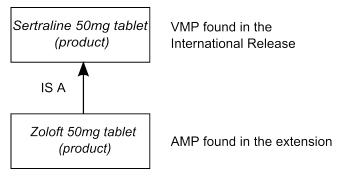


Actual Medicinal Products can be represented in *extensions*. The AMP represents the single unit dose of a medicinal product that is (or has been) made or marketed by a specific manufacturer (trademarked brand name pharmaceutical products). Its *description* requires product name, strength, dosage form, 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 *International Release* of *SNOMED CT*, but may instead exist within an identified domain *extension* (contact

your IHTSDO National Release Center Center for further information). Actual Medicinal Products in an extension have a direct link to their virtual equivalent in the International Release via the | is a | relationship.

Example:



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

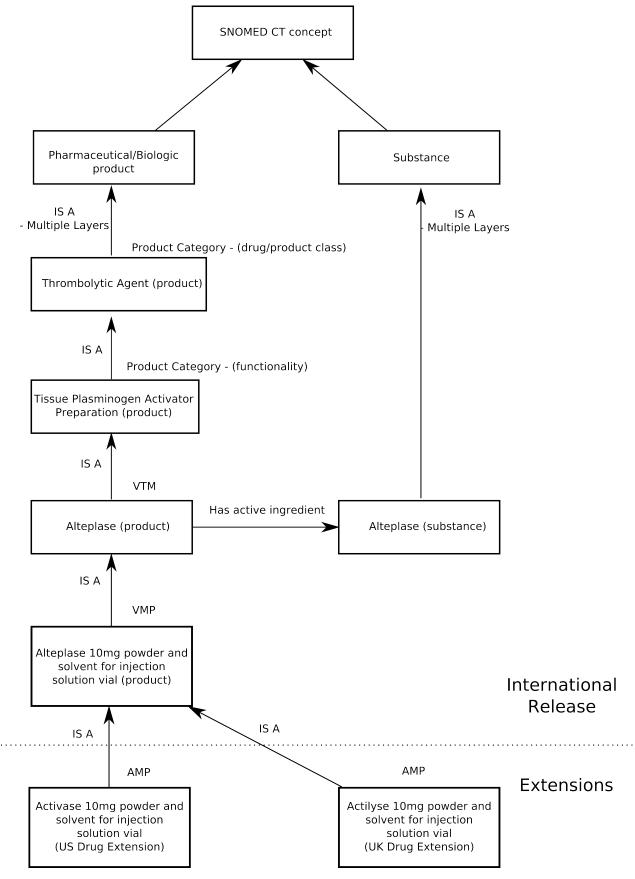


Figure 11: Pharmaceutical/Biologic Product hierarchy structure

5.10 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) | .
- Note: See also Attributes used to define Specimen concepts.

5.11 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) | .
- Note: See also Attributes used to define Physical Object concepts.

5.12 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) | .

5.13 Event



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

Examples of Event concepts:

- | Flood (event) | ;
- | Bioterrorist attack (event) | ;
- | Earthquake (event) | .

Note: See also Attributes used to define Event concepts.

5.14 Environments and geographic locations



The | Environment or geographical location | *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) | .

5.15 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) | .
- | Person (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) | .

5.16 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) | .

5.17 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. Such a code may be used as the value of an attribute in a defining Relationship in pre-coordinated definitions, and/or as the value of an attribute in a qualifier in a post-coordinated expression. 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 | | LATERALITY | | Left | .

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 | | FINDING SITE | | Lung structure | .

Examples of Qualifier value concepts:

- | Unilateral | ;
- | Left | ;
- | Puncture action | .

5.18 Special concept



The Top Level Concept Code | Special concept | and its subclass codes provide a place for concept codes that are no longer active in the terminology.

The subclasses of | Special concept | are:

- Navigational concept | ;
- | Inactive concept | .

5.18.1 Navigational concept



These *concept* codes are to be used only as nodes in alternative navigation structures. Navigational *concepts* are distributed as active *concepts*, with an inactive *Is-a Relationship* to the *concept* "Navigational *concept*". These *concepts* should have no *subtypes*.

5.18.2 Inactive concept (RF2)



When a *concept* is no longer intended for active use, the *concept* and its *Relationships* are turned inactive. Previously, in RF1, the *concept* was moved into an special "Inactive *concept*" hierarchy, this is not done anymore in RF2, the *concept* is inactivated "in place", with its last location described in the history of its inactive *Relationships*.

5.18.3 Namespace concept



The concept 370136006 | Namespace concept (namespace concept) | is a subtype of | SNOMED CT model component |. Each of its subtype concepts has an integer term which is an assigned Extension namespace identifier.

5.19 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 artifact | need not be complete reports or complete records. They can be parts of larger | Record artifact |. For example, a complete health record is a | Record artifact | that also may contain other | Record artifact | in the form of individual documents or reports, which in turn may contain more finely granular | Record artifact | such as sections and even section headers.

5.20 Core metadata concept



Subtypes of | Core metadata concept | provide structural information required to supports International Release data. This supporting information includes sets of enumerated values that apply to attributes of concepts, descriptions and relationships.

5.21 Foundation metadata concept



Subtypes of the | Foundation metadata concept | provide supporting metadata and structural information for derivative release structures including Reference Sets.

5.22 Linkage concept



Linkage concept codes are intended to link two or more other codes to each other to express compositional meanings. All concept codes that can be used as a Relationship Type are included under | Linkage concept I. The ones approved for use are the Concept Model Attributes. Implementation guidance is as yet quite limited for the other Linkage concept codes. Use of them should be regarded as non-standard, tentative and experimental, requiring extra care.

| Linkage concept | is a subclass of | SNOMED CT model component |, and the | Linkage concept | hierarchy contains the sub-hierarchies:

- | Link assertion |;
- | Attribute |.
- Note: In RF1, | Linkage concept | was a top level hierarchy.

5.22.1 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 | ;
- | Has explanation | .

5.22.2 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 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 | .
- | Concept model attribute |:
 - | Laterality | ;
 - | Procedure site | ;
 - | Finding site | ;
 - | Associated morphology | .

Examples of Non-defining attributes:

- | Unapproved attribute | :
 - | Relieved by | ;
 - | Has assessment | .

6

6 Structure and Technology Considerations



The structure and technology behind SNOMED CT enables 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 Implementation Guide* (TIG). See *Inventory of Documentation* on page 12 for *Descriptions* of the content and target audiences for each available document.

6.1 SNOMED CT Tables (Release Format 1 - RF1)



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 tables*, 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.

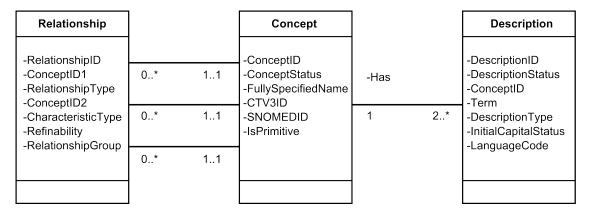


Figure 12: SNOMED CT table structure

6.1.1 Release File Formats



Currently, during a transitional period, there are two distinct Release Formats for SNOMED CT:

- Release Format 2 (RF2): The new standard distribution format for SNOMED CT. This was developed in response to extensive feedback on its predecessor and will replace RF1 during 2012.
- Release Format 1 (RF1): The specification in which SNOMED CT has been provided since its first release in 2002. This format will be phased out, but support of applications that require RF1 format files will be available using a conversion application developed and supplied by the IHTSDO.

The key enhancements in *RF*2 are:

- More robust and consistent version representation;
- Reference sets, provides a more easily extensible and maintainable replacement for RF1 subsets and crossmaps;
- Use of an added hierarchy to represent metadata about the structure of SNOMED CT itself.

Both Release Formats represent:

- The components of *SNOMED CT*:
 - Concepts
 - Descriptions
 - Relationships
- Additional derivatives that provide standard representations of :
 - Value-sets consisting of a specified set of concepts or relationships
 - Cross mapping tables to other codes and classifications.

Both Release Formats are provided in:

- Tab-delimited text files:
- Represent character content in accordance with the *Unicode UTF-8* specification;
- Use SNOMED CT Identifiers as the permanent Identifier of released core components;
- Support extensions to the International Release using namespaces allocated to licensees to denote the provenance of added components and to ensure *Identifier* uniqueness.

6.1.2 The Concepts Table (RF1)



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 SNOMED RT or CTV3 identifier equivalent to a SNOMED CT concept at the time when it originated from those terminologies or, where a new concept was or has subsequently been created only in SNOMED CT, a character string compliant with SNOMED RT/CTV3 identifier construction rules but that is not a legitimate identifier in either. However, changes in SNOMED CT or its contributing schemes after a concept was incorporated (e.g. code retirement) mean that the CTV3ID and SNOMEDID fields can not in the general case be relied upon for mapping to and from either CTV3 or SNOMED RT; alternative derivative products are required.
- 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 *User Guide Glossary*).

6.1.3 The Descriptions Table (RF1)



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.
- Description Type: 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.

6.1.4 The Relationships Table (RF1)



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: *Conceptld1* RelationshipType *Conceptld2*. 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
- Relationship Type: 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 tables*, it indicates that *Concept1* is a *subtype* of *Concept2*.

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

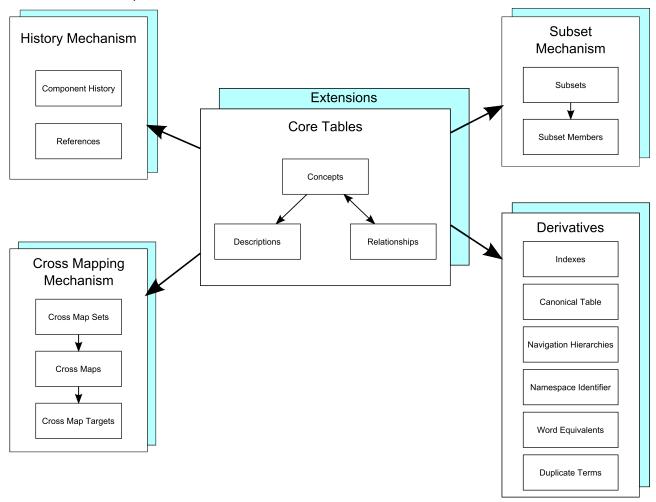


Figure 13: SNOMED CT Data Structure Summary

6.2 History



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 users.

6.2.1 History Mechanism (RF1)



The *history mechanism* involves the following tables:

- Component History Table
- References Table

The Component History Table 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.

The References Table provides a reference from an inactive SNOMED CT component (Concept moved to an Extension, Description, Subset or Cross Map Set) to a component that is current for the Release in which the first component is made inactive. The type of reference indicates the nature of the Relationship between the two components. This is similar to the information that historical relationships provide for inactive Concepts.

6.3 SNOMED CT Subsets



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.

Subsets may also be used to specify simplified or shortened hierarchies for browsing, sometimes called "navigation hierarchies".

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.

6.3.1 Subset table and file structures (RF1)



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.

6.4 Cross Mappings



Cross Mappings enable SNOMED CT to effectively reference other terminologies and classifications. Each cross map matches SNOMED CT 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 source terminologies.

6.4.1 Cross Mapping tables (RF1)



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.

6.5 Extensions



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 the SNOMED CT International Release. 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 International Release 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 *International Release* content.

When content overlaps the scope of *SNOMED CT*, it should be submitted to your *IHTSDO National release* Center for consideration, so that other *SNOMED CT* users can also take advantage of this work. Using the extension structure can also help organizations transfer responsibility for terminology to the *IHTSDO* or to another organization, subject to the terms of the Affiliate License.

6.6 SNOMED CT applications and services



SNOMED Clinical Terms is a terminological resource that can serve many roles in healthcare software applications. The IHTSDO 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.

7

7 Changes and historical notes



7.1 EPISODICITY no longer modeled in active content



| 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*.

7.2 ONSET and COURSE retired



In earlier releases, there were two attributes named | ONSET | and | COURSE |. These were *retired* because they could not be used reproducibly. While | ONSET | was intended to specify the rapidity of onset or the temporal pattern of presentation for a given condition, it was easily confused with the attribute | COURSE | used to represent the duration of a condition. There was not consistent agreement between observers making this distinction.

7.3 Dose form values moved



The *concept* 105904009 | Type of drug preparation (product) | and its *subtypes* were moved to the *Qualifier* value *hierarchy* as of the July 2007 release. 105904009 | Type of drug preparation (qualifier value) | better represents these *concepts* because they are not products.

7.4 Renaming the context/situation hierarchy



The *hierarchy* named 243796009 | situation with explicit context (situation) | was called | context-dependent category | until the July 2006 release. The *hierarchy* was renamed to better describe the meanings in this *hierarchy*.

7.5 Domain change for measurement/evaluation attributes



In releases prior to July 2009, six attributes were approved for use for | measurement procedure | only. For the July 2009 release, the domain for these attributes was expanded to | evaluation procedure |. See Measurement procedures and laboratory procedures for a definition and full discussion of | evaluation procedure | and | measurement procedure |.

7.6 Move of findings to events



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

8

8 Miscellaneous Topics



8.1 References for Editorial Rules and Known Problems



The approved set of detailed editorial rules and guidelines are documented in the SNOMED CT Editorial Guide. Parts of the Editorial Guide are reproduced verbatim in the User Guide.

Known problems and issues are not documented here but instead are tracked on the SNOMED CT Collaborative Space at csfe.aceworkspace.net, under project "IHTSDO". It is possible to review a brief summary of each project without a login, but if you would like access to the Collaborative Space, please contact collabnet(at)ihtsdo.org with your contact details and a list of the project(s) to which you would like access. Known problems and issues are found in the content projects tracker under project "IHTSDO".

8.2 Terms Prefaced with Symbols



There are some *terms* in *SNOMED CT* that are prefaced with a symbol in square brackets. These *concept* codes were inherited from *CTV3* and were used to facilitate mapping to *ICD-10*. They have all been *retired* by moving them to the *UK NHS extension*, and are not recommended for use in clinical records.

Explanations of these term prefixes are as follows:

Table 73: Term Preface Symbols

- [X] Terms starting with [X] were initially used in the Read Codes in the 1995 release, in order to identify ICD-10 terms that were not present in ICD-9.
- [D] Terms starting with [D] are also from CTV3, and identify terms 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'. The [D] meant that in CTV3the code was intended for use in a diagnosis field in the record, even though the term meaning is not a kind of disease.
- [V] A *term* starting with [V] identifies *concept* codes derived from 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 term starting with [M] identifies Morphology of Neoplasm terms present in ICD-9 and ICD 10.

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

8.3 Negation



The meaning of some *concept* codes in *SNOMED CT* depends conceptually on negation (e.g. absence of X, lack of X, unable to do X etc).

8.3.1 Negation and Context



The | Situation with explicit context | hierarchy is intended to manage this kind of semantic situation. The concept model allows a concept code in the | Situation with explicit context | hierarchy to be related to the | Clinical finding | about which context is asserted. For example, | Absence of nausea and vomiting (situation) | is modeled as a | Situation with explicit context | in which the finding of | Nausea and vomiting (disorder) | is absent.

The inclusion of negated meanings introduces complications into *query* formulation, machine classification, and reasoning tasks. The inclusion of a NOT logical operator into the *SNOMED CT* compositional model could simplify modeling of negated meanings. The *current* release of *SNOMED CT* does not directly support classification using this operator, but some modeling formalisms in *current* use today (including database formalisms, *Description Logic* formalisms) include a NOT operator as a fundamental modeling *primitive*.

8.4 Structure of the SNOMED Clinical Terms Identifier (SCTID)



8.4.1 SCTID Data Type



The SCTID data type is a 64-bit positive *integer*.

When rendered as a string an *SCTID* must always be represented using decimal digits and the string rendering has a string the maximum permitted length of 18 digits and a minimum length of 6 digits.

Note: Leading zeros are always omitted from the string rendering of an *SCTID*. For example the value "101291009" must not be rendered as "0101291009".

8.4.2 SCTIDs and Extensions



If the *partition identifier* indicates that the *SCTID* is part of an *Extension* the next seven-digits (from the right) are a *Namespace-identifier* (see *SCTID* for an *Extension Component*). *Namespace-identifier*s are allocated to organizations which areauthorized to issue *Extensions*. They enable unique *SCTID*s to be issued by many organizations and allow each *SCTID* to be traced to an authorized originating organization.

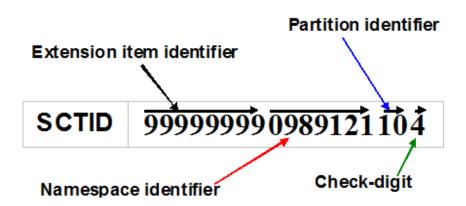


Figure 14: SCTID for an Extension Component

9 SNOMED CT Background



9.1 SNOMED CT: A Comprehensive terminology for Health Care



SNOMED Clinical Terms (SNOMED CT) was developed between 1999 and 2002 from a convergence of the content of SNOMED Reference Terminology® (SNOMED RT) and NHS Clinical Terms Version 3 (CTV3). This convergence was a result of a strategic alliance to between the College of American Pathologists (CAP) and the UK National Health Service. In 2007, the International Health Terminology Standards Development Organisation acquired SNOMED CT and now develops and maintains it on behalf of its Members and Affiliates.

SNOMED CT combines the robust strength of SNOMED RT in the basic sciences, laboratory and specialty medicine with the highly granular clinician focused content of CTV3 (formerly known as the Read Codes). The result is a comprehensive and precise clinical reference terminology that provides unsurpassed clinical content and expressivity for clinical documentation and reporting. SNOMED CT enables clinicians, researchers and patients to share comparable data worldwide, across medical specialties and sites of care.

SNOMED CT is founded on four basic principles that have guided development of its clinical content and technical design. These principles will continue to guide the evolution of SNOMED CT as it adapts and grows in the ever changing global health care environment.

These guiding principles are:

- 1. Development efforts must encompass broad, inclusive involvement of diverse clinical groups and medical informatics experts;
- 2. The clinical content must be quality focused and adhere to strict editorial policies;
- 3. The quality improvement process must be open to public scrutiny and vendor input, to ensure that the terminology is truly useful within healthcare applications;
- 4. There must be minimal barriers to adoption and use.

The design of SNOMED CT has been driven by the expressed needs of software developers for features that improve their ability to develop useful applications. In response to these needs, the design adds unique numeric *Identifiers*, includes links to legacy codes, supports a sustainable migration and maintenance strategy, permits adaptability for national purposes, and fosters alignment with other terminologies and standards such as HL7, LOINC, and DICOM.

The IHTSDO believes that SNOMED CT delivers a standardized quality clinical terminology that is required for effective collection of clinical data, its retrieval, aggregation and re-use as well as the sharing, linking and exchanging of medical information.

The file format used for distributing SNOMED CT content between 2002 and 2011, which is now known as Release Format 1 (RF1), was balloted and approved as an ANSI standard. An enhanced file format, Release Format 2 (RF2), has been approved and adopted by the IHTSDO. As RF2 is phased in during 2011, it will simplify change management and add robust facilities for future extensibility.

9.1.1 SNOMED CT Quality Development Process



The SNOMED Clinical Terms development process incorporates the efforts of a team of internal and external modelers. A documented scientific process is followed which focuses on Understandability, Reproducibility and Usefulness. Content is defined and reviewed by multiple clinician editors. Conflicts between editors are resolved through an iterative process, based on achieving agreement and consensus, before being entered into the terminology. As necessary, additional experts are consulted to review the scientific integrity of the content.

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 CT concept and term and mapped it to the Clinical Terms Version 3 terminology; SNOMED CT 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 CT editors underwent a conflict resolution process to definitively place each concept within the merged
- Auto-classification: The merged database following description mapping conflict resolution underwent a series of quality control checks including auto-classification to identify and eliminate cycle errors (e.g. concept A | is a | B and concept B | Is a | A) and equivalency errors (e.g. where two defined concepts have the exact same definition).
- Hierarchy review: The reviewed database has undergone auto-classification and further review of inferred hierarchies.
- Ongoing refinement. The quality control process is continuously supplemented by feedback from users involved in adoption of SNOMED Clinical Terms.

9.1.1.1 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 CT 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 US, in the UK and in Australia, at which time test sites shared their positive experiences and recommendations for improvement.
- Peer review: The methods used in developing SNOMED CT were presented in 6 scientific papers at the 2001 American Medical Informatics Association (AMIA) meeting, the largest association of leaders in medical informatics in the world. SNOMED CT was also part of an additional three papers and six posters at the 2002 AMIA meeting and additional posters for AMIA 2003 and 2004.

SNOMED CT was also the subject of papers in the American Health Information Management Association (AHIMA) Journal in 2001-2003, posters at 2001 and 2002 annual meetings and presentations at the 2003 and 2004 annual meetings. In addition, AHIMA introduced an education program "Introduction to Clinical terminology" in 2004 which included a SNOMED CT.

Early adopters of SNOMED RT (a structure that mirrored SNOMED CT core tables) were debriefed on their implementation experience in order to identify the key issues to be addressed in the original version of the SNOMED CT Technical Implementation Guide.

9.1.1.2 Continuous Quality Improvement

Continuous improvement is an aim of the IHTSDO: 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 our users better.

9.2 Acknowledgments of Contributors to SNOMED CT®



SNOMED CT was originally created by the College of American Pathologists.

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.

The IHTSDO also acknowledges the contributions of:

- The American Academy of Ophthalmology, for the ophthalmology-related portions of this work.
- SNODENT®: the Systematized Nomenclature of Dentistry, copyright 1998, American Dental Association. Used with permission.
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10

Editorial Guide Glossary



Attribute

An attribute represents a characteristic of the meaning of a concept or the nature of a refinement.

Note: An attribute has a name which is represented by a concept. All the concepts that can be used to name attributes are subtypes of the concept | concept model attribute |. An attribute is assigned a value (attribute value pair) when used in the definition of a concept or in a post-coordinated expression. The permitted attribute values (range.) for an attribute depend on the attribute name and on the domain of the concept being refined.

Example: |Finding site|

Alternatives

Concept Model Attribute Relationship Type Role

Attribute value pair

A combination of an *attribute name* and an *attribute value* used to represent a specific type of information in a generic way without altering the underlying structure of an information model. The *attribute name* identifies the type of information and the *attribute value* provides a value.

Note: Attribute value pairs are used by SNOMED CT in relationships and post-coordinated expressions. In both cases, the attribute name and attribute value are expressed using SNOMED CT concept Identifiers. In the Relationship file, the attribute name if represented by the Relationship typeId and the attribute value by the Relationship. destinationId.

Browser

A computer application or software tool used for exploring and searching terminology content. A typical SNOMED CT browser can locate concepts and descriptions by Identifiers and by searching the text of description terms. Various views of located concepts may be displayed including the set of related descriptions, the hierarchical relationships and other defining relationships.

Alternatives SNOMED CT browser

Check digit

The *check-digit* is the final (rightmost) digit of the *SNOMED CT Identifier* (*SCTID*). 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). It is calculated using the Verhoeff algorithm.

Component

Refers to any item identified by an *SCTID* in the main body of *SNOMED CT*, or in an authorized *Extension*. The *partition identifier* indicates the type of component referred to by that *SCTID*. Each *component* is a uniquely identifiable instance of one of the following:

- Concept
- Description
- Relationship
- Other components in Release Format 1:
 - Subset
 - Subset Member
 - Cross Map Set
 - Cross Map Target

Alternatives SNOMED CT component

Concept

A clinical idea to which a unique Conceptld has been assigned.

The term concept may also be used informally with the following meanings:

- The concept Identifier, which is the key of the Concepts Table (in this case it is less ambiguous to use the term "conceptId" or "concept code");
- The real-world referent(s) of the *Conceptld*, that is, the class of entities in reality which the *Conceptld* represents (in this case it is less ambiguous to use the *term* "meaning" or "code meaning").

Alternatives

SNOMED CT concept

Concept equivalence

Equivalence is the state of two SNOMED CT concept codes or post-coordinated expressions having the same meaning. Concept equivalence can occur when a post-coordinated expression has the same meaning as a pre-coordinated concept code; or when two different post-coordinated expressions have the same meaning.

ConceptId

A SNOMED CT Identifier that uniquely identifies a Concept (meaning).

Example: For the meaning named | Pneumonia (disorder) |, the ConceptId is 233604007.

Note: Field name in SNOMED CT Release Format 1

Concepts table

A table that includes all SNOMED CT concept codes. Each concept code is represented by a single row.

Note: Component Table name in SNOMED CT Release Format 1

Core Table

A table used to represent on the main SNOMED CT components (concepts, descriptions and relationships).

Note: The term "core" has also been used to refer to the content of the SNOMED CT International Release.

Alternatives

SNOMED CT core
Core table
SNOMED CT core table
SNOMED CT core file
Core file

Cross map

A Cross Map is a reference from a Concept code to a Cross Map Target. Each Cross Map is represented as a row in the Cross Maps Table. It links a single SNOMED CT concept code to one or more codes in a target classification (such as ICD-9-CM) or terminology. A Concept code may have a single Cross Map or a set of alternative Cross Maps

CTV3ID

A five-character code allocated to a meaning or term in *Clinical Terms Version 3* (*CTV3*, previously known as *Read Codes*). Each row in the *SNOMED CT concepts* table has a field for the corresponding *concept* code from *CTV3*.

- Note: Field name in SNOMED CT Release Format 1
- Note: The CTV3ID and SNOMEDID fields are no longer supported in Release Format 2. Instead a |Simple map (reference set)| is used to document the link between legacy codes and SNOMED CT.
- **Note:** The *CTV3ID* field should no longer be relied upon for mapping to and from the *Read Codes*. Additional mapping work in the UK identified some anomalies and resulted development of more flexibility table for *Read Code* Mapping

Description

An association between a human-readable phrase (*Term*) and a particular *SNOMED CT concept* code. Each *description* is represented by a separate row in the *Descriptions* File. Each *Description* is assigned a unique *DescriptionId* and connects a *Term* and a *Concept*.

Alternatives

SNOMED CT description

DescriptionId

A SNOMED CT Identifier that uniquely identifies a Description.

Note: Field name in SNOMED CT Release Format 1

Descriptions table

A data table consisting of rows, each of which represents a *Description*.

Note: Component Table name in SNOMED CT Release Format 1

Dialect

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

Enabled application

A software application designed to support the use of SNOMED CT.

Alternatives

SNOMED CT enabled application

Extension

A data table or set of data tables that is created in accordance with the structures and authoring guidelines applicable to SNOMED CT. An extension is ordinarily edited, maintained and distributed by an organization other than the IHTSDO. components in extensions are identified using extension SCTIDs, which are structured to ensure that they do not collide with other SCTIDs, and can be traced to an authorized originator.

Alternatives

SNOMED CT extension

Fully defined concept

Alternatives

Sufficiently defined concept

Fully specified name

A term unique among active Descriptions in SNOMED CT that names the meaning of a Concept code in a manner that is intended to be unambiguous and stable across multiple contexts.



Note: Field name in SNOMED CT Release Format 1

Hierarchy

An ordered organization of concept codes linked together through | is a | relationships. Concept codes linked to their more general parent concept codes directly above them in a hierarchy Concept codes with more general meanings are usually presented as being at the top of the hierarchy and then at each level down the hierarchy code meanings become increasingly more specific or specialized . Formally, a hierarchy is represented as a Directed Acyclic Graph.

History mechanism

The history mechanism is the information distributed with SNOMED CT designed to track the history of changes to its logic definitions and descriptions. The history mechanism is supported by two distribution tables:

- Component History Table
- References Table

SNOMED CT Identifier

A unique integer Identifier applied to each SNOMED CT component (Concept, Description, Relationship, Subset, etc.). The SCTID includes an item Identifier, a check-digit and a partition identifier. Depending on the partition identifier is may also include a namespace identifier.

Alternatives

SNOMED CT identifier SCTID

International release

The set of release files provided on a specified release date, to represent the part of the content of SNOMED CT that forms the common foundation to the terminology available to all IHTSDO Members and Affiliates.



Notes:

1. The International release, provided by the IHTSDO, may be supplemented by Extension releases provided by IHTSDO Members and Affiliates to meet additional national, local and organizational requirements.

2. See also International edition which refers to the same general content, without specifying a particular release date.

Alternatives

SNOMED CT International release SNOMED CT International edition

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 virtually any human language or dialect. These translations attach new language -specific terms as descriptions of existing concept codes and may also use existing descriptions if translation is not necessary. A language subset is a set of references to the descriptions that are members of a language edition of SNOMED CT. Additionally, data in the language subset specifies the DescriptionType of each description (Fully Specified Name, Preferred Term or Synonym).

Mapping mechanism

A set of data structures for representing cross-links to other terminologies and classifications. The Mapping Mechanism data structures are distributed as three tables:

- Cross Map Sets Table
- Cross Maps Table
- Cross Map Targets Table

Modeler

A person who directly edits the logic definitions and other structures of the terminology. Also sometimes called Clinical Editor or Terminology Manager.

Alternatives

SNOMED CT modeler Modeller **SNOMED CT author**

Modeling

The process of editing logic definitions to reflect the meaning intended by the fully specified name.

Alternatives

SNOMED CT modeling Modelling **SNOMED CT authoring**

Namespace identifier

A seven digit number allocated by the IHTSDO to an organization that is permitted to maintain a SNOMED CT Extension. The namespace identifier forms part of the SCTID allocated every component that originated as part of an Extension. Therefore, it prevents collision between SCTIDs issued by different organizations. The namespace-identifier indicates the provenance of each SNOMED CT component.



Note: Short format SCTIDs, which are used for components that originate in the International Release, do not include a namespace-identifier. In this case the partition identifier Partition-identifiers provides sufficient information about the origin of the component.

Alternatives

Extension namespace identifiers Namespaceld

The second and third digits from the right of the string rendering of the SCTID. The value of the partition-identifier indicates the type of component that the SCTID identifies (e.g. Concept, Description, Relationship, etc) and also indicates whether the SCTID contains a namespace identifier.

Alternatives

PartitionId

Postcoordinated expression

Representation of a clinical meaning using a combination of two or more concept Identifiers is referred to as post-coordination.



Note: Some clinical meanings may be represented in several different ways. SNOMED CT technical specifications include guidance for transforming logical expressions to a common canonical form.

Example: SNOMED CT includes the following concepts:

```
125605004 | fracture of bone |
363698007 | finding site |
71341001 | bone structure of femur |
```

SNOMED CT also includes a pre-coordinated concept for 71620000 | fracture of femur |. Therefore It is possible to represent the clinical meaning "fracture of femur" in different ways:

- as a precoordinated expression:
 - 71620000 | fracture of femur |
- or as a postcoordinated expression:
 - 125605004 | fracture of bone | : 363698007 | finding site | = 71341001 | bone structure of femur |

Alternatives

Post-coordinated Post-coordination **Postcoordinated Postcoordination**

Precoordinated expression

Representation of a clinical meaning using a single concept Identifier is referred to as a pre-coordinated expression.



Note: In contrast, expressions that contain two or more concepts Identifier are referred to as post-coordinated expressions. For more information and examples see the glossary entry for post-coordinated expression.

Alternatives

Pre-coordinated expression Precoordinated Pre-coordination Precoordinated Precoordination

Primitive concept

A concept with a formal logic definition that is not sufficient to distinguish its meaning from other similar concepts.

Note:

The meaning of SNOMED CT concept is expressed in a human-readable form by its fully specified name. Each concept also has a formal logic definition represented by a set of defining relationships to other concepts. This logic definition is computer processable. A primitive concept does not have sufficient defining relationships to computably distinguish them from more general concepts (supertypes).

See also sufficiently defined concept.

- **Example:** The concept 5596004 atypical appendicitis (disorder) is primitive because the following definition is not sufficient to distinguish "atypical appendicitis" from any other type of "appendicitis".
 - 116680003 | is a | = 74400008 | appendicitis |
 - 116676008 | associated morphology | = 23583003 | inflammation |
 - 363698007 | finding site | = 66754008 | appendix structure |

Figure 15: Definition of: |atypical appendicitis (disorder)| (primitive)

Qualifying characteristic

An attribute-value relationship associated with a concept code to indicate to users that it may be applied to refine the meaning of the code. The set of qualifying relationships provide syntactically correct values that can be presented to a user for post-coordination. Example: 'Revision status' = 'First revision' is a possible qualifying characteristic of 'Hip replacement'. A qualifying characteristic is contrasted with a defining characteristic. It is referred to in CTV3 as a 'Qualifier.

Alternatives

Qualifier

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 (each identified by a ConceptId). The nature of the association is indicated by a RelationshipType. Each Relationship is represented by a row in the Relationships Table.

Alternatives

SNOMED CT relationship

Relationship type

The nature of a Relationship between two Concepts. Relationship Types are represented in SNOMED CT by Concept codes. In the Relationships Table, the RelationshipType field contains the ConceptId for the concept in SNOMED CT that forms the relationship between two other concepts (ConceptId1 and ConceptId2). For defining and qualifying relationships, the Relationship Type is an Attribute code. Relationship Type should not be confused with *CharacteristicType*.



Note: Field name in SNOMED CT Release Format 1

Relationshipld

A SNOMED CT Identifier that uniquely identifies a Relationship. RelationshipId is the key of the Relationships Table. Each row in the Relationships Table represents a relationship triplet (ConceptId1 RelationshipType -ConceptId2).



Note: Field name in SNOMED CT Release Format 1

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



Note: Component Table name in SNOMED CT Release Format 1

SNOMED CT Release

The content of SNOMED CT or an internally consistent part of SNOMED CT (such as an Extension) provided to licensees at a particular point in time.

Alternatives

Release Version SNOMED CT Edition

Root concept

The single concept that is at the top of the | SNOMED CT Concept | hierarchy.

Root metadata concept

The single concept that is at the top of the | SNOMED CT Model Component (metadata) | hierarchy.

Note: Most of the data in the metadata hierarchy is only relevant to Release Format 2. Therefore, this concept may not be present in some Release Format 1 files.

Alternatives

Root metadata code

SNOMED

An acronym for the SystematizedNomenclature of Medicine originally developed by the College of American Pathologists and now owned and maintained by the IHTSDO. SNOMED Clinical Terms is the most recent version of this terminology. It was preceded by SNOMED RT and SNOMED International.

SNOMED Clinical Terms

SNOMED CT is a clinical terminology maintained and distributed by the IHTSDO. It is considered to be the most comprehensive, multilingual healthcare terminology in the world. It was created as a result of the merger of SNOMED RT and NHS Clinical Terms Version 3.

Alternatives

SNOMED CT

Sufficiently defined concept

A concept with a formal logic definition that is sufficient to distinguish its meaning from other similar concepts.



The meaning of SNOMED CT concept is expressed in a human-readable form by its fully specified name (FSN) and has a formal logic definition represented by a set of defining relationships to other concepts. A Sufficiently defined concept has sufficient defining relationships to computably distinguish it from other concepts.

See also primitive concept.

- **Example:** The concept 74400008 appendicitis (disorder) is sufficiently defined by the following definition because any concept for which this definition was true would be the disorder "appendicitis".
 - 116680003 | is a | = 18526009 | disorder of appendix |
 - 116680003 | is a | = 302168000 | inflammation of large intestine |
 - 116676008 | associated morphology | = 23583003 | inflammation |

• 363698007 | finding site | = 66754008 | appendix structure |

Figure 16: Definition of: |appendicitis (disorder)| (sufficiently defined)

Alternatives

Fully defined concept

Subset

A group of *components* (e.g. *Concepts*, *Descriptions* or *Relationships*) that share a specified common characteristic or common type of characteristic. *Subsets* represent information that affects the way the *components* are displayed or otherwise accessible within a particular *realm*, specialty, application or context.

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 code

A Concept Code that is directly related to the Root Concept Code by a single Relationship of the Relationship Type | is a |. All Concept Codes (except for metadata concepts) are descended from at least one Top-Level Concept Code via at least one series of Relationships of the Relationship Type" | Is a | ".

Top level metadata code

A Concept Code that is directly related to the Root Metadata Code by a single Relationship of the Relationship Type | is a |. All Metadata Concept Codes are descended from at least one Top-Level Metadata Concept Code via at least one series of Relationships of the Relationship Type" | Is a | ".

Note: Most of the data in the metadata hierarchy is only relevant to Release Format 2. Therefore, this concept may not be present in Release Format 1 files.