

# SNOMED RT

*Systematized Nomenclature of Medicine  
Reference Terminology*

VERSION 1.0

# USER GUIDE

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**SNOMED<sup>®</sup> RT**  
**Systematized Nomenclature of Medicine**  
**Reference Terminology**

**USER GUIDE**

<b>1. INTRODUCTION .....</b>	<b>5</b>
1.1. INTENDED AUDIENCE .....	5
1.2. MEANING OF “REFERENCE TERMINOLOGY” .....	5
1.3. VERSION 1.0.....	6
1.3.1. <i>FUTURE EXPANSION OF CONTENT</i> .....	7
1.3.2. <i>CHANGES, ENHANCEMENTS, &amp; TRANSITION TO SNOMED CT</i> .....	7
1.4. PROVIDING FEEDBACK ON SNOMED RT .....	8
<b>2. BACKGROUND.....</b>	<b>9</b>
2.1. SNOMED <sup>®</sup> INTERNATIONAL (SNOMED 3.0-3.5) VS. SNOMED RT .....	9
2.2. PRINCIPLES GUIDING THE DEVELOPMENT OF SNOMED .....	10
2.2.1. <i>Completeness/Comprehensive Content</i> .....	10
2.2.2. <i>Clear, Unambiguous and Nonredundant Concept Orientation</i> .....	11
2.2.3. <i>Nonoverlapping and Integrated Terminologies</i> .....	11
2.2.4. <i>Concept Permanence</i> .....	11
2.2.5. <i>Mapping</i> .....	12
2.2.6. <i>Multiple Granularities</i> .....	12
2.2.7. <i>Compositional</i> .....	12
2.2.8. <i>Synonyms</i> .....	13
2.2.9. <i>Attributes</i> .....	13
2.2.10. <i>Multiple Hierarchies</i> .....	13
2.2.11. <i>Representation</i> .....	13
2.2.12. <i>Nonsemantic Context-free Identifiers</i> .....	14
2.2.13. <i>Unique Identifiers</i> .....	14
2.2.14. <i>Concept Permanence and Version Control</i> .....	14
2.2.15. <i>Formal Definitions</i> .....	15
2.2.16. <i>Elimination of NEC</i> .....	15
2.2.17. <i>Language Independence</i> .....	15
2.2.18. <i>Responsiveness</i> .....	15
2.2.19. <i>Coordination</i> .....	15
<b>3. TECHNICAL DOCUMENTATION .....</b>	<b>16</b>
3.1. DISTRIBUTION FORMATS .....	16
3.2. IDENTIFIER FORMATS .....	16
3.3. CONCEPTS .....	17
3.3.1. <i>Concepts are the Core of SNOMED RT</i> .....	17
3.3.2. <i>Identifiers for Concepts</i> .....	17
3.4. TERMS .....	17
3.4.1. <i>The Fully Specified Name</i> .....	17
3.4.2. <i>The Preferred Name</i> .....	18

3.4.3.	<i>Synonyms</i> .....	18
3.4.4.	<i>Identifiers for Terms</i> .....	18
3.5.	HIERARCHIES .....	18
3.5.1.	<i>General Aspects of SNOMED Hierarchies</i> .....	18
3.5.2.	<i>The “Is-A” Relationship</i> .....	18
3.6.	DEFINITIONS .....	19
3.7.	DISTRIBUTION TABLE DESCRIPTION .....	19
3.7.1.	<i>SNOMED RT Concepts (SRT_CONCEPTS)</i> .....	19
3.7.2.	<i>SNOMED RT Descriptions (SRT_DESCRIPTIONS)</i> .....	22
3.7.3.	<i>SNOMED RT Relationships (SRT_RELS)</i> .....	24
3.7.4.	<i>SNOMED RT Concepts History (SRT_CONCEPTS_HX)</i> .....	26
3.7.5.	<i>SNOMED RT Concepts History Refer-To (SRT_CONCEPTS_HX_REFER_TO)</i> ... 27	
3.7.6.	<i>SNOMED RT Descriptions History (SRT_DESCRIPTIONS_HX)</i> .....	29
3.7.7.	<i>SNOMED RT Descriptions History Refer-To (SRT_DESCRIPTIONS_HX_REFER_TO)</i> .....	31
3.7.8.	<i>SNOMED RT Relationships History (SRT_RELS_HX)</i> .....	32
3.8.	STATED DEFINITIONS FILE (SRT_STATED_DEFS.XML) .....	33
3.8.1.	<i>Information contained in the Stated Definitions File that is not available in the core distribution tables</i> .....	33
3.8.2.	<i>Information contained in core distribution tables that is not available in the Stated Definitions File</i> .....	33
3.8.3.	<i>Description of the stated definitions</i> .....	33
3.8.4.	<i>XML Syntax</i> .....	34
<b>4.</b>	<b>CONTENT DOCUMENTATION</b> .....	<b>36</b>
4.1.	SNOMED’S SEMANTIC MODEL .....	36
4.2.	RELATIONSHIP TYPES (ROLES).....	36
4.2.1.	<i>CRITERIA FOR INTRODUCING NEW RELATIONSHIP TYPES</i> .....	36
4.2.2.	<i>RELATIONSHIP TYPES FOR FINDINGS AND DISORDERS</i> .....	37
4.2.3.	<i>RELATIONSHIP TYPES FOR PROCEDURES</i> .....	39
4.2.4.	<i>RELATIONSHIP TYPES FOR MEASUREMENT PROCEDURES</i> .....	43
4.2.5.	<i>RELATIONSHIP TYPES FOR DRUGS AND DRUG PREPARATIONS</i> .....	45
4.2.6.	<i>RELATIONSHIP TYPES FOR ANATOMY</i> .....	45
4.2.7.	<i>RELATIONSHIP TYPES FOR ANTIGENS AND ANTIBODIES</i> .....	46
4.2.8.	<i>RELATIONSHIP TYPES FOR SPECIMENS</i> .....	47
4.3.	PRE-COORDINATION, POST-COORDINATION .....	48
4.4.	GENERAL INTERPRETATION HEURISTICS .....	48
4.4.1.	<i>Defined vs Primitive</i> .....	48
4.4.2.	<i>AND vs. OR</i> .....	49
4.4.3.	<i>Retired Classification-Style Phrases</i> .....	49
4.4.4.	<i>Inflammation Heuristic</i> .....	49
4.4.5.	<i>Whole vs. Part Heuristic</i> .....	49
4.4.6.	<i>Concepts with a SNOMED ID starting with ‘F’</i> .....	49
4.5.	INTERPRETING THE WORDS IN PREFERRED NAMES: SOME DEFINITIONS ..	50
4.6.	TOPIC-SPECIFIC DESIGN DECISIONS.....	50
4.6.1.	<i>Comments on Anatomy</i> .....	50
4.6.2.	<i>Comments on Findings</i> .....	59
4.6.3.	<i>Comments on Morphology</i> .....	60
4.6.4.	<i>Comments on Procedures</i> .....	62
4.6.5.	<i>Comments on Disorders</i> .....	64
4.7.	THE PROBLEM WITH PRE-COORDINATED COMBINED SITES .....	65

4.8.	COMMENTS ON THE SEMANTIC MODEL .....	66
4.8.1.	<i>Part-whole reasoning in SNOMED RT</i> .....	66
4.8.2.	<i>Common questions and misunderstandings</i> .....	68
<b>5.</b>	<b>APPENDIX A: DESCRIPTION LOGIC PRIMER</b> .....	<b>69</b>
5.1.	COMPONENTS OF SNOMED RT’S SEMANTIC MODEL .....	69
5.1.1.	<i>Declarative semantics</i> .....	69
5.1.2.	<i>Concept definitions</i> .....	69
5.1.3.	<i>Defined vs. primitive concept definitions</i> .....	69
5.1.4.	<i>Defining superordinate concepts (“parents”)</i> .....	69
5.1.5.	<i>Defining relationships (“roles + relationship values”)</i> .....	69
5.2.	EXAMPLE STATEMENTS IN DESCRIPTION LOGIC .....	69
<b>6.</b>	<b>APPENDIX B: CONCEPT MODELING PROCESS</b> .....	<b>72</b>
<b>7.</b>	<b>APPENDIX C: SUPPLEMENTARY DEFINITIONS FOR SELECTED CONCEPTS</b>	<b>75</b>
<b>8.</b>	<b>APPENDIX D: USER FEEDBACK</b> .....	<b>86</b>
<b>9.</b>	<b>ACKNOWLEDGEMENTS</b> .....	<b>88</b>

# 1. INTRODUCTION

## 1.1. INTENDED AUDIENCE

This document provides a description of SNOMED<sup>®</sup> RT, with its distribution file structures, its semantic model, and its content. The primary audience for this document includes software developers and system administrators who are incorporating clinical terminology into their applications. Clinicians and scientists with an interest in the underlying model of SNOMED RT may also be interested in this document.

## 1.2. MEANING OF “REFERENCE TERMINOLOGY”

SNOMED RT is a reference terminology. A reference terminology is “a set of concepts and relationships that provides a common reference point for comparison and aggregation of data about the entire health care process, recorded by multiple different individuals, systems, or institutions.”<sup>1</sup> It may be more accurate to say that SNOMED is a clinical terminology designed primarily with **reference properties** in mind.

In applications that make use of clinical terminology, it is possible to differentiate two main user activities that are supported by the terminology: the first is the representation and recording of clinical statements; the second is the retrieval, aggregation and analysis of those clinical statements.

Reference properties: These are the properties of a clinical terminology that support retrieval, aggregation and analysis. They provide a common reference point for the commonalities between different concepts. The primary reference property for all concepts in SNOMED is the "is a" property which links concepts into a network (hierarchy) consisting of broad concepts at the very top of the hierarchy (e.g., Finding, Procedure, Body Structure, etc.) and increasingly more specific concepts (children) as one navigates down the hierarchy. The "is a" reference property is explained further in Section 3.5–Hierarchies.

Many concepts in SNOMED RT are further defined by additional reference properties called *Relationship Types* or *Roles*. For example, diseases in SNOMED RT are further characterized by four roles: topography (the body structure is affected by the disease); morphology (the morphologic change characterized by the disease); function (the biologic function associated with the disease); and etiology (the cause of the disease). Roles are further described in Section 3.6–Definitions and Section 4.2–Relationship Type.

In contrast to reference properties, **interface properties** are the properties of a clinical terminology that support representation and recording. They interact or *interface* with the clinical user. These include the vocabulary and expressions presented to a user at the point of data entry. Interface properties may be required to create menu-based “pick lists,” to provide acronyms, abbreviations, short phrases, and terms customized to a particular user or setting. Other characteristics that may be useful for data recording include optimizations for natural language processing, parts of speech, translations to and from foreign languages, and so forth.

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<sup>1</sup> Spackman KA., Campbell KE., Côté RA. SNOMED RT: a reference terminology for health care. Proceedings of the 1997 AMIA Fall Symposium. 1997.

SNOMED RT has initially focused on the reference characteristics of terminology because they form the scaffolding or foundation on which the interface characteristics must be built, and because standardization of the reference characteristics can enable implementers and users to customize and optimize their own interfaces.

This is not to say that SNOMED RT has no interface properties. All terms from SNOMED RT can be used in user interfaces. However, one should not expect to find all possible interface terminology terms and expressions in SNOMED RT. For example, a clinician may want to enter "AML – M2" instead of "Acute myelogenous leukemia, FAB M2". The former term is not in SNOMED, though the latter is. Likewise, the terms "Heart attack" and "Coronary infarction" are provided in SNOMED RT as synonyms for "Myocardial infarction" but the vast array of possible additional expressions (MI, coronary attack, etc) are not necessarily included.

Typically, a user or application developer will predefine a list of terms and expressions for use in a particular setting. They will then link each of these user interface terms (e.g., "Coronary attack") to its equivalent in SNOMED RT ("Myocardial infarction") so that upon data entry, the user interface terminology will be automatically recorded in its corresponding reference terminology. The reference terminology, in turn, can be linked to specific action protocols such as decision support applications, care pathways, practice guidelines, and so forth, to trigger events and reminders. Data stored in a reference terminology facilitates messaging across multiple sites, data aggregation, comparison, analysis, and retrieval. That's because whether entered at the point of care as "MI" "Coronary attack" "Heart attack" or any other interface term linked to "Myocardial infarction," each of these expressions will be recognized as representing the same concept – Myocardial infarction.

### **1.3. VERSION 1.0**

Users will appreciate SNOMED RT's comprehensive coverage and organization, which links clinical concepts to each other in a network of explicit hierarchies and defining roles. These characteristics provide enormous benefits over previous versions of SNOMED and over other clinical terminologies that lack these characteristics. However, because this is the first release of a very large terminology; it is inevitable that there will be some errors and omissions. The SNOMED staff and editorial board have the responsibility for and are committed to correcting any inaccuracies and filling in gaps in the terminology.

Comprehensive coverage does not imply that SNOMED RT contains every term and concept currently used in clinical practice. User interface terminology and consumer terminology, as described below, fall outside the scope of the initial releases of SNOMED RT. Likewise, terminology unique to some clinical specialties/subspecialties or branches of healthcare (nursing, dietetics, physical therapy, etc.) may not be broadly covered in this release. Formal collaborations with a growing number of professional organizations have been and are being formed to address these needs and gradually expand SNOMED RT's coverage in these areas.

Hierarchies and roles assigned to concepts in SNOMED RT will continue to be further developed and refined. Principles underlying the assignment of concepts to SNOMED RT hierarchies, and the rules used to govern the assignment of role relationships to concepts, are described later in this document. However, there may be instances in which hierarchies are not complete. These areas are continuing to be addressed and comments and feedback from clinicians, users and developers are encouraged.

### 1.3.1. FUTURE EXPANSION OF CONTENT

The content coverage of SNOMED will continue to expand. In 1999, the College of American Pathologists and the United Kingdom's Secretary of State for Health, on behalf of the National Health Service Executive (NHS), entered into a formal collaboration to combine SNOMED RT and Clinical Terms Version 3, the NHS's thesaurus of health terms which evolved from the Read Codes. The combined work, SNOMED® Clinical Terms (SNOMED® CT) will unite the strengths of the two existing terminologies: the robust strength of SNOMED RT in specialty medicine, including pathology, and the richness of Clinical Terms Version 3 in primary care.

Terminology content in each new release of SNOMED RT will continue to expand in breadth and scope of content. When it is released at the end of 2001, SNOMED CT will include all concepts, terms and identifiers published in SNOMED RT as well as Clinical Terms Version 3 and will be provided in a file structure very similar to SNOMED RT.

### 1.3.2. CHANGES, ENHANCEMENTS, & TRANSITION TO SNOMED CT

Hierarchies and role relationships will continue to be further developed and refined, and content will continue to be added. Users of SNOMED RT who are interested in anticipating the changes should watch the SNOMED CT web site ([www.snomed.org/snomedct](http://www.snomed.org/snomedct)) for documentation of proposed changes that are likely to occur with SNOMED CT. Software developers and users of SNOMED RT who are utilizing the hierarchies and role relationships can be assured that the SNOMED team will provide a smooth transition to SNOMED CT.

Several features have been built into SNOMED RT to ensure a smooth transition to SNOMED CT. SNOMED RT will utilize a numeric identifier, the SCTID (SNOMED CT identifier), as the primary identifier for concepts and descriptions. This identifier does not contain semantic information related to the meaning of a concept or term. **All SCTIDs assigned to concepts and descriptions in SNOMED RT will be carried forward in SNOMED CT.** Furthermore, the file structure of SNOMED RT and SNOMED CT is very closely aligned. SNOMED RT and SNOMED CT will both contain three core tables (Concepts, Descriptions, and Relationships) and associated History Tables. A minimal number of additional fields will be added to the distribution tables in SNOMED CT. As of this printing, column headings (field names) in the SNOMED RT core tables match anticipated headings in the SNOMED CT tables. Additional detailed specifications and questionnaires seeking feedback about SNOMED CT are available from [www.snomed.org/snomedct](http://www.snomed.org/snomedct).

#### **1.4. PROVIDING FEEDBACK ON SNOMED RT**

Comments on this document or any other aspect of SNOMED RT are welcome. Feedback regarding the content of SNOMED RT, including its hierarchies, is particularly encouraged. Appendix D contains a suggested format for submitting new term additions and recommendations to correct or modify hierarchy or role assignments.

Comments can be submitted to the address below or via phone, fax or e-mail:

SNOMED International  
College of American Pathologists  
325 Waukegan Road  
Northfield, IL 60093  
Tel: 800-323-4040  
Fax: 847-832-8335  
E-Mail: [snomed@cap.org](mailto:snomed@cap.org)



## 2. BACKGROUND

### 2.1. SNOMED<sup>®</sup> INTERNATIONAL (SNOMED 3.0-3.5) VS. SNOMED RT

SNOMED RT is a next generation work, fully compatible with SNOMED International but revolutionary in design. It uses SNOMED International as its foundation, and presents the data in a completely machine-readable format. **All codes assigned in SNOMED International through SNOMED version 3.5 are retained in SNOMED RT.**

- SNOMED RT allows for multiple parents - SNOMED International does not.
- Hierarchies and multi-axial cross-references are explicitly defined in a separate SNOMED RT Relationships Table. In SNOMED International, hierarchies are implied in the termcode; and hierarchy and cross reference information is not machine readable.
- Although all codes assigned in previous versions of SNOMED will be retained in SNOMED RT for forward and backward compatibility, the SNOMED RT codes are true *context free identifiers* and contain no inherent hierarchical information.
- Unique identifiers are assigned to each term in SNOMED RT to enable users to differentiate synonyms. SNOMED International does not provide unique identifiers for synonyms.
- As in SNOMED International, retired codes in SNOMED RT are never reassigned to a different term or concept.
- All terms that ever existed in SNOMED 3.0 through SNOMED 3.5 are included in SNOMED RT with the version number indicating when they were added.
- In SNOMED RT, all terms and concepts that have been retired are marked with the version number indicating when they were retired and the DescriptionId or ConceptId with which they were replaced. Retire and Refer To data are presented in a machine-readable table. SNOMED International does not provide machine-readable updates.
- A fully-specified name is provided in SNOMED RT for each concept to more definitely convey the concept's exact meaning. This is not provided in SNOMED International.

For clarity, certain key naming conventions in SNOMED RT have been changed:

SNOMED International	SNOMED RT
Termcode	Concept Identifier (ConceptId)
Enomen	Description
Eclass	DescriptionType

## 2.2. PRINCIPLES GUIDING THE DEVELOPMENT OF SNOMED

Two papers, both published in 1998, describe the principles upon which the development of SNOMED RT is based. Cimino's "Desiderata for Controlled Medical Vocabularies in the Twenty-First Century"<sup>2</sup> outlines twelve requirements of an ideal controlled medical vocabulary. Similar characteristics are cited in Chute et al's "A Framework for Comprehensive Health Terminology Systems in the United States"<sup>3</sup> which represents the combined opinion of the ANSI-HISB Vocabulary Working Group and the CPRI Working Group on Codes and Structures.

SNOMED RT's development was guided by the principles in Cimino's and Chute's papers, and as a result it has been built with the following characteristics:

1. Completeness/comprehensive content
2. Clear, unambiguous and nonredundant concept orientation
3. Nonoverlapping and integrated with other terminologies
4. Concept permanence
5. Mapping to other terminologies and classifications
6. Multiple granularities
7. Compositional syntax
8. Inclusion of synonyms
9. Inclusion of attributes
10. Multiple hierarchies
11. Representation of concepts
12. Nonsemantic context-free identifiers
13. Unique identifiers
14. Concept permanence and version control
15. Formal definitions
16. Elimination of NEC
17. Language independence
18. Responsiveness
19. Coordination

Sections 2.2.1 - 2.2.19 below describe how these principles are put into practice in SNOMED RT.

### 2.2.1. Completeness/Comprehensive Content

Two studies were conducted by the Computer-based Patient Record Institute (CPRI) to evaluate the ability of current coded nomenclatures and classification systems to accurately and completely reflect the information found in patients' medical records.

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<sup>2</sup>Cimino, JJ. Desiderata for controlled medical vocabularies in the twenty-first century. *Meth Inform Med.* 1998; 37: 394-403.

<sup>3</sup>Chute CG, Cohn SP, Campbell JR. A framework for comprehensive health terminology systems in the United States. *J Am Med Inform Assoc.* 1998; 4(6):503-9.

The first study evaluated the *completeness* of various coding systems -- how well they could code the information contained in patients' medical records.<sup>4</sup> Because some coding systems were not designed to code all the clinical content of medical records, the second study was limited to controlled vocabularies.<sup>5</sup> In addition to completeness, the second study also evaluated features such as clarity, definitions, administrative mapping, and clinical taxonomy. In both studies, SNOMED was ranked as the most comprehensive controlled vocabulary for coding the contents of a patient record.

SNOMED RT continues to build upon the long established SNOMED commitment to continuously add additional terms and concepts that reflect contemporary practice. This is accomplished by constantly mining data from a variety of sources including medical literature, medical record documents, user suggestions, and formal relationships with professional societies which ensure coverage of terminology specific to clinical specialties.

### 2.2.2. Clear, Unambiguous and Nonredundant Concept Orientation

SNOMED RT is based upon explicit representation of unique concepts, each with a single, coherent meaning. As with previous versions of SNOMED, each individual concept in SNOMED RT is represented once, and is assigned a unique ConceptId. Alternative ways of expressing the concept are represented as synonyms in the Descriptions Table.

### 2.2.3. Nonoverlapping and Integrated Terminologies

Specialized terminologies developed and maintained by professional organizations are being integrated and coordinated with SNOMED RT along with cross maps to other recognized terminologies and classifications. This endeavor promotes coherence and reduces potential duplication of effort by various organizations and individuals.

### 2.2.4. Concept Permanence

The meaning of each concept is presented in SNOMED RT will never change. Any alteration to a concept that changes or clarifies the concept's original meaning results in the assignment of a completely new concept and identifier and, if appropriate, the retirement of the old concept. What this means is that the *meaning of medical data* that has been coded with SNOMED RT will never change.

*Concept permanence* provides a guarantee of data integrity to users of SNOMED RT. This principle of concept permanence isn't limited to the current version of SNOMED RT -- future versions of SNOMED will incorporate all of the concepts in SNOMED RT. This means there will be no loss of data integrity for any data encoded with SNOMED RT, even after future versions of SNOMED are in use.

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<sup>4</sup>Chute C, Cohn S, Campbell K, Oliver D, Campbell JR. The content coverage of clinical classifications. JAMIA. 1996;3:224-33.

<sup>5</sup>Campbell JR, Carpenter P, Sneiderman C, Cohn S, Chute CG, Warren J. Phase II evaluation of clinical coding schemes: completeness, taxonomy, mapping, definitions, and clarity. JAMIA. 1997;4:238-51.

### 2.2.5. Mapping

SNOMED RT currently includes cross mappings to ICD-9-CM (International Classification of Disease, 9th Revision Clinical Modification), ICD-O (International Classification of Diseases for Oncology) topography, and the International Union of Biochemistry and Molecular Biology (IUBMB) Enzyme Nomenclature. It also contains an integration with Laboratory LOINC<sup>®</sup> codes.

### 2.2.6. Multiple Granularities

To facilitate data entry and retrieval, SNOMED RT continues the SNOMED practice of including both granular atomic concepts which can be used to build more complex statements and, where practical, commonly-used precoordinated terms. For example:

Procedure  
Surgical procedure  
Cardiovascular surgical procedure  
Vascular surgery procedure  
Creation of vascular bypass  
Creation of arterioarterial bypass  
Arterial intra-abdominal bypass  
Ilioiliac shunt  
Ilioiliac bypass graft with vein

If SNOMED RT was used to code an "Ilioiliac bypass graft with vein," it would be possible to retrieve records of that operation by searching at various different levels of granularity, including "Vascular surgery procedure," "Arterial intra-abdominal bypass," and "Ilioiliac shunt."

### 2.2.7. Compositional

SNOMED RT supports a compositional syntax that enables a composite concept to be created by various combinations of atomic concepts and still be recognized as the same concept.<sup>6</sup> Using this approach, a concept such as acute appendicitis, for example, can be recognized as being equivalent to a variety of combined atomic concepts. For example:

- appendicitis  $\sqcap$  (has-chronicity acute)
- acute disease  $\sqcap$  (associated-topography appendix)  $\sqcap$  (associated-morphology inflammation)
- disease  $\sqcap$  (has-chronicity acute)  $\sqcap$  (associated-topography appendix)  $\sqcap$  (associated-morphology inflammation)

The precoordinated (already composed) concept "acute appendicitis" is also available in SNOMED RT.

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<sup>6</sup> Spackman KA, Campbell KE, Compositional concept representation using SNOMED: towards further convergence of clinical terminologies. Proc AMIA Annu Fall Symp. 1998.

### 2.2.8. Synonyms

Synonyms are assigned to the ConceptId to which they refer. The exact meaning of a synonym or the exact context to which it refers, can be referenced back to the concept's fully specified name. For example, "Primary pulmonary coccidioidomycosis" has four synonyms in SNOMED RT:

- Coccidioidal pneumonitis
- Coccidioidomycotic pneumonitis
- Desert rheumatism
- San Joaquin Valley fever

These terms are all linked back to "Primary pulmonary coccidioidomycosis" through the SNOMED RT concept identifier for this concept. To differentiate multiple synonyms of a given concept, each synonym is assigned its own unique DescriptionId.

### 2.2.9. Attributes

SNOMED contains a comprehensive list of modifier and qualifier terms to precisely represent each medical event within its context. Encoding clinical data generally requires the context to be specified. SNOMED codes for specifying context are known as "qualifiers", and are found in four hierarchies: General information qualifiers (G-0000), qualifiers for type of diagnosis (G-1000), qualifiers for certainty of diagnosis (G-2000), and special information qualifiers (G-4000).

Detailed encoding also requires modifiers, and SNOMED has a long list of adjectival modifiers (under G-A0F8).

### 2.2.10. Multiple Hierarchies

SNOMED RT is a multi-hierarchical terminology. This means a single concept can be explicitly defined in more than one hierarchy. This facilitates the consistent retrieval and aggregation of information.

For example, "Pneumococcal pneumonia" is defined as both a lung disease and an infectious disease. The SNOMED RT code for Pneumococcal pneumonia is linked to the semantic meaning for both "Infectious disease" and "Lung disease." This means coded data regarding pneumococcal pneumonia can be retrieved by searching for infectious diseases or lung diseases.

### 2.2.11. Representation

Concepts and descriptions in SNOMED RT are represented by coded identifiers, which contain no inherent meaning or other attributes which may limit or restrict future assignment of identifiers for new terms and concepts.

### 2.2.12. Nonsemantic Context-free Identifiers

In older versions of SNOMED, concept identifiers contained information about the concepts. For example, disease concepts began with "D." In addition, other information about the concepts, such as where they fit into the hierarchies, was contained in the alphanumeric concept identifiers. This practice of including semantic information in concept identifiers is very convenient, but is not practical because it creates severe limitations in expressing the meaning of a concept and can lead to serious misinterpretations.

The concept identifiers in SNOMED RT do not contain any semantic information. They are *non-semantic (meaningless) context-free* identifiers. Although all term codes assigned in previous versions of SNOMED will be retained in SNOMED RT for forward and backward compatibility, the hierarchical information inherent in these codes should not be relied upon in SNOMED RT. Hierarchical information about the concept will be maintained in the Relationships Table which will easily accommodate multiple hierarchies.

### 2.2.13. Unique Identifiers

Every termcode ever assigned in SNOMED, beginning with SNOMED version 3.0, will be permanently retained in the SNOMED RT tables. In order to ensure forward and backward compatibility, this includes codes that were retired in early versions. Once retired, a code is never reassigned to a new concept or new term.

To manage legacy data from early versions of SNOMED – SNOMED II (1979) and SNOP (1965), a complimentary Bridge File is available from the College of American Pathologists which links the legacy code to its corresponding SNOMEDId in SNOMED RT.

### 2.2.14. Concept Permanence and Version Control

Each term and concept in SNOMED contains a record of the version of SNOMED in which it first appeared in the terminology. In addition, for concepts and terms that have been retired, there will also be a record of the SNOMED version in which they were retired. Retired terms and concepts are assigned a "refer to" ConceptId or DescriptionId and a reason for the modification.

Surgical construction of fistula -RETIRED-  
Refer to P1-08611 Construction of shunt  
Added: 1994.0101  
Retired: 2000.1101

Because of the permanence of "Surgical construction of fistula," it will always be possible to retrieve information coded with this retired SNOMED concept. Users who want to use this retired SNOMED concept are referred to a new concept, "Construction of shunt," which they can use instead.

#### 2.2.15. Formal Definitions

SNOMED RT concepts are explicitly defined by their semantic relationships with other concepts in the terminology. These formal concept definitions and relationships are represented in the Relationships Table in a machine readable format. The human readable meaning of a concept is represented by the Fully Specified Name, Preferred Name, and Synonyms.

The machine readable, formal definitions of SNOMED RT concepts are distributed to users in a Stated Definitions File (see Section 3.8).

#### 2.2.16. Elimination of NEC

SNOMED has eliminated the use of “NEC”. Used in ICD-9 and other classification-style terminologies, “NEC” stands for “Not Elsewhere Classified”, and permits the creation of catch-all categories for cases that do not fit any of the categories directly described in the classification. As new concepts are added to a terminology, the meaning of “NEC” can change (since what was once *not* classified elsewhere now in fact *may* be). This direct alteration in meaning of one code resulting from changes elsewhere in the terminology would make it difficult or impossible to determine what is meant by the code.

#### 2.2.17. Language Independence

Individual dialect tables will reflect preferred terms and synonyms used in individual countries or regions. The first release of SNOMED RT will be limited to a US-English dialect table only.

#### 2.2.18. Responsiveness

Updates to SNOMED RT will be provided at least twice per year or more frequently, depending upon user feedback. Feedback on the content of SNOMED RT is encouraged. A method for providing comments and suggestions is detailed in Appendix D.

#### 2.2.19. Coordination

The College of American Pathologists is a not-for-profit organization that has established a separate operating division, SNOMED International, committed to coordinating and maintaining a comprehensive scientifically validated reference terminology that enables clinicians, researchers and patients to communicate worldwide, across medical specialties and sites of care. Coordination efforts include the establishment of approved cross-maps to other recognized terminologies, including administrative classifications and commercial databases, as well as the establishment of formal relationships with professional societies for the inclusion of authoritative specialty-specific terminology into SNOMED.

### 3. TECHNICAL DOCUMENTATION

#### 3.1. DISTRIBUTION FORMATS

SNOMED RT will be provided in ASCII tab-delimited flat files which can be imported into any database or other software application. Details on the file structure and format are specified in Section 3.7. The SNOMED RT files are designed as relational tables with each line in the file representing a row in the table. The first row of each table contains column headings. All other rows contain data. SNOMED RT is not software and is not itself accompanied by any software application.

#### 3.2. IDENTIFIER FORMATS

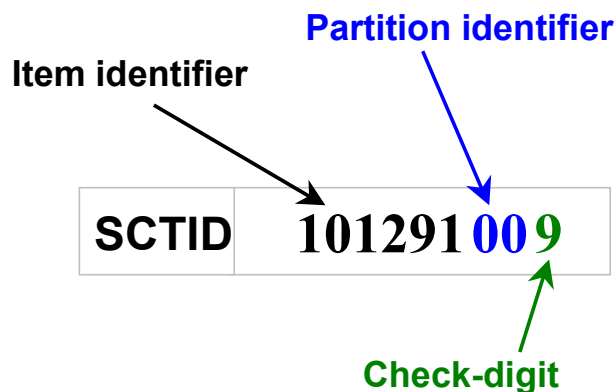
SNOMED RT provides two kinds of identifier for concepts, the SNOMEDId and the SCTID:

- 1) The SNOMEDId: This is the same identifier used in SNOMED International (version 3.0 to 3.5). It consists of up to 8 characters, the first of which can be any of {A, C, D, F, G, J, L, M, P, S, T}, followed optionally by a second character, a dash, and then either 4 or 5 characters. All characters subsequent to the first, exclusive of the dash, are from the set {A, B, C, D, E, F, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0}.
- 2) The SCTID (**SNOMED CT identifier**) is being introduced for the first time in SNOMED RT and will be carried forward in SNOMED CT. The SCTID is a generic designation referring to the unique concept identifiers and description identifiers in SNOMED RT. The SCTID does not contain semantic information related to the meaning of a term. It does however have a partitioned structure that allows the user to readily recognize whether the term is a concept or a description. While this distinction may appear minimally advantageous in SNOMED RT, additional identifiers will be introduced in SNOMED CT, making the distinction more relevant in the future. However, the true advantage of partitioning the SCTID is that it prevents reuse of the same identifier for a different type of component (i.e., it helps avoid the possibility that a concept is inadvertently given the same identifier as a description) and thus avoids ambiguity. This also allows the nature of the identifier to be recognized when stored in a record or transferred in a message.

The rightmost digits in a decimal string representation of the SCTID have the following defined roles:

- A single check-digit is used to validate the identifier.
- A two-digit partition-identifier, which ensures that the identifier is unique in the scope of SNOMED (RT and CT). For example, the same identifier cannot be allocated to a Concept and to a Description.





### SCTID Structure

The SCTID represents a ConceptId if the partition identifier=00 and a DescriptionId if the partition=01. Item numbers uniquely identify an individual entity within the specified Concept or Description partition. For additional information on the check digit, see Section 3.7.1.1.

## 3.3. CONCEPTS

### 3.3.1. Concepts are the Core of SNOMED RT

SNOMED RT is a concept-oriented terminology. A concept is a unit of thought - a phrase or an individual term with specific intensional meaning. Concepts can be nouns or verbs that describe a disease or diagnosis, a body structure, a procedure, a body function, an etiology, etc. For example, "Metastatic malignant neoplasm to leg" is a SNOMED concept representing the notion of a cancerous tumor that has spread to the leg. "Paroxysmal coughing;" "Bout of coughing;" and "Fit of coughing" are all unique descriptions in SNOMED representing the single concept or notion of uncontrolled coughing. There are over 128,000 unique concepts in SNOMED RT version 1.0.

### 3.3.2. Identifiers for Concepts

The SNOMED termcode (SNOMEDId) has been used since 1993 to identify concepts in SNOMED 3.0 through SNOMED 3.5. As explained above, SNOMED RT will introduce the SCTID, a numeric identifier that will transition to SNOMED CT. Existing applications that use SNOMEDIds from SNOMED version 3.0-3.5 can continue to operate normally using those concept identifiers. New or revised applications should anticipate SNOMED CT by using the new numeric ConceptId, which is in the SCTID format of the SNOMED RT concepts table.

## 3.4. TERMS

A term is the word or group of words used to express a concept. In SNOMED RT, terms are classified as either a fully specified name, a preferred name, or a synonym. Each active concept has one fully specified name and one preferred name and may have zero to many synonyms.

### 3.4.1. The Fully Specified Name

The Fully Specified Name of a concept provides an unambiguous but lengthy name that is used to document what is meant by a particular code. Sometimes it may appear stilted or awkward, but its purpose is to clarify meaning, not to present a commonly-used or natural phrase. It includes words and phrases that, in the usual context, are not stated but are understood. For example, in a context

related to eye disorders, such as two ophthalmologists speaking to each other about an eye patient, the word “fundus” is sufficient to indicate the ocular fundus. Outside that context, the word “fundus” can mean uterine fundus, gastric fundus, etc.

#### 3.4.2. The Preferred Name

The Preferred Name of a concept is one of the terms associated with a concept. Chosen as the default name for distribution purposes, it is considered to be the "term of choice" that best represents the most common word or phrase used to describe the concept. Each SNOMED concept has only one Preferred Name identified in the distribution tables. If it is ambiguous when seen out of context, (e.g. funduscopy, ventriculoplasty), users can refer to the Fully Specified Name to find which meaning is intended. In a given situation, implementers and users may actually prefer a term other than the distributed Preferred Name. The Preferred Name is intended only as a starting point, not as a mandatory or even prescriptive statement about what clinicians should say in clinical language. In other words, it is “preferred” only in the sense that it was chosen by SNOMED developers in preference to the synonyms (if any) to be the default term that is shown to users.

#### 3.4.3. Synonyms

Synonyms are terms that *may* represent a concept, depending on the context. Terms need not be unique across all concepts. The synonym category in SNOMED admits phrases that may appear to be too general, in the situation when context supplies missing information; for example, “fundus” may appear as a synonym of ocular fundus, gastric fundus and uterine fundus.

#### 3.4.4. Identifiers for Terms

SNOMED RT distributes a separate identifier for each concept/term pair called the “DescriptionId” (see 3.7.2.1). The DescriptionId identifies each string attached to a concept. As an example, “fundus” as a synonym for “ocular fundus” will have a different DescriptionId than “fundus” as a synonym for “gastric fundus”. This enables users to record the DescriptionId as the only identifier, allowing retrieval of both the concept intended and the particular synonym used.

### 3.5. HIERARCHIES

#### 3.5.1. General Aspects of SNOMED Hierarchies

#### 3.5.2. The “Is-A” Relationship

As mentioned in the introduction of this User Guide, reference properties are those attributes of a clinical terminology that support retrieval, aggregation and analysis and provide a common reference point for the commonalities between different concepts. The primary reference property for all concepts in SNOMED is the "is a" property which links concepts into a network (hierarchy) consisting of broad concepts at the very top of the hierarchy (e.g., Finding, Procedure, Body Structure, etc.) and increasing more specific concepts (children) as one navigates down the hierarchy.

For example, the "is a" hierarchy in SNOMED RT links the very specific disorder "Myocardial infarction" to the more general disorder "Coronary artery disease," which itself is linked to an even more general disorder "Disease of the artery," and leads ultimately to the root concept "Finding, conclusions, and/or assessment":

Disease *is a* Finding, conclusion, and/or assessment  
Disease of the cardiovascular system *is a* Disease  
Vascular disease *is a* Disease of the cardiovascular system  
Disease of the artery *is a* Vascular disease  
Coronary artery disease *is a* Disease of the artery  
**Myocardial infarction *is a* coronary artery disease**

As shown above, the "is a" reference property provides a commonality between "Myocardial infarction" and any other disease in SNOMED RT that is also classified in any of the following hierarchies: coronary artery disease, vascular disease, disease of the cardiovascular system, disease, and ultimately any concept in SNOMED RT that is a Finding, conclusion, and/or assessment. The hierarchy linkages are provided in the SNOMED RT Relationships Table which is described in greater detail in sections 3.5 and 3.7.

### 3.6. DEFINITIONS

Many concepts in SNOMED RT are further defined by additional reference properties called *Relationship Types* or *Roles*. For example, diseases in SNOMED RT are further characterized by four roles: topography (the body structure is affected by the disease); morphology (the morphologic change characterized by the disease); function (the biologic function associated with the disease); and etiology (the cause of the disease). The additional reference properties for myocardial infarction are its topography "myocardium" and its morphology "infarction." The morphology role provides additional commonality between "Myocardial infarction" and any other disease in SNOMED RT that is also characterized as having a morphology of "infarction" (such as pulmonary infarction, cerebellar infarction, hepatic infarction, etc). The topography role provides commonality with any disease characterized as having a topography of myocardium or any of the parents of myocardium (heart, cardiovascular system)

### 3.7. DISTRIBUTION TABLE DESCRIPTION

SNOMED RT is delivered in eight relational tables:

1. Concepts
2. Concepts History
3. Concepts History Refer-To
4. Descriptions
5. Descriptions History
6. Descriptions History Refer-To
7. Relationships
8. Relationships History

#### 3.7.1. SNOMED RT Concepts (SRT\_CONCEPTS)

Concepts are the foundation of SNOMED RT. The Concepts Table lists each unique concept that ever appeared in SNOMED, beginning with SNOMED International version 3.0.

### 3.7.1.1. *ConceptId*

ConceptId is the SNOMED RT Concept Identifier, an SCTID which is a unique 6 to 18 digit positive integer assigned to every concept in SNOMED RT. The ConceptId does not contain any semantic information related to the meaning of the concept. However, there is a consistency in the assignment of the last three digits of the identifier:

- The last digit is a single check-digit used to validate the identifier and is calculated from Verhoeff's Dihedral Group D5 Check. More information about the check digit calculation, including a sample Java script for computing the check digit is available upon request. Additional documentation is also provided in the SNOMED CT design documents, available on the web ([www.snomed.org/snomedct](http://www.snomed.org/snomedct)).
- The two digits preceding the check digit will always be zeroes "0". This identifies the identifier as a concept. It ensures that ConceptIds will be unique in the scope of SNOMED RT and that the same integer will never be inadvertently allocated to a DescriptionId.

### 3.7.1.2. *FullySpecifiedName*

FullySpecifiedName represents the completely described meaning of the concept and is a useful reference when the term, as displayed in the Descriptions Table (described below), does not adequately convey the concept's exact meaning. A significant number of Fully Specified Names will be the same as the Preferred Name in the Descriptions Table, but will also include, in parentheses, the name of the uppermost-level parent concept to help further distinguish the concept. Examples are provided in the sample excerpt from the Concepts Table shown below.

As new concepts are added in SNOMED, and as ambiguities in the descriptions of existing SNOMED concepts are noted, entries in the FullySpecifiedName column will become more descriptive.

The FullySpecifiedName is case sensitive. Superscript notations appear as ^notation^ while subscript notations appear as >notation<. The following are examples:

Example of superscript - Le<sup>a</sup> appears in the file as Le^a^.

Example of subscript - A<sub>2</sub> appears in the file as A>2<.

### 3.7.1.3. *ConceptStatus*

ConceptStatus indicates whether the Concept is in current use. The number zero ("0") indicates that the concept is current (in current/active use). The number one ("1") indicates that the concept is retired (withdrawn from active use).

### 3.7.1.4. *SNOMEDId*

SNOMEDId represents the original alphanumeric hexadecimal code used in the previous edition of SNOMED (SNOMED version 3.0-3.5). Alphanumeric SNOMED codes are retained in SNOMED RT to facilitate forward compatibility. The hierarchies that were previously inferred in the SNOMED 3.0-3.5 coding convention are not valid in SNOMED RT. *In SNOMED RT, the SNOMEDId cannot be relied on to identify hierarchies; the SNOMEDId should be regarded as an identifier of the concept only.* To aid in the transition from legacy systems, alphanumeric identifiers will continue to be assigned to new concepts in SNOMED RT for an indefinite period of time in addition to the SCTID ConceptIds.

### 3.7.1.5. SRT\_CONCEPTS Table Format

COLUMN NAME	DATA TYPE	MAX. LENGTH	DESCRIPTION
ConceptId	Integer	18	SNOMED RT Concept Identifier is an SCTID unique integer for every concept in SNOMED RT. The last digit will always be a check digit and the two digits immediately preceding the check digit will always be "00"
FullySpecifiedName	Text	255	Fully Specified Name is a phrase that describes a Concept in a way that is intended to be unambiguous. In SNOMED RT, many of the Fully Specified Names will be similar to the Preferred Name. Superscript notations appear as ^notation^ Subscript notations appear as >notation<.
ConceptStatus	Number	1	Concept Status indicates whether the Concept is in current use or withdrawn from current use. 0 = Current (in current/active use). 1 = Retired (withdrawn from active use).
SNOMEDId	Text	8	SNOMEDId is a SNOMED alphanumeric identifier for this particular Concept as assigned to concepts in all previous versions of SNOMED 3. Alphanumeric SNOMEDId identifiers will continue to be assigned to new concepts in SNOMED RT. Unlike previous versions of SNOMED, the alphanumeric identifier does not imply any hierarchical or definitional meaning.

### 3.7.1.6. SRT\_CONCEPTS Table Examples

ConceptId	FullySpecifiedName	Concept Status	SNOMEDId
2458006	Educational therapy (procedure)	0	P9-34500
2459003	Destructive procedure of artery of upper extremity (procedure)	0	P1-37C10
2460008	Compression of spinal nerve root, NEC -RETIRED- (disorder)	1	D1-23720
2461007	Tennis elbow test (procedure)	0	F-17320
2462000	Glucose dehydrogenase (substance)	0	F-66498
2463005	Acquired heterochromia of iris (disorder)	0	DA-72532
2464004	Moderate cytologic atypia (morphologic abnormality)	0	M-67002
2465003	Neutrophil chemotaxis (biological function)	0	F-D0922
2466002	Chloride peroxidase (substance)	0	F-670F8
2467006	Cassia angustifolia (living organism)	0	L-D6242
2468001	Breath analyzer (device)	0	A-2C328
2469009	Onychomalacia (disorder)	0	D0-54174
2470005	Brain damage (disorder)	0	DA-00015
2471009	Postoperative intra-abdominal abscess (disorder)	0	DD-66A61
2472002	Absence of urine volume (finding)	0	F-72405
2473007	Intermittent vertical heterotropia (disorder)	0	DA-78173
2474001	Repair of malunion of metatarsal bones (procedure)	0	P1-19940
2475000	Urine specimen collection, 24 hours (procedure)	0	P3-02160
2476004	Flavobacterium gleum (living organism)	0	L-1F111
2477008	Superficial thrombophlebitis (disorder)	0	D3-87714
2478003	Glass eye (device)	0	A-04810

### 3.7.2. SNOMED RT Descriptions (SRT\_DESCRIPTIONS)

A Description associates a given concept with the various terms or phrases used to express the concept. Therefore, each combination of a concept and a term is a Description and is identified by a DescriptionId. Every ConceptId, both active and inactive, is listed in the Descriptions Table along with a unique DescriptionId for each unique way of expressing the concept.

#### 3.7.2.1. DescriptionId

DescriptionId is the SNOMED RT Description Identifier -an SCTID which is a unique 6 to 18 digit positive integer assigned to every description in SNOMED RT. The DescriptionId does not contain any semantic information related to the meaning of the description. However, as with the ConceptId, there is a consistency in the assignment of the last three digits of the identifier:

- The last digit is a single check-digit used to validate the identifier and is calculated from Verhoeff's Dihedral Group D5 Check. More information about the check digit calculation, including a sample Java script for computing the check digit is available upon request.
- The two digits preceding the check digit will always be "01". This identifies the identifier as a description. It ensures that DescriptionIds will be unique in the scope of SNOMED RT and that the same integer will never be inadvertently allocated to a ConceptId.

#### 3.7.2.2. ConceptId

This is an SCTID that provides a key to the Concepts table, so that descriptions can be linked to the concepts that they identify.

#### 3.7.2.3. Term

The designation "Term" was formerly known as the Enomen (English nomenclature) in previous versions of SNOMED. It represents the name associated with the description, and is described as succinctly as possible.

Terms are case sensitive. Superscript notations appear as <sup>notation</sup> while subscript notations appear as <sub>notation</sub>. The following are examples:

Example of superscript - Le<sup>a</sup> appears in the file as Le<sup>a</sup>.

Example of subscript - A<sub>2</sub> appears in the file as A<sub>2</sub>.

#### 3.7.2.4. DescriptionType

DescriptionType indicates whether the term is the preferred term for a concept (DescriptionType = 1) or a synonym of the preferred term (DescriptionType = 2). DescriptionType is analogous to ECLASS (English classification) in SNOMED 3. Each active concept (i.e., those with ConceptStatus = 0) has one term in the Descriptions Table with an DescriptionType of 1, and zero to many terms with DescriptionType of 2, each of which is differentiated by its unique DescriptionId. Refer to Sections 3.4.2 and 3.4.3 for additional information about preferred terms and synonym.

#### 3.7.2.5. DescriptionStatus

DescriptionStatus indicates whether the Description is in current use. The number zero ("0") indicates that the description is current (in active use). The number one ("1") indicates that the description concept is retired (withdrawn from active use). The number eight ("8") represents a Retained Description – a Description that is not in current use but is retained as a reference to a concept that has been retired. A Retained Description provides users with the name of the retired concept and is useful when encountering data that was previously coded with a ConceptId that is

now inactive (e.g., see DescriptionId 1949466013 in the sample Descriptions Table diagram below.)

3.7.2.6. *SRT\_DESCRIPTIONS Table Format*

COLUMN NAME	DATA TYPE	MAX. LENGTH (characters)	DESCRIPTION
DescriptionId	Integer	18	SNOMED RT Description Identifier is a unique SCTID positive integer for every Description in SNOMED RT. The last digit will always be a check digit and the two digits immediately preceding the check digit will always be "01"
ConceptId	Integer	18	The unique SNOMED RT ConceptId of the Concept to which this description applies.
Term	Text	255	The text of a description that can be used to describe the concept to which this description applies. Superscript notations appear as ^notation^ Subscript notations appear as >notation<.
DescriptionType	Number	1	An indication of whether the Term is the Preferred term or Synonym for the Concept to which this Description applies. 1 = Preferred Term for the associated Concept 2 = Synonym of the associated Concept.
DescriptionStatus	Number	1	Indicates whether the Description is in current use. 0 = Current: the Description is in current use. 1 = Retired: the Description has been withdrawn. 8 = Retained: the Description is not in current use but is retained as a reference to a Concept that has been retired.

### 3.7.2.7. SRT\_DESCRIPTIONS Table Examples

DescriptionId	ConceptId	Term	Description Type	Description Status
5209016	2458006	Educational therapy	1	0
5210014	2458006	Educational therapy, NOS	2	1
5211013	2459003	Destructive procedure of artery of upper extremity	1	0
5212018	2459003	Destructive procedure of artery of upper extremity, NOS	2	1
5213011	2460008	Compression of spinal nerve root, NEC	1	1
199466013	2460008	Compression of spinal nerve root, NEC - RETIRED	1	8
5214017	2461007	Tennis elbow test	1	0
5215016	2462000	Glucose dehydrogenase	1	0
5216015	2463005	Acquired heterochromia of iris	1	0
5217012	2464004	Moderate cytologic atypia	1	0
5218019	2465003	Neutrophil chemotaxis	1	0
5219010	2466002	Chloride peroxidase	1	0
5220016	2467006	Cassia angustifolia	1	0
5221017	2468001	Breath analyzer	1	0
5222012	2469009	Onychomalacia	1	0
5223019	2469009	Soft nails	2	0
5224013	2470005	Brain damage	1	0
5225014	2470005	Brain damage, NOS	2	1
5226010	2471009	Postoperative intra-abdominal abscess	1	0
5227018	2472002	Absence of urine volume	1	0
5228011	2472002	Anuria	2	0
5229015	2473007	Intermittent vertical heterotropia	1	0
5230013	2474001	Repair of malunion of metatarsal bones	1	0
5231012	2475000	Urine specimen collection, 24 hours	1	0
5232017	2475000	24 hour urine specimen collection	2	0
5233010	2476004	Flavobacterium gleum	1	0
5234016	2477008	Superficial thrombophlebitis	1	0
5235015	2477008	Superficial thrombophlebitis, NOS	2	1
5236019	2478003	Glass eye	1	0

### 3.7.3. SNOMED RT Relationships (SRT\_RELS)

The Relationships Table represents the knowledge base of SNOMED RT. It defines the hierarchy(ies) of each concept in SNOMED RT by linking the concept to its parent concept through the "IS-A" or "PART-OF" relationship. It also describes the essential characteristics of the concept via a set of predetermined roles.

***It is important to understand that the Relationships Table replaces the hierarchical information previously inherent in the termcode of preceding editions of SNOMED.***

Each active ConceptId in the Concepts Table contains at least one corresponding ConceptId in the Relationships Table designated as ConceptId1. The ConceptId is repeated for each relationship assigned to the concept. RelationshipType defines the relationship between ConceptId1 (the source concept) and ConceptId2 (the target concept). The RelationshipType itself is a ConceptId.



### 3.7.3.1. SRT\_RELS Table Format

COLUMN NAME	DATA TYPE	MAX. LENGTH (characters)	DESCRIPTION
ConceptId1	Integer	18	SNOMED RT Concept Identifier (ConceptId) of the Concept which is the source of this relationship.
RelationshipType	Integer	18	SNOMED RT Concept Identifier (ConceptId) of the Concept which represents the type of relationship between the related Concepts.
ConceptId2	Integer	18	SNOMED RT Concept Identifier (ConceptId) of the Concept which is the target of this Relationship.

### 3.7.3.2. SRT\_RELS Table Examples

**SRT\_RELS Table**

Concept Id1	Relation-shipType	Concept Id2
2458006	116680003	90102008
2459003	116680003	46593005
2461007	116680003	116325002
2463005	116677004	41296002
2463005	116680003	70397008
2466002	116680003	68101005
2467006	116680003	85376004
2468001	116680003	30234008
2469009	116677004	72651009
2469009	116680003	17790008
2470005	116676008	37782003
2470005	116677004	12738006
2470005	116680003	8533009
2470005	116680003	127294003
2471009	116676008	44132006
2471009	116677004	113345001
2471009	116680003	75100008
2472002	116677004	19787009
2472002	116680003	106100005
2474001	116677004	53884002
2474001	116679001	52090005
2474001	116680003	35269008
2474001	116680003	33544007
2474001	116680003	119694001
2474001	116680003	19506004
2475000	116680003	57617002
2476004	116680003	18986002

**Translation of codes (for illustration only)**

ConceptId1 Term	Relationship Type Term	ConceptId2 Term
Educational therapy	ISA	Social psychotherapy
Destructive procedure of artery of upper extremity	ISA	Destructive procedure of artery of extremity
Tennis elbow test	ISA	Elbow maneuver
Acquired heterochromia of iris	ASSOC-TOPO	Iris
Acquired heterochromia of iris	ISA	Pigmentary iris degeneration
Chloride peroxidase	ISA	Oxidoreductase
Cassia angustifolia	ISA	Cassia
Breath analyzer	ISA	Medical laboratory analyzer
Onychomalacia	ASSOC-TOPO	Nail
Onychomalacia	ISA	Disease of nail
Brain damage	ASSOC-MORPH	Damage
Brain damage	ASSOC-TOPO	Brain
Brain damage	ISA	Intracranial space-occupying lesion
Brain damage	ISA	Traumatic and non-traumatic brain injury
Postoperative intra-abdominal abscess	ASSOC-MORPH	Abscess
Postoperative intra-abdominal abscess	ASSOC-TOPO	Abdomen
Postoperative intra-abdominal abscess	ISA	Abdominal abscess
Absence of urine volume	ASSOC-TOPO	Lower urinary tract
Absence of urine volume	ISA	Lower urinary tract finding
Repair of malunion of metatarsal bones	ASSOC-TOPO	Metatarsal
Repair of malunion of metatarsal bones	HAS-OBJECT	Malunion of fracture
Repair of malunion of metatarsal bones	ISA	Repair of bone
Repair of malunion of metatarsal bones	ISA	Operation on bone injury
Repair of malunion of metatarsal bones	ISA	Foot repair
Repair of malunion of metatarsal bones	ISA	Surgical repair of lower extremity
Urine specimen collection, 24 hours	ISA	Urine specimen collection
Flavobacterium gleum	ISA	Flavobacterium

### 3.7.4. SNOMED RT Concepts History (SRT\_CONCEPTS\_HX)

The Concepts History Table chronicles the history of each concept, including the version number in which the ConceptId was added and/or retired (inactivated). Each ConceptId in the Concepts Table contains a corresponding ConceptId in the Concepts History Table to trace the history of the concept. There will be two entries for retired ConceptIds - one entry indicating when the concept was added (Active) and another entry indicating when the concept was retired (Inactive).

SNOMED versions are represented in the Concepts History table with the following version numbers:

SNOMED 3.0	1994.0101
SNOMED 3.1	1995.0101
SNOMED 3.3	1996.0101
SNOMED 3.4	1996.0701
SNOMED 3.5	1998.0101
SNOMED RT 1.0	2000.1101

#### 3.7.4.1. SRT\_CONCEPTS\_HX Table Format

COLUMN NAME	DATA TYPE	MAX. LENGTH (characters)	DESCRIPTION
ConceptId	Integer	18	SNOMED RT Concept Identifier: ConceptId from the Concepts Table. Every ConceptId in the Concepts Table has one or more rows in the Concepts History Table.
ConceptStatus	Number	1	Status of the ConceptId 0 = Active 1 = Inactive (concept is retired - see SRT_CONCEPTS_HX_REFER_TO Table for further information) Every ConceptId in the Concepts Table has one or more rows in the Concepts History table
Version	Number	9	Version numbers are represented as dates. Format: XXXX.XXXX where the first four digits represent the year, the first two digits following the decimal point represent the month and the last two digits represent the day. If ConceptStatus = 0, Version represents the SNOMED version number in which the concept was added to SNOMED If ConceptStatus = 1, Version represents the SNOMED version number in which the concept was retired in SNOMED

### 3.7.4.2. SRT\_CONCEPTS\_HX Table Examples

ConceptId	ConceptStatus	Version
2458006	0	1994.0101
2459003	0	1994.0101
2460008	0	1994.0101
2460008	1	2000.1101
2461007	0	1994.0101
2462000	0	1994.0101
2463005	0	1994.0101
2464004	0	1994.0101
2465003	0	1994.0101
2466002	0	1994.0101
2467006	0	1994.0101
2468001	0	1994.0101
2469009	0	1995.0101
2470005	0	1996.0101
2471009	0	1994.0101
2472002	0	1994.0101
2473007	0	1994.0101
2474001	0	1994.0101

### 3.7.5. SNOMED RT Concepts History Refer-To (SRT\_CONCEPTS\_HX\_REFER\_TO)

The Concepts History Refer-To table lists the new concept (ConceptId2) which replaces a retired concept (ConceptId1). ReferRelation specifies the association between the new concept (ConceptId2) and the inactive one (ConceptId1) - e.g., equivalent match, proximate match, narrower match, etc. NS means that the refer-relation is not specified. In some instances, there will be no replacement ConceptId for a retired concept. In these cases, ConceptId2 will be represented by a zero and NS (not specified) will appear in the ReferRelation column. Note that there may be instances where one retired concept will refer to two or more active concepts. An example is illustrated in the table example below where ConceptId1 274006 (Crushing injury of ankle AND/OR foot excluding toes -RETIRED-) refers to two concepts - 65896005 (Crushing injury of ankle) and 43422002 (Crushing injury of foot).

#### 3.7.5.1. SRT\_CONCEPTS\_HX\_REFER\_TO Table Format

COLUMN NAME	DATA TYPE	MAX. LENGTH (characters)	DESCRIPTION
ConceptId1	Integer	18	SNOMED RT Concept Identifier from the Concepts History Table where STATUS=1
ReferRelation	Text	30	Refer-to Relationship: description of the association between the new concept (ConceptId2) and the inactive one (ConceptId1) (e.g., equivalent match, proximate match, narrower match, etc.) NS = Not Specified
ConceptId2	Integer	18	SNOMED RT Concept Identifier which replaces the Inactive concept. 0 = Not Specified

3.7.5.2. *SRT\_CONCEPTS\_HX\_REFER\_TO* Table Examples

ConceptId1	Refer Relation	ConceptId2
274006	NS	65896005
274006	NS	43422002
2283008	NS	67321002
2325001	NS	88292008
2460008	NS	111236008
2542006	NS	42282006
2549002	NS	16356006
2557004	NS	87163000
2685007	NS	123350008
2787008	NS	11087003
2868007	NS	2868007
2993005	NS	68983007

### 3.7.6. SNOMED RT Descriptions History (SRT\_DESCRIPTIONS\_HX)

The Descriptions History Table chronicles the history of each Description, including the version number in which the DescriptionId was added and/or retired (inactive). Each DescriptionId in the Descriptions Table contains a corresponding DescriptionId in the Descriptions History Table to trace the history of the Description. There will be two entries for retired DescriptionIds – one entry indicating when the Description was added (Active) and another entry indicating when the Description was retired (Inactive).

SNOMED versions are represented in the Descriptions History table with the following version numbers:

SNOMED 3.0	1994.0101
SNOMED 3.1	1995.0101
SNOMED 3.3	1996.0101
SNOMED 3.4	1996.0701
SNOMED 3.5	1998.0101
SNOMED RT 1.0	2000.1101

#### 3.7.6.1. SRT\_DESCRIPTIONS\_HX Table Format

COLUMN NAME	DATA TYPE	MAX. LENGTH (characters)	DESCRIPTION
DescriptionId	Integer	18	SNOMED RT Description Identifier: DescriptionId from the Descriptions Table. Every DescriptionId in the Descriptions Table has one or more rows in the Descriptions History Table.
DescriptionStatus	Number	1	0 = Active 1 = Inactive (term is retired - refer to SRT_DESCRIPTIONS_HX_REFER_TO Table for further information)
Version	Number	9	Format: XXXX.XXXX where the first four digits represent the year, the first two digits following the decimal point represent the month and the last two digits represent the day. If DescriptionStatus = 0, Version represents the SNOMED version number in which the term was added to SNOMED If DescriptionStatus = 1, Version represents the SNOMED version number in which the term was retired in SNOMED

3.7.6.2. *SRT\_DESCRIPTIONS\_HX Table Examples*

DescriptionId	Description Status	Version
5209016	0	2000.1101
5210014	0	1994.0101
5210014	1	2000.1101
5211013	0	2000.1101
5212018	0	1994.0101
5212018	1	2000.1101
5213011	0	1994.0101
5213011	1	2000.1101
199466013	8	2000.1101
5214017	0	1994.0101
5215016	0	1994.0101
5216015	0	1994.0101
5217012	0	1994.0101
5218019	0	1994.0101
5219010	0	1994.0101
5220016	0	1994.0101
5221017	0	1994.0101
5222012	0	1995.0101
5223019	0	1995.0101
5224013	0	2000.1101
5225014	0	1996.0101
5225014	1	2000.1101
5226010	0	1994.0101
5227018	0	1994.0101
5228011	0	1994.0101
5229015	0	1994.0101
5230013	0	1994.0101
5235015	0	1995.0701
5235015	1	2000.1101
5236019	0	1994.0101

### 3.7.7. SNOMED RT Descriptions History Refer-To (SRT\_DESCRIPTIONS\_HX\_REFER\_TO)

The Descriptions History Refer-To table lists the new Description (DescriptionId2) which replaces a retired Description (DescriptionId1). ReferRelation specifies the association between DescriptionId2 and DescriptionId1 (i.e., equivalent match, proximate match, narrower match, etc.). NS means that the refer-relation is not specified. In some instances, there will be no replacement DescriptionId for a retired description. In these cases, DescriptionId2 will be represented by a zero and NS (not specified) will appear in the ReferRelation column.

#### 3.7.7.1. SRT\_DESCRIPTIONS\_HX\_REFER\_TO Table Format

COLUMN NAME	DATA TYPE	MAX. LENGTH (characters)	DESCRIPTION
DescriptionId1	Integer	18	SNOMED RT Description Identifier: DescriptionId from the Descriptions History Table where STATUS=1
ReferRelation	Text	30	Refer-to Relationship: description of the association between the new Description (DescriptionId2) and the inactive one (DescriptionId1) (i.e., equivalent match, proximate match, narrower match, etc.) NS = Not Specified
DescriptionId2	Integer	18	SNOMED RT Description Identifier which replaces the Inactive term. 0 = Not Specified

#### 3.7.7.2. SRT\_DESCRIPTIONS\_HX\_REFER\_TO Table Examples

DescriptionId1	Refer Relation	DescriptionId2
5210014	NS	5209016
5212018	NS	5211013
5225014	NS	5224013
5235015	NS	5234016

### 3.7.8. SNOMED RT Relationships History (SRT\_RELS\_HX)

SRT\_RELS\_HX chronicles the complete history of all relationships that have appeared in SNOMED RT. Every row that ever appeared in the SNOMED RT Relationships Table will appear in this table with the version number that it was active (status = 0) or removed (status = 1).

#### 3.7.8.1. SRT\_RELS\_HX Table Format

##### SRT\_RELS\_HX

COLUMN NAME	DATA TYPE	MAX. LENGT H (characters)	DESCRIPTION
ConceptId1	Integer	18	SNOMED RT Concept Identifier (ConceptId) of the Concept which is the source of this relationship.
RelationshipType	Integer	18	SNOMED RT Concept Identifier (ConceptId) of the Concept which represents the type of relationship between the related Concepts.
ConceptId2	Integer	18	SNOMED RT Concept Identifier (ConceptId) of the Concept which is the target of this Relationship.
RelStatus	Number	1	0 = Active ConceptId1/Relationship/ConceptId2 combination 1 = Inactive (retired) ConceptId1/Relationship/ConceptId2 combination

#### 3.7.8.2. SRT\_RELS\_HX Table Examples

ConceptId1	Relationship Type	ConceptId2	RelStatus	Version
2458006	116680003	90102008	0	2000.1101
2459003	116677004	75531005	0	2000.1101
2459003	116680003	107769006	0	2000.1101
2459003	116680003	46593005	0	2000.1101
2460008	116680003	123039001	0	2000.1101
2461007	116677004	123037004	0	2000.1101
2461007	116680003	116325002	0	2000.1101
2462000	116680003	68101005	0	2000.1101
2463005	116676008	33359002	0	2000.1101
2463005	116677004	41296002	0	2000.1101
2463005	116680003	70397008	0	2000.1101
2464004	116680003	50673007	0	2000.1101
238002	116680003	116366002	1	2000.1001
239005	116680003	106236003	1	2000.1001
240007	116680003	8889005	1	2000.1001
240007	116680003	45191008	1	2000.1001
240007	127485006	67740006	1	2000.1001
240007	116677004	48075008	1	2000.1001
241006	116677004	12738006	1	2000.1001
241006	116677004	21483005	1	2000.1001
241006	116680003	84757009	1	2000.1001



### 3.8. STATED DEFINITIONS FILE (*SRT\_STATED\_DEFS.XML*)

The core distribution tables for SNOMED RT are shown above, and provide essential information for implementation of SNOMED. However, SNOMED RT is also distributed in a form that provides details that will be of interest to some developers and users who have the ability to take advantage of advanced description logic properties of SNOMED. This additional information is available as the Stated Definitions File, which is distributed in XML syntax.

#### 3.8.1. Information contained in the Stated Definitions File that is not available in the core distribution tables

The stated definitions file provides the description logic definitions of concepts; there are several elements of stated definitions that the relational tables do not contain. These include:

- Specification of whether a definition is “primitive” or “defined” (see Description Logic Primer for explanation)
- Specification of the “kind” of a concept (see DL Primer; at present all concepts have the same kind, but future versions may split the terminology into mutually exclusive kinds.)
- Role groupings that require certain roles to appear together (see DL Primer; at present there are no role groupings, but it is anticipated these will be used in future versions).
- Other special purpose information that may be added to the definitions over time.

#### 3.8.2. Information contained in core distribution tables that is not available in the Stated Definitions File

The Stated Definitions File has a version number, but none of the internal elements have version information distributed in this format – users should refer to the history tables for version and history information. The file includes stated definitions only; it does not show the inferred hierarchical relationships – users should refer to the relationships table for complete specification of the hierarchical relationships. The concept identifiers distributed in the file are SNOMEDIds. Only the fully-specified-names are included in this file – again, users should refer to the descriptions table for synonyms and their identifiers.

#### 3.8.3. Description of the stated definitions

The stated definitions consist of three main components: defining concepts, defining roles, and a flag that indicates whether they are *primitive* or *defined*. A primitive definition contains necessary but not sufficient conditions for identifying subtypes of the concept; a definition that is not primitive (i.e. is fully defined) contains both the necessary and sufficient conditions to allow subtypes to be identified. In other words, fully defined concepts may have descendants assigned by algorithmic classification, while primitive concepts must have all descendants assigned manually.

The stated definitions are put into a form such that all the defining concepts in the definition are primitive concepts. In addition, all defining roles provide features that differentiate the concept from its defining parent concepts. For example, the only defining (primitive) concept for appendicitis is “disease”. Intermediate hierarchical terms above appendicitis (such as “inflammatory disorder of the abdomen”) are fully defined and therefore are not included in the stated definition of appendicitis. The fact that appendicitis is a subtype of these intermediate concepts can be inferred from their definitions.

### 3.8.4. XML Syntax

The XML syntax for the Stated Definitions File is given in a Document Type Definition file (snomedrt.dtd). The contents of the DTD, with explanatory comments, are reproduced here:

```
<!ELEMENT snomed-terminology
    (rolenames,          --Lists the names of roles
     cDef*)             --0 or more concept definitions
    >
<!ELEMENT rolenames
    (rlnm*)            -- role name
    >
<!ELEMENT rlnm (#PCDATA)>
<!ELEMENT cDef        -- concept definition
    (cd,              -- code (SNOMED ID)
     nm,              -- name (fully specified name)
     prim?,          -- if present, concept is primitive
     kind?,          -- if present, indicates kind
     defC,           -- defining concepts
     defR)           -- defining roles
    >
<!ELEMENT prim EMPTY>
<!ELEMENT kind (#PCDATA)>
<!ELEMENT defC        -- defining concepts
    (cn*)            -- zero or more concept names
    >
<!ELEMENT defR        -- defining roles
    ((rl |
     roleGroup)*     -- zero or more roles, or
     -- zero or more roleGroups
    )>
<!ELEMENT roleGroup (rl+)> -- one or more roles
<!ELEMENT cn (#PCDATA)>
<!ELEMENT rl          -- role
    ((all | some),   -- quantifier, either "some" or "all"
     nm,             -- role name (attribute name)
     val)           -- role value
    >
<!ELEMENT nm (#PCDATA)>
<!ELEMENT cd (#PCDATA)>
<!ELEMENT val (#PCDATA)>
<!ELEMENT all EMPTY>
<!ELEMENT some EMPTY>
```

#### 3.8.4.1. Example of concept definition in XML format

```
<cDef>
  <nm> Excision of lesion of patella (disorder) </nm>
  <cd>P1-18376</cd>
  <defC>
    <cn>P1-10356</cn>
  </defC>
  <defR>
    <rl>
      <some/>
      <nm>ASSOC-TOPO</nm>
      <val>T-12730</val>
    </rl>
    <rl>
      <some/>
      <nm>REMOVES</nm>
      <val>M-01000</val>
    </rl>
  </defR>
</cDef>
```

## 4. CONTENT DOCUMENTATION

### 4.1. SNOMED'S SEMANTIC MODEL

A semantic model for terminology, in general, is a set of abstract entities (structures and mechanisms) used to specify the meaning of concepts. Most semantic models (in fact, virtually *all* semantic models for terminology) employ some kind of formal logic. SNOMED's semantic model is based on a subset of predicate logic known as *description logic*. The foundation of the model is a set of *relationship types*, also called *roles* or *attributes*.

### 4.2. RELATIONSHIP TYPES (ROLES)

*Relationships* in general define the association between two concepts. Although the "ISA" relationship is provided in the relationships table, ISA is not a "role" per se, but instead represents a special kind of relationship with special status in logic. It describes the subsumption relationship between two concepts, or in other words, ISA describes the parent-child relationships in the hierarchy (ie, Pulmonary Anthrax *is-a* Anthrax; Pulmonary Anthrax *is-a* Lung Disease). Every active concept in SNOMED is assigned at least one is-a relationship.

All the other relationship types are all called "roles". First the criteria for introducing new roles are introduced, and then the roles used in SNOMED are described with examples.

#### 4.2.1. CRITERIA FOR INTRODUCING NEW RELATIONSHIP TYPES

Three criteria have been used to evaluate relationship types (roles) and to determine whether they should be added to the terminology. Proposed roles should be *useful*, *understandable*, and *reproducible*.

##### 4.2.1.1. Useful

The role should represent distinctions that are useful for clinical data recording, retrieval, aggregation, or analysis. This criterion also helps us to prioritize the effort of creating definitions so that distinctions that are most useful will be represented first.

##### 4.2.1.2. Understandable

The meaning of a proposed role should be capable of being explained to and understood by other health professionals; and it should make sense to individuals from disciplines other than those proposing the role. In other words, the role must have some face validity, and must not depend on special knowledge that is completely inaccessible to individuals outside a particular field. This does not mean that roles must be "dumbed down", but they must be capable of being explained in a way that is accessible to the general medical audience.

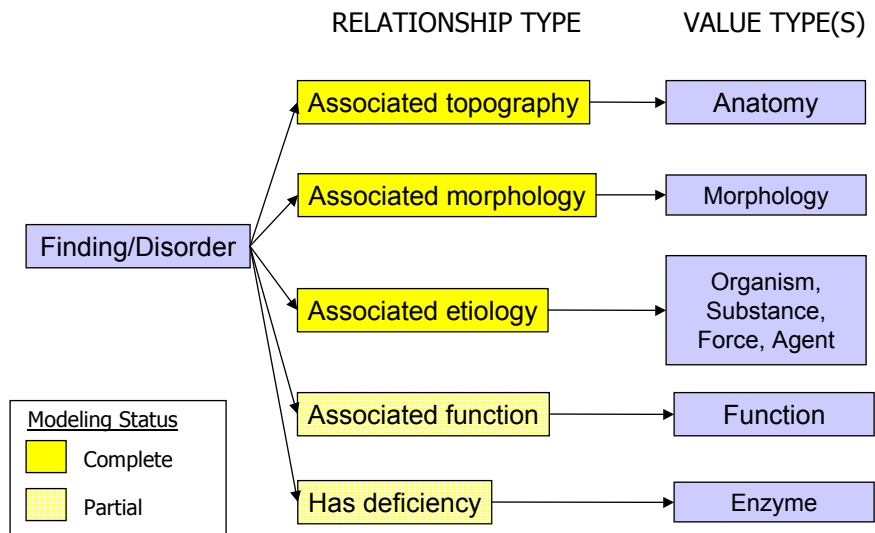
##### 4.2.1.3. Reproducible

The way the role is to be applied should be reproducible. In other words, it should be possible to provide sufficient information for people to apply the role consistently, in the absence of special communication among those applying it. Empirical evidence of reproducibility is the gold standard; lack of empirical reproducibility is grounds for retiring a role in favor of more reproducible ones.

## 4.2.2. RELATIONSHIP TYPES FOR FINDINGS AND DISORDERS

(SNOMED RT, Nov 2000)

### Relationship Types for Findings & Disorders



#### 4.2.2.1. ASSOCIATED TOPOGRAPHY

ASSOC-TOPO names the site affected by a condition, or the affected site resulting in a condition.

Examples:

Polymyalgia	ASSOC-TOPO	Muscle
Renovascular hypertension	ASSOC-TOPO	Renal artery
Renal arterial hypertension	ASSOC-TOPO	Renal artery

#### 4.2.2.2. ASSOCIATED ETIOLOGY

ASSOC-ETIOLOGY names the direct causative agent (organism, toxin, force) of a disease or disorder. It does not include vectors (such as the mosquito that transmits malaria). It also does not include method or mechanism by which the etiology is introduced to the body. This distinction can be subtle - the presence of a verb within the concept is often a clue (e.g. "Contact-dermatitis-due-to-other-non-food-plant\_D0-10288 ASSOC-ETIOLOGY Plant" is correct while "Contact-dermatitis-due-to-other-non-food-plant\_D0-10288 ASSOC-ETIOLOGY Contact-with-plants\_A-A2700" is incorrect.) Etiologies that involve the absence or deficiency of a substance are also not included.

Examples:

Acute mountain sickness	ASSOC-ETIOLOGY	High altitude
Cocaine delusional disorder	ASSOC-ETIOLOGY	Cocaine
Congenital syphilitic encephalitis	ASSOC-ETIOLOGY	Treponema pallidum

#### 4.2.2.3. ASSOCIATED MORPHOLOGY

ASSOC-MORPH names the morphologic (structural) change affected by a disease or disorder.

Examples:

Incomplete ossification of carpal bone	ASSOC-MORPH	Incomplete bone formation
Traumatic pneumohemothorax	ASSOC-MORPH	Air leakage
Calcification of trachea	ASSOC-MORPH	Calcium deposition

#### 4.2.2.4. ASSOCIATED FUNCTION

ASSOC FUNCTION: Relates a finding or disorder to its associated biologic function. Values must be subtypes of “biological function”

Examples:

Decreased hair growth	ASSOC-FUNC	Hair growth
Masticatory dysfunction	ASSOC-FUNC	Mastication
Occasional overeating	ASSOC-FUNC	Eating

#### 4.2.2.5. ASSOCIATED DEFICIENCY

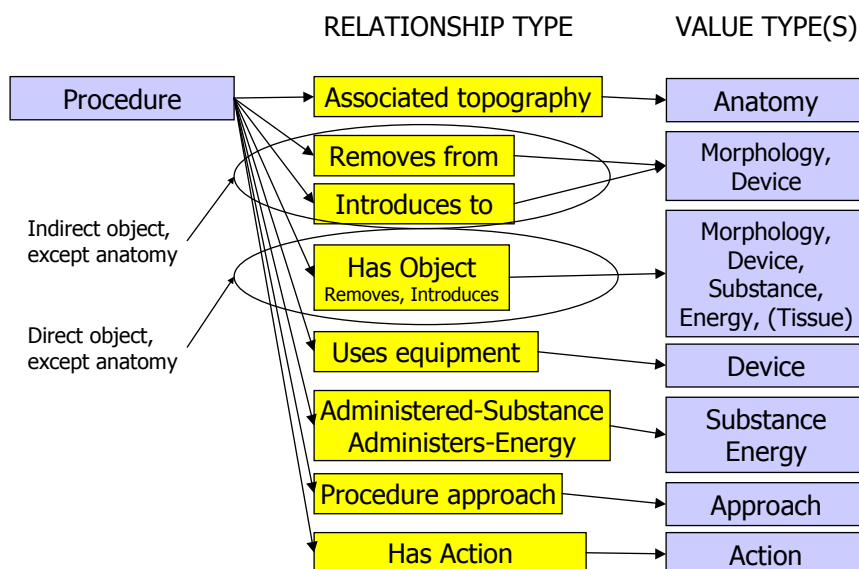
ASSOC-DEFICIENCY: This role is used for a set of enzyme deficiency concepts. Its use may be expanded in the future, but at present it is limited.

Examples:

Deficiency of aryl sulfatase	ASSOC-DEFICIENCY	Aryl sulfatase
------------------------------	------------------	----------------

4.2.3. RELATIONSHIP TYPES FOR PROCEDURES  
(SNOMED RT, Oct 2000)

## Relationship Types for Surgical Procedures



### 4.2.3.1. ASSOCIATED TOPOGRAPHY

ASSOC-TOPO names the anatomical site affected by a procedure. It is usually the direct object of surgical actions, but may also be the indirect object – such as the site from which or to which some pathological structure or device is removed or introduced. In the first example below, kidney is the direct object; in the second example, kidney is the indirect object.

Examples:

Nephrectomy	ASSOC-TOPO	Kidney
Excision of cyst from kidney	ASSOC-TOPO	Kidney
Exploration of choroid	ASSOC-TOPO	Choroid

### 4.2.3.2. USES-EQUIPMENT

USES-EQUIPMENT names the equipment used to accomplish a procedure. The domain for relationship values is mainly devices, although equipment might occur in the drug section. It is limited to naming the *means* of accomplishing a procedure. If a device is implanted, removed or otherwise is the direct object of the root procedure, *HAS-OBJECT* should be used. If the device is the location to which something is introduced, *INTRODUCES-TO* should be used. If the device is the location from which something is removed, *REMOVES-FROM* should be used. Use of this role is limited to Procedure concepts.

Examples:

Arthroscopy	USES-EQUIPMENT	Endoscope
Insertion of Thomas shunt	USES-EQUIPMENT	Cannula
Fiberoptic colonoscopy	USES-EQUIPMENT	Endoscope

#### 4.2.3.3. PROCEDURE-APPROACH

PROCEDURE-APPROACH names the directional, spatial, or relational access to the topographic site of a procedure. The values are limited to subtypes of concept “G-D000 procedural approach”. The scope of this role excludes the psychiatric approach and the approach to problem solving, both of which are felt to be more of a method. It is limited to concepts of type “procedure”.

Examples:

Abdominal hysterectomy	PROCEDURE-APPROACH	Trans-abdominal approach
Open reduction of maxillary fracture	PROCEDURE-APPROACH	Open approach
Percutaneous urinary vesicostomy	PROCEDURE-APPROACH	Percutaneous approach

#### 4.2.3.4. HAS-OBJECT

HAS-OBJECT names that thing towards which the root operation of the procedure is directed. The HAS-OBJECT role specifies the "what" of the root procedure, but not the "why" of the root procedure. In other words, it is “object” in the sense of “thing”, *not* “objective.” The domain for relationship values is devices, substances, abnormal morphologies, and tissues. It is limited to procedure concepts. When the direct object of a procedure is an anatomical structure (other than tissue types), *ASSOC-TOPO* is used instead of *HAS-OBJECT*. Also, for clarity of modeling, *HAS-OBJECT* was excluded from use for those concepts that are removals (use *REMOVES* instead) and for those concepts that are introductions (use *INTRODUCES* instead.)

For example: Resection-of-nasal-polyp

- *REMOVES* polyp\_(abnormal\_morphology) is correct
- *ASSOC-TOPO* nasal\_mucosa is correct
- *HAS-OBJECT* nasal\_mucosa is NOT correct
- *REMOVES* nose is NOT correct
- *REMOVES* nasal\_polyp\_(disorder) is NOT correct

Examples:

Delayed suture of wound	HAS-OBJECT	Wound
Closure of jejunal fistula	HAS-OBJECT	Fistula
Reduction of fracture of tibia	HAS-OBJECT	Fracture

#### 4.2.3.5. HAS-ACTION

HAS-ACTION names the root operation or main deed or action of the procedure.

Examples:

Repair of tendon by direct suture	HAS-ACTION	Repair – action.
Closure of jejunal fistula	HAS-ACTION	Closure – action.
Excision of urethral stricture	HAS-ACTION	Excision – action.



#### 4.2.3.6. *INTRODUCES*

INTRODUCES names the material, substance, prosthesis or other entity that is placed into or on the body. *INTRODUCES* is the direct object of the main action for introductions that do not involve a body structure or tissue. Introductions of a body structure or tissue are types of grafting. Use of the role is limited to Procedure concepts that are children of "Introduction (P1-04FFF)". Values can be drugs and other substances, devices, prostheses and other materials.

Examples:

Intravascular radionuclide therapy	INTRODUCES	Radioactive isotope
Insertion of rod through fracture	INTRODUCES	Orthopedic internal fixation device
Typhus vaccination	INTRODUCES	Typhus vaccine

#### 4.2.3.7. *REMOVES*

REMOVES names the material, substance, tissue, prosthesis or other entity that is removed from the body by procedures that are kinds of "removal". If a "removal" type procedure has an ASSOC-TOPO body site from which the removal is made, the value of the REMOVES role must be different. It is limited to Procedure concepts that are subtypes of "removal (P1-03003)".

Examples:

Sequestrectomy of phalanges of hand	REMOVES	Sequestrum
Removal of pancreatic drain	REMOVES	Drain
Thromboendarterectomy	REMOVES	Thrombus
Excision of tumor of soft tissue of flank	REMOVES	Neoplasm

#### 4.2.3.8. *ADMINISTERS-ENERGY*

ADMINISTERS-ENERGY names the energy applied to, placed into, or transmitted through the body with the intent of achieving a therapeutic, prophylactic, protective, diagnostic, nutritional, and/or physiological goal. The domain for this role is mainly the Physical Agents, Activities, and/or Forces hierarchy.

Examples:

Epilation by electrolysis	ADMINISTERS-ENERGY	Electricity
Laser resurfacing of skin	ADMINISTERS-ENERGY	Laser-generated electromagnetic radiation

#### 4.2.3.9. *ADMINISTERED-SUBSTANCE*

ADMINISTERED-SUBSTANCE names the chemical placed into the body or the non-inert material placed onto the body that is meant to interact chemically with the intent of achieving a therapeutic, prophylactic, protective, diagnostic, nutritional and/or physiological goal. It is used to model procedures where the main deed is *not* introduction, but which involve the administration of a substance, such as imaging and anesthesia procedures that involve particular substances. For procedures where the main deed is introduction, use *INTRODUCES* instead.

Examples:

Amobarbital interview	ADMINISTERED-SUBSTANCE	Amobarbital
Radiocalcium absorption study	ADMINISTERED-SUBSTANCE	Calcium radioisotope
Peritoneal dialysis	ADMINISTERED-SUBSTANCE	Peritoneal dialysis solution

*4.2.3.10.INTRODUCES-TO*

INTRODUCES-TO names the device or structure to which an entity is introduced. Its values **exclude** body site. When a concept involves introduction to a body site, the site should be the value of the ASSOCIATED-TOPOGRAPHY role and not the INTRODUCES-TO role. It is limited to procedure concepts that are subtypes of "introduction (P1-04FFF)".

Examples:

Catheterization of pancreatic cyst	INTRODUCES-TO	Cyst
Irrigation of ureteral catheter	INTRODUCES-TO	Ureteral catheter

*4.2.3.11.REMOVES-FROM*

REMOVES-FROM names the device or structure from which an entity is removed. Its values **exclude** anatomical site. When the concept involves removal from an anatomical site, the site should be the value of the ASSOCIATED-TOPOGRAPHY role and **not** the REMOVES-FROM role. It is limited to procedure concepts that are subtypes of "removal (P1-03003)".

Examples:

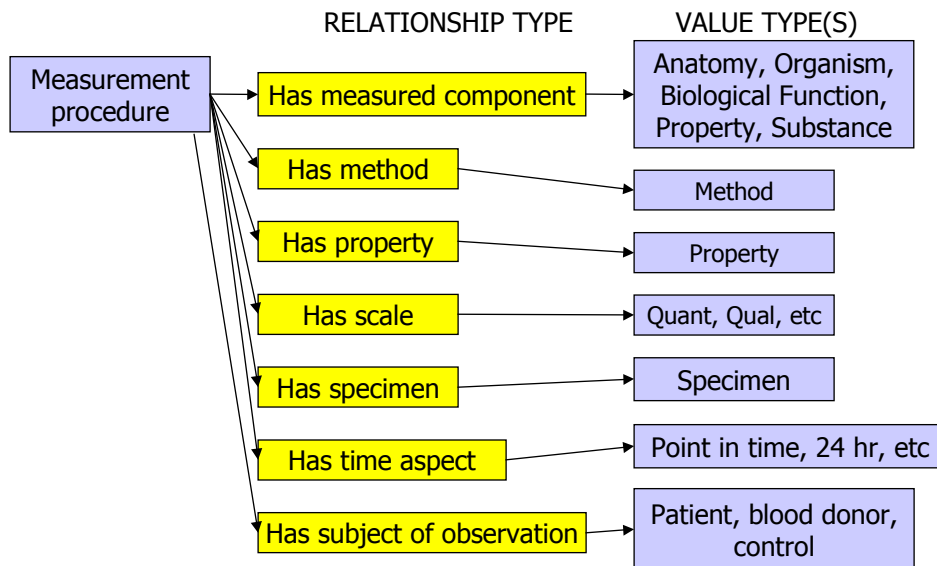
Debridement and suture	REMOVES-FROM	Wound
Evacuation of intracerebral hematoma	REMOVES-FROM	Hematoma
Aspiration of diverticulum of pharynx	REMOVES-FROM	Diverticulum

#### 4.2.4. RELATIONSHIP TYPES FOR MEASUREMENT PROCEDURES

The roles used for measurement procedures are found mostly in the LOINC integration file. These roles are used to link the value of a component of the LOINC name to the corresponding SNOMED code.

(SNOMED RT, Nov 2000)

### Relationship Types for Measurement Procedures



#### 4.2.4.1. HAS-MEASURED-COMPONENT

HAS-MEASURED-COMPONENT names the substance, entity, physiological function or physical property being measured. The value can come from a number of sections, usually the substance section.

Examples:

Bleeding time, Ivy	HAS-MEASURED-COMPONENT	Hemostatic function
ABO typing	HAS-MEASURED-COMPONENT	ABO blood group

#### 4.2.4.2. HAS-METHOD

HAS-METHOD names the method by which a procedure is performed (e.g., India ink preparation, flow cytometry).

Examples:

Hemoglobin A	HAS-METHOD	Electrophoresis
ABO typing	HAS-METHOD	Hemagglutination

#### 4.2.4.3. HAS-PROPERTY

HAS-PROPERTY names the kind of quantity being measured (e.g., concentration).

Examples:

Serum sodium MCNC	HAS-PROPERTY	Mass concentration
24 hour urine steroids	HAS-PROPERTY	Mass rate

#### 4.2.4.4. HAS-SCALE-TYPE

HAS-SCALE-TYPE names the scale of the result of an observation of a diagnostic test (i.e. quantitative, qualitative, semi-quantitative).

Examples:

Serum sodium	HAS-SCALE-TYPE	Quantitative
ABO typing	HAS-SCALE-TYPE	Nominal

#### 4.2.4.5. HAS-SPECIMEN

HAS-SPECIMEN names the specimen used for a measurement. Its values are subtypes of G-8000 Specimen. Values from the anatomy section are **excluded**. (The liver is not a specimen, except when some or all of it is removed, and the concept “tissue specimen from liver” can be modified to indicate the type of procedure used to obtain it, which the code for “liver” alone does not convey).

Examples:

Serum sodium measurement	HAS-SPECIMEN	Serum specimen
ABO typing, patient	HAS-SPECIMEN	Red cell specimen from patient

#### 4.2.4.6. HAS-SUBJECT-OF-OBSERVATION

HAS-SUBJECT-OF-OBSERVATION distinguishes observations or actions on the patient (or samples taken from the patient) from observations or actions on non-patient materials that relate to the patient. This role is typically used in blood banking procedures.

Examples:

ABO typing	HAS-SUBJECT-OF-OBSERVATION	Patient
ABO typing	HAS-SUBJECT-OF-OBSERVATION	Blood donor

#### 4.2.4.7. HAS-TIME-ASPECT

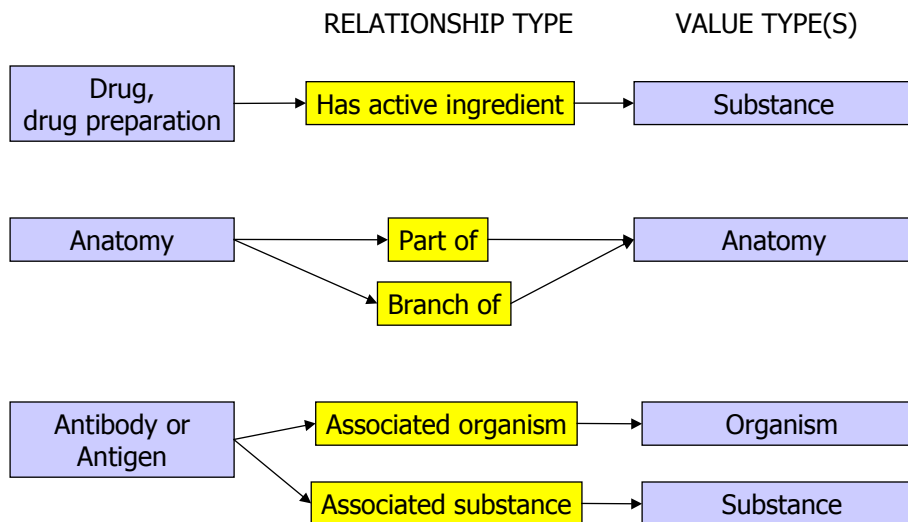
HAS-TIME-ASPECT names definitional temporal relationships for a procedure.

Examples:

24-hour urine creatinine	HAS-TIME-ASPECT	24 hours
24-hour urine ketogenic steroids	HAS-TIME-ASPECT	24 hours

(SNOMED RT, Nov 2000)

## Additional Relationship Types



### 4.2.5. RELATIONSHIP TYPES FOR DRUGS AND DRUG PREPARATIONS

#### 4.2.5.1. HAS-ACTIVE-INGREDIENT

HAS-ACTIVE-INGREDIENT names ingredients that interact with the molecular components of an organism. This interaction alters the function of components and therefore characterizes the effect of a drug.

Examples:

Alka-Mints Chewable Antacid	HAS-ACTIVE-INGREDIENT	Calcium carbonate
Correctol Laxative Tablets	HAS-ACTIVE-INGREDIENT	Bisacodyl
Nicorette	HAS-ACTIVE-INGREDIENT	Nicotine polacrilex 7

### 4.2.6. RELATIONSHIP TYPES FOR ANATOMY

#### 4.2.6.1. PART OF

Part-of names the anatomical structural part-whole relationships. To say “A part-of B” means that structure A is completely included in structure B. There are several other possible ways of interpreting “part-of”. SNOMED RT does *not* use “part-of” for non-anatomical meanings, such as grouping tests together in batteries. Nor is it used to indicate relationships that are not strict inclusion. For example, if the humerus was defined in SNOMED as part-of the shoulder, inferences would result that said that fractures of the distal humerus were kinds of fracture of the shoulder region. It is all right to say that the *proximal* humerus is part of the shoulder region, but not the humerus. Likewise, the shoulder cannot be part of both the trunk and the upper extremity, unless it was asserted that the trunk and upper extremity overlap. If one assumes that the trunk and upper extremity are completely disjoint, it violates SNOMED's use of “part-of” to make the shoulder region part of both.

Examples:

Lumbar vertebra	part-of	Lumbar spine
Stratum lucidum	part-of	Stratum corneum
Meniscus of knee joint	part-of	Knee joint
Glottis	part-of	Larynx

4.2.6.2. *BRANCH-OF*

Branch-of names the relationship of arteries, veins, nerves, lymphatics and other similar structures to their branches. The direction of flow is not taken into consideration, but rather the structural branching. For veins, "tributary-of" would be the converse relationship which can be inferred from the stated branch-of relationships.

Examples:

Right ulnar artery	branch-of	Brachial artery
Internal jugular vein	branch-of	Brachiocephalic vein
Sciatic nerve	branch-of	Sacral plexus
Lymphatics of diaphragm	branch-of	Thoracic duct

4.2.7. RELATIONSHIP TYPES FOR ANTIGENS AND ANTIBODIES

4.2.7.1. *ASSOCIATED-ORGANISM*

ASSOC-ORGANISM names the organism that is the target of an antibody, or the organism that bears a particular antigen. It may also be used to define measurement procedures by naming the organism that is the focus of the procedure. For example, this enables the retrieval of all "tests for rubella" to be stated as "measurement-procedure and (some assoc-organism rubella)", which should retrieve both direct culture of rubella virus and measurements of titers of antibody to rubella virus.

Examples:

Antibody to hepatitis C	ASSOC-ORGANISM	Hepatitis C virus
Anti-fungal antibody	ASSOC-ORGANISM	Fungus
Serologic test for rubella	ASSOC-ORGANISM	Rubella virus
VDRL test	ASSOC-ORGANISM	Treponema pallidum

4.2.7.2. *ASSOCIATED-SUBSTANCE*

ASSOC-SUBSTANCE names the substance that is the target of an antibody, or the substance on which an antigen is carried. The substance may be a protein, drug, or other substance involved in antigen-antibody interactions.

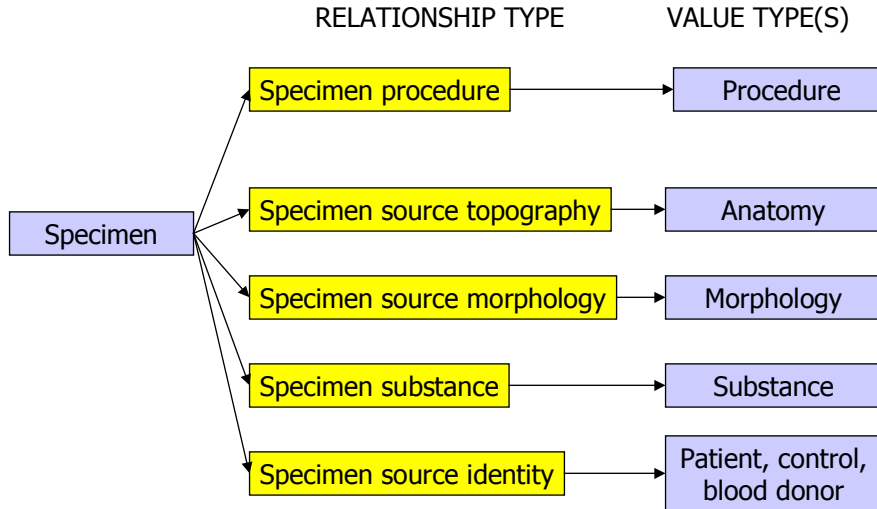
Examples:

Alpha lactalbumin antigen	ASSOC-SUBSTANCE	Alpha lactalbumin
Somatotropin antigen	ASSOC-SUBSTANCE	Growth hormone
Anti-striated muscle antibody	ASSOC-SUBSTANCE	Striated muscle (tissue)

4.2.8. RELATIONSHIP TYPES FOR SPECIMENS

(SNOMED RT, Nov 2000)

## Specimen Relationship Types



### 4.2.8.1. SPECIMEN PROCEDURE

SPEC-PROCEDURE names the procedure by which a specimen is obtained.

Examples:

Clean catch urine specimen	SPEC-PROCEDURE	Urine specimen collection, clean catch
Total gastrectomy specimen	SPEC-PROCEDURE	Total gastrectomy

### 4.2.8.2. SPECIMEN SOURCE TOPOGRAPHY

SPEC-SOURCE-TOPO names the anatomic site from which a specimen is obtained.

Examples:

Cervix cytologic material	SPEC-SOURCE-TOPO	Uterine cervix
Throat culture specimen	SPEC-SOURCE-TOPO	Pharynx

### 4.2.8.3. SPECIMEN SOURCE MORPHOLOGY

SPEC-SOURCE-MORPH names the abnormal structure from which a specimen is obtained. The values may be any subtype of morphologic abnormality.

Examples:

Specimen from cyst	SPEC-SOURCE-MORPH	Cyst
Specimen from wound abscess	SPEC-SOURCE-MORPH	Wound abscess
Tissue specimen obtained from ulcer	SPEC-SOURCE-MORPH	Ulcer

### 4.2.8.4. SPECIMEN-MATERIAL

SPEC-MATERIAL names the kind of material or substance of which the specimen is primarily constituted. The substance may be a protein, drug, or other substance, or may be a type of material, device, cell or tissue type (e.g. cartilage, muscle, bone).

Examples:

Hair specimen	SPEC-MATERIAL	Hair
Serum specimen	SPEC-MATERIAL	Serum
Fibroblast specimen	SPEC-MATERIAL	Fibroblast
Urine specimen	SPEC-MATERIAL	Urine

4.2.8.5. SPECIMEN SOURCE IDENTITY

SPEC-SOURCE-ID differentiates specimens on the basis of the kind of individual or entity that is the source of the specimen. In a direct patient care context it is ordinarily assumed that specimens come from patients. In the broader context that includes such diverse areas as public health and forensics, specimens can come from a wide variety of sources. They can come from various kinds of person, such as blood donors, or from groups of people, such as pooled blood products or control materials. They can also come from non-human living sources such as animal disease vectors, toxic plants and microbial isolates; and from non-living sources such as drinking water, air-conditioning ducts, and so forth.

Examples:

Serum specimen from blood product	SPEC-SOURCE-ID	Blood product unit
Platelet poor plasma specimen from control	SPEC-SOURCE-ID	Donor of control material
Blood specimen from newborn	SPEC-SOURCE-ID	Newborn
Mushroom specimen	SPEC-SOURCE-ID	Mushroom

**4.3. PRE-COORDINATION, POST-COORDINATION**

Pre-coordination refers to the creation of a single code for a concept that can be defined in terms of several other codes. For example, the code for “clean catch urine specimen” can be defined in terms of “specimen”, “clean catch procedure”, and “urine (body substance)”, using the roles for defining specimens. Likewise, “acute appendicitis” can be defined in terms of “disease”, “appendix” and “inflammation”, using the roles for defining disorders and findings.

Determination of which concepts are pre-coordinated depends on several factors, including user requirements. For example, some users may want a single code for “carcinoma of the breast.” On the other hand, pathologists are accustomed to the use of the morphology code for “carcinoma” with the topography code for “breast”, a practice called “post-coordination”.

It is possible to recognize the equivalence of the pre-coordinated form and the post-coordinated form, and therefore achieve complete and accurate retrieval and aggregation of clinical data. To achieve this recognition of equivalence, it is necessary to employ a computer program that correctly interprets the *definitions* of the pre-coordinated concepts and the *expressions* of the post-coordinated concepts. Definitions of pre-coordinated concepts are provided in the *SRT\_STATED\_DEFS.XML* file, and inferred relationships based on those definitions are provided in the *SRT\_RELS* table. Expressions of post-coordinated concepts must use the same set of roles if they are to be recognized as equivalent.

**4.4. GENERAL INTERPRETATION HEURISTICS**

4.4.1. Defined vs Primitive

- A concept is primitive until a set of necessary and sufficient conditions has been specified that will differentiate the concept from all others. "Necessary" is equivalent to "always true" for relationships between the concept and other concepts in the knowledge base. Example:



Syphilitic aortitis IsA Syphilis, ASSOC-MORPH inflammation; ASSOC-TOPO aorta. One must also state that it IsA tertiary syphilis in order to be considered defined.

#### 4.4.2. AND vs. OR

- "AND/OR" in a preferred name is an inclusive-or.  
For example: both "X" and "Y" should be classified as children of the concept "X-AND/OR-Y"

#### 4.4.3. Retired Classification-Style Phrases

- Concepts with "NEC", some concepts "other" such as "Other disorder of joint" have been retired from the knowledge base.
- Terms with "NOS" are deprecated, and NOS is not used in the fully-specified-name.

#### 4.4.4. Inflammation Heuristic

- For conditions containing "Acute ...itis" or "Chronic ...itis", the "Acute" and "Chronic" are generally taken to mean the temporal onset of the disease or disorder. While there is often close correlation with the histologic appearance (acute inflammation showing polymorphonuclear leukocytes, and chronic inflammation showing lymphocytes), one cannot necessarily assume that an "Acute ...itis" shows histological evidence of polys or that a "Chronic ...itis" has histological evidence of lymphocytic infiltrates. In SNOMED RT, acute inflammation (morphology) and chronic inflammation (morphology) are included in the concept definition only if they are necessarily present.
- Inflammatory conditions containing the lexical string "hypertrophic" (aka hypertrophic-itis's) are not generally true hypertrophies. The tissues are enlarged due to inflammation, and not due to true hypertrophy.

#### 4.4.5. Whole vs. Part Heuristic

- It can be unclear if a concept refers to "part" vs. "whole" or "partial" vs. "complete". For example, "excision-of-hand" - does this mean "excision-of-entire-hand" or does it mean "excision-of-part-or-whole -hand" or does it mean "complete-excision-of-part-or-whole -hand", etc?
- Unless otherwise specified in the preferred name, assume "part or whole " and not "whole".
- Unless otherwise specified in the preferred name, assume "partial or complete" and not "complete".
- Examples:
  - Assume "excision-of-hand" to mean "partial-or-complete-excision-of-part-or-whole-hand".
  - Assume "colonoscopy" to be a visualization of part of or the entire colon using an endoscope.
  - Assume "hand" in the topography section to mean "part-or-whole-hand".
  - Assume "amputation-of-hand" to mean "amputation-of-part-or-whole-hand".

#### 4.4.6. Concepts with a SNOMED ID starting with 'F'

- The former F section has been split into three main groups:
  - 1) Findings/assessments (children of F-01001 Finding, conclusion, AND/OR assessment)
  - 2) True biological functions (children of F-00000 Biological function),
  - 3) Substances (children of F-61002 Substance).

- Concepts with codes beginning with F may have subconcepts that are diseases and disorders, as long as they are of the first type (findings). To determine a concept's type, look at its fully-specified-name, or examine the top of its stated hierarchy, using the browser.

#### 4.5. INTERPRETING THE WORDS IN PREFERRED NAMES: SOME DEFINITIONS

Term	Definition
<b>Acute Inflammation</b>	Inflammatory process involving PMN infiltration. ('Acute' does not necessarily refer to temporal onset of inflammation.)
<b>Arm (upper arm) vs Arm (upper extremity)</b>	Arm_T-D8200 refers to upper arm, shoulder to elbow (does not include forearm T-D8500). Arm_T-D8000 refers to upper extremity, including shoulder and hand.
<b>Chronic Inflammation</b>	Inflammatory process involving chronic inflammatory cells, granulomatous changes, organizing inflammations. ('Chronic' does not refer to temporal onset of inflammation.)
<b>Congenital vs. Hereditary vs. Familial</b>	<b>Congenital:</b> Present at birth. <b>Hereditary:</b> Transmission via genetic material present in the parents <b>Familial:</b> Occurs more frequently within a family than would be expected by chance.
<b>Disease vs. Disorder</b>	No systematic distinction is made between concepts named disease vs those named disorder, and they generally can be considered equivalent. They are subtypes of "finding".
<b>Embryo</b>	From conception to 9 weeks
<b>Essential vs. Idiopathic</b>	Synonymous
<b>Excisional biopsy</b>	Removes the entire structure pointed to by the HAS-OBJECT role.
<b>Fetus</b>	From 9 weeks to birth
<b>Finding</b>	A finding is anything that can be asserted about the patient (or other subject of investigation); generally, findings can complete the phrase "The patient has ...".
<b>Hyperplasia vs. Hypertrophy</b>	<b>Hypertrophy:</b> Increase in bulk due to increased cell size. <b>Hyperplasia:</b> Increased number of normal cells, which may increase bulk.
<b>Infectious agent</b>	Subsumes all bacteria, viruses, fungi, protozoa, and prions. It does not distinguish whether or not a particular agent actually is known to cause infectious disease in man.
<b>Idiopathic vs. Essential</b>	Synonymous
<b>Infant</b>	From 30 days post birth to 1 year
<b>Injury</b>	Damage inflicted to the body by an external force.
<b>Laceration</b>	A rupture is a laceration (and not a synonym of laceration as indicated in Snomed V3.4). A surgical incision is NOT a laceration.
<b>Leg (lower leg) vs. Leg (lower extremity)</b>	Leg T-D9400 refers to lower leg, knee to ankle (does not include thigh/upper leg), while Leg T-D9000 refers to lower extremity, including hip and foot.
<b>Lesion vs. Morphologic abnormality</b>	Synonymous. Any structural abnormality. (In some contexts, "lesion" may have a more specific meaning; if needed, such a concept could be added).
<b>Neonatal vs. Newborn</b>	Synonymous. Birth to 28 days.
<b>Obstruction</b>	Obstruction M-34000 is a general concept meant to subsume both partial and complete obstructions.
<b>Parasite</b>	Parasite L-50000 subsumes all subtypes of L-500F2 (Protozoa). Whether a particular protozoan actually parasitizes a particular species (such as man) is not distinguished.
<b>Pneumonia vs. Pneumonitis</b>	Synonymous. Inflammation of the lung involving alveoli and/or interstitial spaces.
<b>Finger (digit of hand) vs Finger (non-thumb digit)</b>	There are two codes for these two meanings of finger: T-D0311 is "digit of hand", or in other words, finger-including-thumb, while T-D8800 is finger-excluding-thumb.

#### 4.6. TOPIC-SPECIFIC DESIGN DECISIONS

##### 4.6.1. Comments on Anatomy

##### 4.6.1.1. Joints – Joint regions:

In many diseases and procedures, reference is made to areas of the body that may ambiguously imply either a joint or a region surrounding the joint. The main words that may ambiguously refer to either a joint or a region are:

Ankle	=	Ankle joint [T-15750]	Ankle region [T-D9500]
Knee	=	Knee joint [T-15720]	Knee region [T-D9200]
Hip	=	Hip joint [T-15710]	Hip region [T-D2500]
Wrist	=	Wrist joint [T-15460]	Wrist region [T-D8600]
Elbow	=	Elbow joint [T-15430]	Elbow region [T-D8300]
Shoulder	=	Shoulder joint [T-15410]	Shoulder region [T-D2220]

A concerted effort was made to specify correctly either the joint or the region as the topography of procedures and diseases that involve these concepts. Sometimes these decisions were made arbitrarily.

Shoulder (region) is considered part of the upper extremity, and hip (region) is considered part of the lower extremity.

Bone of shoulder [T-12210]: This concept is used to define procedures and diseases affecting some bone tissue of the shoulder region. It is therefore NOT a kind of bone (organ), but an organ system subdivision of the skeletal system, and is part of the shoulder region. Any part of the humerus, scapula or clavicle that is also part of the shoulder region is a part of bone of shoulder.

Tarsal joint [T-15770]: This is a group of joints between the seven bones of the tarsus. The talocalcaneonavicular joint [T-15772] is the articulation between the talus and the other bones of the tarsus, and is thus assumed to be what is meant by the rarely-used term "talotarsal joint". The subtalar joint [T-1577B] is the same as the talocalcaneal joint. Dislocations of the subtalar joint will ordinarily also involve the talonavicular joint [T-1577C]. The subtalar and talonavicular joints taken together constitute the talocalcaneonavicular joint.

#### 4.6.1.2. Lower limb – Lower Leg – Leg – Foot

The lower limb (syn: lower extremity) includes the foot, but the lower leg (syn: leg) does not. Stedmans definition of lower leg is "The segment of the inferior limb between the knee and the ankle".

#### 4.6.1.3. Body parts – Body regions (U. of Washington Digital Anatomist concepts):

Rosse's notion of body part (and body part subdivision) was adopted for use in SNOMED RT anatomy modeling.<sup>7</sup> As a result, the various joint "regions" listed above are all classified as "body part subdivisions", since that is what is intended by the various diseases and procedures that use these concepts in their definitions. (They are not body parts because they are defined not by a set of bones but rather by a particular joint and its surrounding structures). However, the use of the word "region" in SNOMED RT is according to common usage and is intended as a three-dimensional structure, NOT according to Rosse's two-dimensional concept of "Body region". In other words, these regions are not simply "virtual" surface regions, but include the deep structures

<sup>7</sup> Rosse C, Mejono JL, Modayur BR, Jakobovits KP, Hinshaw JF, Brinkley JF. Motivation and organizational principles for anatomical knowledge representation: the digital anatomist symbolic knowledge base. JAMIA. 1998;3:224-33.

as well. They include the overlying skin, the subcutaneous tissues, the bones, muscles, tendons, fascia, vessels and other included organs and tissues in the region

4.6.1.4. *Skin regions – Skin of <named body part>*

Since "skin of finger" means "some or all of the skin of finger", either "is-a" or "part-of" could potentially be used to represent the relationship between "skin of finger" and "skin of hand". In SNOMED RT, "is-a" was chosen for these relationships. Thus "skin of finger" is-a "skin of hand", is-a "skin of upper extremity", is-a "skin region". The word "region" has not been added to all of these concepts, since it has been assumed by the editors of SNOMED RT that it is apparent that "skin region of finger" and "skin of finger" mean the same thing.

4.6.1.5. *Organs – Organ system subdivisions:*

Rosse’s notion of body organ was also adopted. Organs include individual bones, joints, muscles, arteries, veins, lymph vessels, nerves, etc. Concepts that involve groups of such organs are frequently listed in SNOMED. In most cases, these have been interpreted to be concepts in the subsumption hierarchy (is-a hierarchy) of the particular organ type, that is, they are kinds of organ. When another concept is needed to represent the collection of organs (rather than an organ in the collection), another concept (code) has been created that is *a kind of* organ system subdivision. However, many such collections don’t yet have such a corresponding organ system subdivision concept (see, for example, quadriceps femoris muscle). The default has been to interpret concepts as organs rather than organ system subdivisions. Examples:

<u>Organ</u>	<u>Organ system subdivision</u>
Vertebra (bone of vertebral column)	Spine (subdivision of skeletal system)
Cervical vertebra	Cervical spine (subdivision of spine)
Third cervical vertebra	—
Bone of skull	Skull (subdivision of skeletal system)
Bone of thoracic cage	Thoracic cage (subdivision of skeletal system)
Rib	—
Third rib	—
Right third rib	—
Quadriceps femoris muscle	—
Quadriceps femoris muscle, left	—
Vastus medialis muscle	—

4.6.1.6. *Cell, Tissue, Organ:*

In general, organs are made up of tissue, and tissue is made up of cells. However, a cell is not necessarily part of tissue, and tissue is not necessarily part of a named organ.

4.6.1.7. *Body systems and tracts:*

Many terms are used imprecisely in clinical practice and in medical publications to refer to body systems or tracts, and ambiguities frequently arise with many of these terms. In particular, the

terms for the gastrointestinal, alimentary, genitourinary, urinary, respiratory, biliary, lymphatic, lymphoid, immune, reticuloendothelial, and hematopoietic systems of the body may have multiple interpretations. The following definitions and distinctions were arbitrarily made in order to achieve internal consistency of SNOMED RT terminology. While it is recognized that there may be disagreements about what names should be used for each of these concepts, it is hoped, nonetheless, that these definitions are consistent and clear in defining what each concept was intended to include and exclude in SNOMED.

#### 4.6.1.7.1. Urinary system – Urinary tract – Genitourinary system – Genitourinary tract

Urinary system: includes the organs involved in the formation and secretion of urine, including the kidney, ureters, bladder, and urethra.

Urinary tract: includes the organs involved in the secretion of urine but excludes the kidney itself (*note*: this a tentative attempt to see how this concept works); includes the renal pelvis, ureters, bladder, and urethra. It is a fairly subtle distinction from urinary system, but is useful for categorizing disorders affecting the flow of urine (as opposed to its formation). Unfortunately, "urinary tract" is often used as a synonym of urinary system, so it may be necessary to use a different phrase to describe this concept in the next release of SNOMED RT.

Upper urinary tract: Urinary tract above the junction of ureter with bladder. Do upper urinary tract infections include kidney infections? If so, the upper urinary tract must include the kidney. If not, it doesn't. This issue may need to be revisited.

Genitourinary system: includes the entire urinary system as well as the organs of reproduction. Here, genitourinary tract is allowed to be synonymous with genitourinary system.

#### 4.6.1.7.2. Digestive system – Digestive tract – Alimentary tract – Gastrointestinal tract (upper & lower)

Digestive tract: same as alimentary tract, includes the entire passage for food through the body, including mouth, oral cavity (both vestibule of mouth and *cavitas oris propria*), oropharynx, esophagus, stomach, duodenum, jejunum, ileum, colon, rectum, and anal canal.

Digestive system: includes the digestive tract as well as the associated organs of digestion, including tongue, teeth, salivary glands, liver, pancreas, gallbladder and biliary tract.

Gastrointestinal tract: would more properly be named the "esophago-gastrointestinal tract", since the esophagus is ordinarily included in the concept by common usage. This is contrary to some dictionaries, which exclude the esophagus, and does not follow a strict lexical interpretation. But the usual practice in SNOMED is to abandon a strict lexical interpretation when it is inconsistent with common usage.

Upper gastrointestinal tract: By convention in describing upper GI bleeding and upper GI radiographic and endoscopic procedures, this includes the esophagus, stomach and duodenum. It is part of the gastrointestinal tract (as defined for SNOMED RT).

Lower gastrointestinal tract: By common convention in describing lower GI bleeding, lower GI radiographic and endoscopic procedures, and lower GI output from ileostomies and colostomies, this includes the jejunum, ileum, cecum, colon, rectum and anal canal. The ligament of Treitz may be used as the dividing line between upper and lower GI tract (and the dividing line between duodenum and jejunum). See *J Vasc Interv Radiol* 9:747 for an example that shows inclusion of the jejunum and below as part of the lower GI tract. Also, from a logical standpoint, if the upper

GI tract ends at the duodenum, and there is no concept for “middle GI tract”, then the jejunum can be inferred to be in the lower GI tract.

#### 4.6.1.7.3. Biliary tract – Liver

Biliary tract: includes the gallbladder and the intrahepatic and extrahepatic bile ducts, and the common bile duct. It does not include the liver itself. "Biliary system" is used as a synonym for biliary tract. (Another concept might be created to include the entire liver with the biliary tract, but at present there is not a perceived need for it).

#### 4.6.1.7.4. Respiratory tract – Respiratory system – Upper aerodigestive tract

"Respiratory tract" was chosen mean the same as the Nomina Anatomica concept of "apparatus respiratorius", which includes the structures through which air passes from the nares to the alveoli. The oral cavity, however, is not included (even though functionally one might expect it to be). The phrase “respiratory system” is often regarded as a synonym of "respiratory tract", and this meaning has been adopted. An additional meaning is possible, but a concept for a more global respiratory system that might include the diaphragm, pleura, lungs, and CNS components of breathing has not yet been added.

Upper aerodigestive tract is a phrase that may have several meanings. The SNOMED code for "upper aerodigestive tract" has adopted the meaning defined by Muir and Weiland in "Upper aerodigestive tract cancers", *Cancer* 1995 Jan 1;75(1 Suppl):147-53, which states: "Cancers of the upper aerodigestive tract constitute approximately 4% of all malignancies. These include cancer of the lip, tongue, major salivary glands, gums and adjacent oral cavity tissues, floor of the mouth, tonsils, oropharynx, nasopharynx, hypopharynx and other oral regions, nasal cavity, accessory sinuses, middle ear, and larynx." This definition matches the tumors included in the CAP Cancer Checklist for upper aerodigestive tumors. Some publications include the esophagus, or at least the cervical esophagus, when referring to the upper aerodigestive tract, but it was decided to exclude esophagus as part of the aerodigestive tract in SNOMED RT.

Aerodigestive tract is a phrase with more variation in meaning than "upper aerodigestive tract." Because of the variable meanings, and limited reference to "aerodigestive tract" in the literature, "aerodigestive tract" has not been added at this time as a separate concept. It certainly would include the upper aerodigestive tract plus the tracheobronchial tree, lungs, and esophagus, but the few literature citations using the term do not appear to intend it to include any of the digestive tract below the stomach. A strict lexical interpretation might lead one to include the entire digestive tract. There appears to be no definitive resolution of this ambiguity, and no particular need for one.

Upper respiratory tract is that part of the respiratory tract from the larynx up, and includes the nasal cavity, paranasal sinuses, nasopharynx, oropharynx and larynx.

Lower respiratory tract begins below the larynx, and includes the tracheobronchial tree (from the trachea through the terminal bronchioles) as well as the alveolar respiratory tract or pulmonary region (from the respiratory bronchioles to the alveoli).

#### 4.6.1.7.5.Lymphoid system – Lymphatic system – Immune system– Mononuclear phagocytic system

Lymphatic system: is conceptually the set of structures through which lymph flows. It includes the lymph nodes and lymphatics (lymph vessels). It supports the categorization of concepts that relate to the flow of lymph.

Lymphoid system: is conceptually the set of structures made up of aggregates of lymphoid cells. It includes lymphoid aggregates of the intestine, marrow, liver, and other locations, the lymph nodes, spleen, and thymus. It excludes the lymph vessels. It supports categorization of lymphomas.

Immune system: includes all of the lymphoid system, as well as the mononuclear phagocytic system, and humoral and cellular immune factors such as antibodies, cytokines, etc.

Mononuclear phagocytic system: a collection of true macrophages, distributed widely in the body. Part of the immune system.

Reticuloendothelial system: an outdated term, most closely related to the mononuclear phagocytic system, but also includes some essentially non-phagocytic endothelial and fibroblastic cells that line lymphoid sinusoids and hematopoietic tissues.

#### 4.6.1.7.6.Skeletal system [T-11000] – Bony skeleton [T-11002] – Vertebral column [T-11500]

The skeletal system (systema skeletale) includes both bones and cartilages of the body. The bony skeleton includes just the bones. The vertebral column (spine) is part of the skeletal system, and includes the intervertebral discs (fibrocartilage). The spine is not strictly part of the bony skeleton, but is part of the skeletal system. However, individual vertebrae are part of the bony skeleton.

#### 4.6.1.7.7.Hematopoietic system – Blood – Spleen – Lymph nodes – Thymus:

Hematopoietic is used to mean the not-as-yet-mature cellular elements that eventually form the cellular components of blood. The blood itself cannot be strictly part of the hematopoietic system, since this would cause all components of blood to be part of the hematopoietic system (including components like albumin, clearly not 'hematopoietic'). Leukocytes, red cells and platelets are the *result* of hematopoiesis, but they are not blood-forming themselves, in the strict sense used in SNOMED RT (otherwise leukocytosis would become a disorder of hematopoiesis, whereas it can arise simply from a demargination of white cells during stress). A concept "cellular components of blood" was created for this purpose. Note that platelets are not actually cells, but are 'cellular components'. Likewise, for spleen, lymph nodes and thymus, "hematopoietic cells of spleen" etc. was created to indicate that they are part of the hematopoietic system. This enables differentiation of disorders of the hematopoietic system from infectious, traumatic and other disorders, and prevents incorrect autoclassification.

#### 4.6.1.7.8.Blood – Cardiovascular system – Hematopoietic system:

The blood is not necessarily part of the cardiovascular system, nor is it necessarily part of the hematopoietic system. If it is, then leukemia would be a cardiovascular disorder, and septicemia would be a hematopoietic disorder. Since these inferences violate the clinical expectations of

SNOMED RT, the underlying model of anatomical relationships has been made to support the kind of relationships that are correct and expected. Thus blood is a body fluid, not strictly part of either the hematopoietic or cardiovascular systems.

#### *4.6.1.8. Tendons – Muscles:*

Is a muscle an entire functional unit, including attachments to the skeletal system, or merely the contractile part of this unit? Either choice could be made; clinically one thinks of the muscle as the contractile part only. Rosse's definition of organ implies that tendons should be considered subdivisions of their corresponding muscles, rather than organs in their own right. Thus the Achilles tendon would be part of the triceps surae (gastrocnemius and soleus) muscle. This would make a rupture of the Achilles tendon a kind of disorder of the triceps surae (gastrocnemius and soleus) muscle. Functionally this makes sense, but it may violate the natural sense of "muscle" as contractile tissue only.

#### *4.6.1.9. Long bone – Short bone: [T-11016, T-11017]*

ICD-9 makes a distinction between the long bones of the limbs (humerus, radius, ulna; femur, tibia, fibula) and all the others, which it terms short bones. Dictionary definitions of long bone sometimes cite the proportional relationship between length and width (length >> width), and one could infer from this description that metacarpals, metatarsals, and phalanges might fit the definition of long bone. However, these have not been defined as long bones, and instead follow the ICD-9 distinction (see 170.5 and 170.8, for example). Thus far, non-limb bones have been left unclassified with respect to long vs short.

#### *4.6.1.10. Sternum – Manubrium, Body, Xiphoid:*

The sternum is strictly not a bone but three bones closely joined together. However, in SNOMED RT the sternum has been modeled as a bone (organ), as well as the manubrium, body of sternum, and xiphoid. This means that three organs are all part of another organ (this is counter to the definition of organ, but the logic engine does not complain).

#### *4.6.1.11. Nasal turbinates – Nasal conchae:*

The bone underlying the nasal turbinates (T-111A1 to T-111A4) has been differentiated from the turbinates themselves. The turbinates themselves (T-21370, T-21380, T-21390 and T-21391) include both bone and overlying mucous membranes and other tissues. The inferior nasal turbinate bone is a facial bone (and skull bone) in its own right. However, parts of the ethmoid bone form the middle, superior and supreme nasal conchae. This means that T-111A2, T-111A3 and T-111A4 are not strictly separate bones, but parts of the ethmoid bone. They have been listed as kinds of nasal turbinate bone, which is not strictly correct. Following these rules strictly would require them to be, instead, types of organ subdivision (of the ethmoid bone). They are listed as part-of ethmoid bone - the rule has been violated slightly to allow the concept "nasal turbinate bone" to have all four descendents (inferior, middle, superior and supreme nasal turbinate bone).



#### 4.6.1.12. *Pulmonary vein – Vein of lung:*

Pulmonary vein [T-48500]: There are four pulmonary veins that enter the left atrium, two on each side; these are what is intended by the code named "pulmonary vein." The pulmonary veins are "great vessels" (vessels that enter the heart). Common usage sometimes might result in people referring to any vein that is part of the lung as a "pulmonary vein," but in SNOMED RT there is a separate code for this meaning.

Vein of lung [T-48581]: Means any vein that drains the lung. Pulmonary veins are kinds of "vein of lung." "Pulmonary vein" and "vein of lung" are not synonyms in SNOMED.

#### 4.6.1.13. *Pulmonary artery – Artery of lung – Trunk of pulmonary artery:*

Trunk of pulmonary artery [T-44100]: This is the main pulmonary artery, the "great vessel" coming off the right ventricle and splitting into right and left main pulmonary arteries. Some dictionaries make this synonymous with "pulmonary artery".

Artery of lung [T-44003]: Any pulmonary artery within the lung.

Pulmonary artery [T-44000]: Any artery(ies) conveying unoxygenated blood from the heart into the lungs, including the trunk, right and left branches of the pulmonary artery, which are within the mediastinum, and all their branches, which tend to occur at or past the hilum and are therefore within the lung.

#### 4.6.1.14. *Common carotid artery – Artery of neck*

The right common carotid artery usually arises from the brachiocephalic trunk behind the right sternoclavicular joint, and thus has no real thoracic portion. However, the left common carotid arises from the arch of the aorta and does have a short thoracic portion. Should the common carotid artery (not specifying laterality) be an artery of neck, i.e. an artery that is part of the neck? Strictly speaking, it is not, because of the thoracic portion of the left common carotid. At present, however, the model of anatomy includes common carotid artery as an artery of the neck. This may need to be changed.

#### 4.6.1.15. *Regional lymph nodes of the lung:*

Concepts from traditional anatomy (lymph nodes categorized as: pulmonary, bronchopulmonary, tracheobronchial, tracheal, and esophageal) have been retained along with concepts developed for clinical staging of lung cancer (lymph nodes categorized into 14 stations). Groups concerned with the clinical staging of lung cancer have developed at least three different nomenclatures for "stations" of lung-related lymph nodes. The ATS (American Thoracic Society) map, published in 1983, is given in *Am Rev Respir Dis* 1983; 127:659-669. A revised system adopted by AJCC and UICC in 1997 is given in *Chest* 1997; 111:1718-1723. Even though the numbering of the stations is very similar, the inter-relationships between the various terms are complex, particularly in stations 4 and 10, near the carina and hilar regions. For example, it is assumed that AJCC Station 10, named "hilar lymph node", is a synonym for "bronchial lymph node" and "bronchopulmonary lymph node". However, ATS Station 10R, named "right tracheobronchial lymph node" is not a child of "tracheobronchial lymph node" because its definition includes nodes covered by both "lower paratracheal lymph node" (AJCC Station 4) and by "hilar lymph node" (AJCC Station 10).

"Tracheobronchial lymph node" is used merely as a parent term for inferior tracheobronchial (subcarinal) and superior tracheobronchial (a subset of lower paratracheal).

*4.6.1.16. Shoulder region – Upper limb; Hip region – Lower limb:*

A decision was made to include the shoulder region as part of the upper extremity, and the hip region as part of the lower limb. This follows the general pattern used in ICD-9 (“upper limb including shoulder”, “lower limb including hip”). It would be possible to add concepts for upper limb not including shoulder and lower limb not including hip. So far this has not been done.

*4.6.1.17. Axilla – Upper limb – Trunk:*

The axilla is bounded by the upper limb laterally and the thorax medially; therefore it is not strictly part of either the upper limb or the trunk.

*4.6.1.18. Teeth – Maxilla – Mandible:*

Even though teeth are supported by the maxillary or mandibular bone, they are *not* "part-of" the maxilla [T-11170] or mandible [T-11180]. Teeth *are* part of upper jaw [T-D1214] and lower jaw [T-D1215].

*4.6.1.19. Mouth (region) [T-D0662] – Mouth (orifice) [T-51000]:*

The mouth region includes both the vestibule and the oral cavity proper. The mouth orifice is bounded by the lips. Most disorders that have ASSOC-TOPO “mouth” should use mouth region, not mouth orifice.

*4.6.1.20. Base of tongue [T-53131] – Root of tongue [T-53130]:*

Some sources make the base and root synonymous, but these have been differentiated in SNOMED RT. The base of the tongue is the posterior third, the dorsal surface of which forms the anterior wall of the oropharynx. The root of the tongue rests on the floor of the mouth. The nerves and vessels that supply the intrinsic muscles of the tongue traverse the root of the tongue.

*4.6.1.21. Inferior surface of tongue [T-53400] – Ventral surface of tongue [T-53123]:*

Even though SNOMED 2 and SNOMED 3 had separate codes for these, they are regarded as synonyms in SNOMED RT. There is no ventral surface of the posterior third of the tongue, so the ventral surface of the anterior two thirds is the same as the ventral surface, which is the inferior surface. This concept [T-53123] has been retired.

#### 4.6.1.22. Prostate lobes:

The "posterior lobe" of the prostate is described in newborns but does not persist into the adult. The three prostate lobes [T-92050] are the left and right lateral lobes and the variable middle lobe.

#### 4.6.1.23. Larynx [T-24100] – Inlet of larynx [T-24300] – Interarytenoid fold [T-24462] – Hypopharyngeal aspect of interarytenoid fold [T-24466]:

The interarytenoid fold forms part of the inlet of the larynx. The fold has two surfaces, one forming part of the wall of the supraglottic larynx, the other forming part of the wall of the hypopharynx (the "food tube" behind the larynx, leading to the esophagus). Is the "hypopharyngeal aspect of the interarytenoid fold [T-24466]" a part of the the hypopharynx, the larynx, or both? A tumor of this site should be categorized as a tumor of the hypopharynx, and not as a tumor of the larynx, but the interarytenoid fold [T-24462] is considered part of the larynx. Given these two facts, a part-of relationship is *not* given between the hypopharyngeal aspect of the interarytenoid fold [T-24466] and the interarytenoid fold [T-24462]. This emphasizes the fact that in SNOMED RT the modeling of anatomical concepts is based on the way that model causes disorders and procedures to be organized, and is *not* based on a simple reading of the term names.

### 4.6.2. Comments on Findings

#### 4.6.2.1. Finding – Function:

The distinction between a finding and a function may be difficult to see at first, but it is believed a reproducible distinction has been found for SNOMED RT. A finding provides interpretive information about the status of the patient (or some aspect of the patient or population), such that it can be used meaningfully to complete the sentence: "*The patient has \_\_\_\_\_*". Functions, on the other hand, include any non-structural aspects (functional aspects, properties, and some semi-structural properties like volumes) that can be evaluated or measured. Once a statement is made about the value of a function, the statement is a finding. Thus "hematopoiesis" is a function, and "impaired hematopoiesis" is a finding. "Vision" is a function, and "normal vision" is a finding. "Gait" is a function, and "staggering gait" is a finding. "Deep tendon reflex" is a function, and "reduced deep tendon reflexes" is a finding. "Mean red cell corpuscular volume MCV" is a function (a measurable property of red cells), while "Increased MCV" is a finding.

#### 4.6.2.2. Problem – Symptom – Sign – Diagnosis – Finding:

For the hierarchy to work properly, any entity that is below a heading must *always* and *necessarily* be a kind of that heading. This creates problems in the area of findings, where the same finding can be reported by the patient as a subjective observation (a symptom), can be reported by someone other than the patient as an observation (a sign), can be listed as a problem (or not), and can be listed as a diagnosis (or not). The *context* frequently determines whether a particular finding is a problem, symptom, sign, or diagnosis (or simply a finding). Therefore, "problem" is regarded as an *assertion* that can be made about a particular finding, rather than a heading in the

hierarchy that would have all possible problems listed below it. Likewise symptom, sign, and diagnosis are assertions.

In general, any finding can be a problem or a diagnosis, depending on the context. Most findings can also be either symptoms or signs. It is deceptively difficult to identify findings that always and necessarily must be symptoms. Some findings are *named* as signs, so these will in fact always and necessarily be signs (e.g. "doll's eye sign").

#### 4.6.2.3. *Finding – Disorder – Episode:*

Disorder (almost everything in the SNOMED "D" axis) is defined as a specialized kind of finding. There probably also needs to be a distinction between disorders and episodes. Episodes are findings also. For example, it is useful to differentiate between an asthmatic attack (episode) and the disorder asthma, between a seizure (episode) and a seizure disorder, between a bout of diarrhea and a chronic diarrheal disorder. Although the distinction is recognized, it may not yet have been systematically applied to all concepts in SNOMED RT.

#### 4.6.2.4. *Paralysis – Motor Paralysis – Weakness – Paresis – Muscle Weakness:*

Paralysis can mean motor paralysis alone, the loss of power of voluntary movement, or can sometimes imply both sensory and motor paralysis. "Muscular paralysis" has been defined as a synonym of paralysis [F-A0840], while sensory paralysis would be the same as [F-2A005] Lack of sensation (synonym: anesthesia). Paresis means incomplete motor paralysis, and is of course manifested by muscle weakness. However, in prior versions of SNOMED, muscle weakness was listed as a synonym of paresis. Creation of a separate term for muscle weakness was considered, since "muscle weakness" and "paresis" seem to have diverged somewhat in usage, with paresis being used for clinical findings and disorders of more well-defined etiology, while muscle weakness is used as a broader term that encompasses muscle weakness of unknown cause or of more non-specific causes, as well as those of more well-defined cause. For example, in the weakness of the quadriceps muscle following a prolonged immobilization in a cast, some clinicians might find it unacceptable to call this a "quadriceps paresis," even though this is technically correct usage. On balance it was decided to leave muscle weakness and paresis as synonyms.

### 4.6.3. Comments on Morphology

#### 4.6.3.1. *Morphology (abnormal structure) – Morphologic finding:*

A category called "morphologic finding" was created as a type of finding. Another potentially confusing distinction in SNOMED RT, this split allows us to say that "red color" is a (morphologic) finding relating to the property "color", while "lymphoblast" is an abnormal structure, even though they both have codes beginning with "M" and therefore were formerly both classified as "morphology". Exactly where this split should be made is somewhat arbitrary. A concept is placed into the morphologic findings when it is not necessarily abnormal, or when it is a fairly simple or primary observation of a property. Properties such as color, size, weight, quantity,

appearance, consistency, and translucency can often be directly observed and may not necessarily imply abnormality. Generally speaking, something is placed into the abnormal structures when the conclusion requires more "inference" and less simple "observation", and when the structural change is abnormal by definition. Red color is a simple observation, so it naturally is regarded as a morphologic finding; the histologic structure characteristic of Hodgkin's disease requires significant inference based on primary observations, and it is always abnormal, so it is categorized as an abnormal structure.

#### *4.6.3.2. Morphology (abnormal structure) – Disorder:*

A distinction has been made between the structure that is characteristic of a disorder ("M" axis), and the disorder itself ("D" axis). Thus, Hodgkin's disease (clinical) has associated-morphology Hodgkin's disease (morphology). This distinction is useful also in defining various procedures involving abnormal structures.

#### *4.6.3.3. Morphology (abnormal structure) – Anatomy (normal structure) – Cell:*

In the development of SNOP, and later SNOMED, the distinction between "M" and "T" was that a normal structure went into the T axis, and an abnormal structure went into the M axis. Thus the situation where normal hematopoietic cells are in T, while abnormal ones are in M. For example, a hypersegmented poly is M-64010, while a neutrophil is T-C1260. But surely they are both cells and so must appear in the "cell" hierarchy under T-E0000. In SNOMED RT, the top level for cell is "body structure". This allows the classification of a "normal cell" as a child of "cell" as well as a child of "physical anatomical entity" (which excludes abnormal structures), and allows an "abnormal cell (M-62000)" to be classified as a child of "cell" as well as a child of "morphologic abnormality."

#### *4.6.3.4. Morphology (abnormal structure) – Pathologic processes:*

The Morphology section contains phrases that sound like pathologic processes (inflammation, repair, fibrosis, ...) as opposed to a structure affected by the process, but this is an interpretation based only on the meaning of the word or phrase, and fails to take into account the way the coding system is used. When a pathologist lists an "M" morphology code in a report, it means that there is a specimen or structure in which the morphology is manifest. The pathologist does not observe the inflammatory process per se, but observes the structure that has been affected by the process. Thus M-40000 "Inflammation" has always meant "structure affected by inflammatory process", or "inflamed structure". There does not appear to be a need, at present, for a separate code to mean inflammation as a process; if a disease is inflammatory, it produces inflamed structures; if a procedure affects inflammation (e.g. treats it), it affects structures that are inflamed. The designation of the "M" axis concepts as abnormal structures is necessary for consistent definitions of diseases and procedures using these codes as role (attribute) values.

#### 4.6.4. Comments on Procedures

##### *4.6.4.1. What is included in "procedures"?*

The top level of the procedure hierarchy is intended to include all kinds of clinical action, including not just surgical and invasive procedures but also all kinds of non-invasive interventions, referrals, placement, counseling, teaching, planning, regimens, courses of therapy, history taking, physical examination, tests of all kinds, monitoring, and so forth. Although there are narrower interpretations of the word "procedure", the top level SNOMED concept is very broad. (Narrower interpretations might, for example, include only those actions that involve direct contact with the patient and can be done in a single episode; or, perhaps even narrower, the set of actions that would ordinarily be done to a patient in a "procedure room", such as lumbar puncture, phlebotomy, etc.)

##### *4.6.4.2. What is a surgical procedure?*

The definition of "surgical" seems straightforward until one attempts to make a clean distinction between those procedures that are always and necessarily surgical, and those that are not. Although the following definition is still a "work in progress", it is the result of a significant amount of discussion and thought by the contributors to SNOMED, and seems to have served us reasonably well in splitting the surgical procedures from the rest:

*A surgical procedure* involves planned alteration of the structure of the body, ordinarily requiring the disruption of some body surface, usually through an incision. Root procedures that are necessarily surgical include: construction, closure, open reduction, dissection, avulsion, open biopsy, debridement, decortication, enucleation, excision, scraping, stripping, exteriorization, fixation, incision, ligation, plastic repair.

Some actions are regarded as not necessarily surgical including venipuncture, phlebotomy, centesis, closed needle biopsy, and closed reduction.

For purposes of existing terms in SNOMED, "operation" is regarded as synonymous with "surgical procedure." (Though in ordinary usage there may be operations that are non-surgical.)

##### *4.6.4.3. Some specific comments regarding laboratory procedures:*

Lab tests usually require that a specimen be obtained from the patient and prepared in a specified manner. In SNOMED (particularly in P3), pathology and laboratory procedure concepts that do not otherwise specify should be assumed to include the entire process, not simply the intra-laboratory activity. In other words, unless otherwise specified, the tests are named primarily from the perspective of what is done for the patient, rather than from the perspective of what each health care worker does to accomplish the task.

Examples:

Serum sodium measurement [P3-74021]: This procedure concept includes obtaining the specimen, preparing it, running the test, and reporting the result.

PAP test [P3-45261]: This concept includes obtaining the specimen, making the smear, staining, screening, interpreting and reporting.

Preparation of cytologic smear from genital source [P3-45260]: This is the smear preparation only, which includes staining if staining is done, but excludes obtaining the specimen, examining the slide microscopically, interpreting the findings, or reporting.

#### *4.6.4.4. Some specific comments regarding radiologic procedures:*

Diagnostic radiologic examination [P5-00010] had a synonym of "X-ray", but was defined as any diagnostic procedure of radiology, ultrasound, or nuclear medicine. Since the preferred name is "diagnostic radiologic examination", [P5-00010] retains that general meaning. It includes under it the codes for consultative activities of radiologists, separated out from imaging procedures themselves. The imaging procedure codes, by SNOMED RT's default criteria, do not differentiate among the various aspects of ordering, imaging, interpretation and reporting. A new term, "Diagnostic radiography"[P5-00011] was created for the specific meaning of diagnostic imaging procedures utilizing x-rays.

Imaging procedures: HAS-OBJECT role is not needed.

#### *4.6.4.5. Procedure on bone - Procedure on skeletal system:*

There are five anatomical concepts related to "bone".

1. Bone (tissue): the tissue type that makes up bones.
2. Bone (organ): individual particular bones, such as femur, tibia, ulna, scaphoid, lunate, etc.
3. Skeletal system subdivision: groupings of bones taken together, such as spine, skull, bony pelvis.
4. Bone (system): the pars ossea systematis skeletalis, the bone part of the skeletal system
5. Skeletal system: the entire skeletal system, including both the bones and the part of the skeleton composed of cartilage.

Because bone (tissue) is part-of bone (organ), and bone (organ) is part-of bone (system), bone (system) can be used to define aggregate terms that involve bones. Since the skeletal system includes the bones and cartilage of the skeleton, it may be possible to have a procedure on the skeletal system that is not a procedure on bone.

[Note: For now, "skeletal system subdivision" has also been defined as a part-of bone (system). This may need to change if there are procedures on cartilaginous skeleton that involve skeletal system subdivisions.]

#### *4.6.4.6. Repair of fistula – Closure of fistula:*

Can you repair a fistula without closing it? Can you close a fistula without repairing it? These are regarded as synonyms in SNOMED RT, even though in the general case a closure is a subtype of repair. In other words, in SNOMED RT, all fistula repairs are also closures.

#### 4.6.4.7. Immunization – Vaccination:

Immunization may be accomplished by active immunization (introduction of a vaccine), or by passive immunization (introduction of immunoglobulin / antibodies ). Vaccination, by definition, is the introduction of a vaccine, and is therefore synonymous with active immunization, since a vaccine is a substance that can induce active immunity. The preferred name of some terms that formerly said "immunization" have been changed to "vaccination", where it is clear that vaccination was intended. In other cases, a new subordinate term was created for vaccination, and the original immunization term was left as a superordinate term to encompass both active and passive immunization procedures.

#### 4.6.5. Comments on Disorders

##### 4.6.5.1. Diseases of the skin and subcutaneous tissue

- Cellulitis and abscess affect both skin and subcutaneous tissues.
- Granulomas have morphology Granulomatous inflammation
- Dermatitis does not necessarily need to be erythematous.
- Alopecia affects hair, because even though the hair follicle may not be abnormal, the shaft of the hair is affected.
- If multiple etiologies are involved (such as a drug and sunlight) all are included as values of separate ASSOC-ETIOLOGY roles.

##### 4.6.5.2. Diseases of the musculoskeletal system

- “Nonallopathic lesion” means a problem not defined by allopathic medicine but may be defined by chiropractic or other alternative paradigm.
- Collagen diseases D1-10000 includes the systemic rheumatic diseases even though they do not necessarily primarily involve collagen; the concept is used in the sense of systemic rheumatic disease.
- Radiculitis is both a neuropathy and a neuritis.

##### 4.6.5.3. Diseases of the respiratory system

- Asthma\_ D2-51000 is defined as an inflammatory condition of the bronchi leading to bronchospasm and may have varied clinical manifestations including different degrees of dyspnea, wheezing, and cough.
- Extrinsic-allergic-alveolitis\_ D2-54000 is taken to be synonymous with Hypersensitivity-pneumonitis, and refers to pulmonary symptoms following exposure to inhaled antigens (often organic), causing disease at the alveolar/interstitial level.
- Pneumoconiosis\_ D2-53000 refers to any diffuse interstitial pulmonary disorder caused by inhalation of dusts, although more current usage of the word “pneumoconiosis” is reserved for inorganic dusts.
- Occupational-lung-disorder\_ D2-52100 is taken to be lung disease attributable to occupational exposure. If a specific occupation is lexically expressed in a term, then this term would bear strong consideration for being classified as an Occupational-lung-disorder\_ D2-52100.



- Extrinsic-asthma\_D2-51100 is asthma caused by some factor in the environment.
- Chemical-fumes\_C-20070 is used as the ASSOC-ETIOLOGY for Respiratory-condition-due-to-chemical-fumes-and-vapors\_D2-53550 since chemical fumes could not be reliably distinguished from vapors and thus are assumed to be the same.

#### 4.6.5.4. Infectious diseases

- AIDS is assumed to be an infection by HIV, not any of the animal immunodeficiency viruses. (e.g. Simian AIDS is not a subtype of AIDS)
- Infestation is taken to be equivalent to Infection in DE-70000, Disease due to arthropod. Therefore, Infestation by Arthropod X is considered defined by parent "Infectious Disease" and Assoc-Etiology "Arthropod X"
- Osteomyelitis is defined as infection of bone, not necessarily involving bone marrow.
- Actinomycosis\_DE-11010 is an infectious disorder due to Actinomyces. It results in an inflammatory condition involving lymph nodes and generating pus containing sulphur granules.
- Actinomycotic-infection\_DE-11000 corresponds to ICD-9 category 039, which includes infectious diseases caused by Subclass Actinomycetes.

#### 4.6.5.5. Rheumatic fever [D3-17100]:

Rheumatic fever usually affects the heart, but not always. D3-17110 "Rheumatic fever without heart involvement" is clearly a kind of rheumatic fever. It is also clearly *not* a kind of heart disease. This means that rheumatic fever must not be classified as a kind of heart disease. D3-17410 "Acute rheumatic heart disease" specifies rheumatic fever affecting the heart.

### 4.7. The problem with pre-coordinated combined sites

Users need a convenient way of indicating that a disease or procedure or specimen involves a group of structures. One way this has been accomplished in previous versions of SNOMED was by creating special "combined site" codes in the Topography section.

However, combined sites creates a problem in the modeling of anatomy concepts - the modeling becomes more and more complicated when an increasing number of combined site codes continue to be supported. The reason is that an *is-a* or *part-of* relationship needs to be created that will allow proper retrieval of the case.

For example, imagine the combined site "liver and spleen" and a query for diseases of the spleen that will retrieve diseases involving this combined site. In order for this to happen, it appears there are several choices. The most obvious would be to make "liver and spleen" a kind of liver and a kind of spleen. But this means that when the is-a hierarchy is navigated, the following results appear:

Physical anatomical entity

Organ

Liver

Liver-and-spleen

Spleen

Liver-and-spleen

There could be arbitrarily many concepts that have an "is-a" relationship to each site, and navigation of the anatomy hierarchies would look ugly. This seems very messy, and makes "liver-and-spleen" a kind of organ, which isn't really true.

Another possibility is to make liver a part-of "liver and spleen" and make spleen part-of "liver and spleen". But then one might need "liver and gallbladder", "liver and diaphragm", "liver and adrenal", "liver and ipsilateral adrenal", "liver and contralateral adrenal", and so forth. If a part-of relationship is added for every combined site, there could be arbitrarily many part-of relationships in the definition of each site that is involved in a combined site.

A third alternative is to provide specific pre-coordinated sites as a separate hierarchy of entities defined by ASSOC-TOPO roles. This would require creation of a root entity for all hierarchies (a modest suggestion). Then one could define the combined site "liver and spleen" as: (defconcept "liver and spleen, CS" (and entity (some ASSOC-TOPO liver)(some ASSOC-TOPO spleen)))

Then, an excision procedure done on both liver and spleen could be simply: "excision procedure" AND "liver and spleen, CS".

A serious drawback to this approach is that the top level gets a big set of combined-site entities attached to it, and they can't be moved down the hierarchy.

Moving them down the hierarchy requires duplication of the sites for each major type of thing for which they would be used. In other words, for diseases and procedures, there would have to be two different parents, "procedure on combined site" and "disease of combined site".

A final alternative is to leave most combined sites out of the reference terminology hierarchies entirely, but supply them to users as separate tables that could then be implemented as something like "data recording macros" that could be properly expanded out when used in a software application. This last approach is what is currently recommended.

#### **4.8. COMMENTS ON THE SEMANTIC MODEL**

##### **4.8.1. Part-whole reasoning in SNOMED RT**

###### *4.8.1.1. Why aren't all valid part-of relationships directly inferred by the automated inference mechanism?*

The inference mechanism that is used with SNOMED RT allows users to take advantage of part-of relationships to infer subsumption (is-a) relationships. How this works is fairly complicated, but using the results is very simple. "Part-of" is a role, and role relationships *themselves* are inherited only along strict is-a lines. This means that "stomach" can inherit the part-of relationships of its

parents (digestive organ, body organ), but it cannot inherit the part-of relationships of concepts that are not its (is-a) parents. For example, stomach is part-of the upper gastrointestinal tract. So if the upper gastrointestinal tract is part-of the digestive system, you might expect stomach to inherit the relationship “part-of digestive system”. **But it does not**, because stomach is an organ and digestive system is an organ system, so they are different kinds of thing and logical inheritance does not transfer across different kinds of thing.

#### 4.8.1.2. What is the value of automated inferencing using “part-of”?

The way to take advantage of “part-of” is by using it to allow automated inference of is-a relationships. Using a feature called “right identity”, the ASSOC-TOPO role to be valid across part-of relationships, *even when the part-of’s link across multiple different types of concepts*. Right identity is effectively the same construct as the “specialisedBy” construct in GRAIL (see Rector et. al, *Art Intell Med* 9(2):139, 1997). This permits the inference that an incision of the stomach is a kind of incision of the digestive system. In other words, it permits automated inference that:

Incision AND (some ASSOC-TOPO stomach)

is subsumed by

Incision AND (some ASSOC-TOPO digestive system)

because, transitively, stomach is part-of upper GI tract, and upper GI tract is part-of digestive system, therefore (some ASSOC-TOPO digestive system) subsumes (some ASSOC-TOPO stomach).

Notice that SNOMED automatically infers the subsumption of concepts defined by an ASSOC-TOPO role relationship, rather than directly inferring a strict part-of relationship between stomach and digestive system.

#### 4.8.1.3. Can the SNOMED RT relationships table be used to construct a “part-of” hierarchy?

Yes, the explanation above is merely intended to explain why certain “part-of” relationships are not directly inferred by the automated inference engine, and why they aren't seen in “inferred” views of the definition of a concept. The relationship “stomach part-of digestive system” is not explicitly stated, even though it is a true relationship, and even though diseases and procedures of the stomach will be inferred to be diseases and procedures of the digestive system, respectively. One can readily construct the “stomach part-of digestive system” relationship from the stated relationships:

Stomach            part-of upper GI tract  
Upper GI tract    part-of digestive system

This is how these relationships are intended to be used.

## 4.8.2. Common questions and misunderstandings

### *4.8.2.1. Is SNOMED's semantic model based on KRSS (Knowledge Representation System Syntax)?*

Definitions in SNOMED's semantic model can be expressed in several different syntaxes, including KRSS or XML. It is just as incorrect to state that SNOMED's model is based on XML as it is to say that it is based on KRSS. It would be correct to state that SNOMED's semantic model is based on description logic.

### *4.8.2.2. Does the SNOMED model or knowledge base require a particular description logic tool?*

SNOMED has been developed using the Ontylog classifier, but there is nothing in the SNOMED knowledge base that is dependent on that particular classifier. Other classifiers such as GRAIL, FaCT, and LOOM could also be used.

### *4.8.2.3. Is SNOMED's model incompatible with GALEN or GRAIL?*

Discussions with the GALEN developers confirm that there is no known reason why the SNOMED definitions could not be represented in GRAIL syntax and classified using the GRAIL engine. A direct test of this idea would be fruitful and could determine whether there are any unanticipated complications.

### *4.8.2.4. Can I reliably retrieve and aggregate clinical concepts without using a description logic inference engine?*

The answer to this question depends on how the concepts are recorded, and how they are to be retrieved. In general, it is not possible to guarantee reliable retrieval and aggregation unless the assumptions, models and rules applied to recording data are consistent with the assumptions, models and rules applied when retrieving and aggregating. Retrieval and aggregation is trivial if data is recorded using single unmodified "pre-coordinated" codes, and retrieved and aggregated using the stated hierarchies for these codes. However, if data is recorded using so-called "post-coordination," that is, using composition or qualification of concepts (using a base code that is modified or qualified by other codes), retrieval can become less reliable, because there may be several different ways to record the same concept. Experiments testing the retrieval of clinical records have been carried out and confirm that, under certain test conditions, it is possible to retrieve and aggregate post-coordinated clinical data based on a semantic model but without a formal description logic inference engine. [ref Bentley, Brown, Price 1999] This result may depend on restricting post-coordination to those combinations that have been explicitly approved ("sanctioned"). When data can be recorded using post-coordination (based on a particular semantic model), without explicit sanctioning of individual code combinations, then retrieval should be carried out using software capable of recognizing the equivalence (and subsumption) of different statements in that model. Reliably achieving such recognition is dependent on the principles underlying the semantic model; description logic engines are designed precisely to accomplish reliable recognition of equivalent statements that use the model, and thus they can provide reliable support for retrieval and aggregation of clinical concepts.

## 5. Appendix A: Description Logic Primer

The title of this appendix probably offers more than it can deliver, but it is provided in hopes of providing some foundation in description logic for the average user who is struggling to understand it. Description logic is a kind of mathematical logic related to first order predicate logic. It has also been called “terminological logic” because of its use in creating formal systems that express the inter-relationships of terms. The SNOMED RT semantic model is based in description logic.

### 5.1. Components of SNOMED RT’s semantic model

#### 5.1.1. Declarative semantics

SNOMED’s semantic model is declarative. In other words, the meaning of each concept can be determined by examining its declared definition, without requiring reference to a hidden or non-declared procedure. Definitional statements can be expressed in straightforward logic symbols.

#### 5.1.2. Concept definitions

The semantic model is used to create a definition for each concept in SNOMED. These concept definitions describe the essential characteristics of the concept, in terms of other concepts and relationships (see below).

#### 5.1.3. Defined vs. primitive concept definitions

There are two kinds of concept definition: those that are “primitive”, and those that are fully defined. A primitive definition expresses a set of necessary conditions, but does not express sufficient conditions. A full definition includes sufficient conditions such that any instance matching those conditions is always and necessarily an instance of that concept. A concept is considered "Defined" when all **necessary** and **sufficient** components (IsA relationships and Relationship values) are expressed.

For example, “disease of the respiratory tract” could be fully defined as “any disease in which the involved sites include a respiratory tract structure”.

#### 5.1.4. Defining superordinate concepts (“parents”)

Familiar to most users as the upper nodes in a hierarchy tree, these superordinate concepts define the nodes beneath them in the tree. From a logical standpoint, these are strict subsumption relationships. In other words, the “child” concept must always and necessarily be a kind of (or subtype of) the “parent” concept. These hierarchies are expressed in the SNOMED Relationships table by the “is-a” relationship. For example, “pneumonia” is-a “respiratory disease”.

#### 5.1.5. Defining relationships (“roles + relationship values”)

Description logic permits the use of concepts in the definition of other concepts by adding quantified “role relationships”.

### 5.2. Example statements in description logic

The following table illustrates how the definition given above for “disease of respiratory tract” can be expressed using concept identifiers with a description logic syntax:

Symbol	Description
Dresp	Disease of the respiratory tract
Dz	Disease
Rtract	Respiratory tract structure
site	Associated topography (role relationship)

General description logic syntax:  $D_{resp} \doteq D_z \sqcap \exists \textit{site} . R_{tract}$

KRSS syntax: (defconcept Dresp (and Dz (some site Rtract)))

```
XML syntax: <cDef><cd>Dresp</cd><nm>Disease of respiratory tract</nm>
<defC>Dz</defC>
<defR>
<rl><some/><nm>site</nm>
<val>Rtract</val></rl>
</defR>
</cDef>
```

All semantic definitions in SNOMED have this same general structure. They are represented as a conjunction (“anding”) of defining superordinate concepts and existentially-quantified role relationships.

Much of the literature on description logic uses the following symbols and interpretations:

Symbol	Interpretation
$\sqsubseteq$	Subsumption (“is a subtype-of”)
$\doteq$	Definitional equivalence (“is defined as”)
$\exists$	Existential quantification (“some”)
$\sqcap$	Conjunction (“and”)
$R.C$	<i>Dot</i> links role <i>R</i> to its value, concept <i>C</i>

In the literature about description logics, the language named **ALC** is often referenced as providing a basic set of logic operators. These include, in addition to the ones mentioned in the table above, negation ( $\neg$ ) universal quantification ( $\forall$ ), or disjunction ( $\sqcup$ ). However, at present, no definitions in SNOMED RT use negation, universal quantification or disjunction.

The following table gives some trivial examples of how statements about terminology can be represented using description logic operators. The objective of the examples is to provide users of SNOMED with some common sense terminology and definitions that can help to clarify the meaning of the description logic definitions in SNOMED.

In particular, the example about green frogs may help to explain the use of the existential quantifier in SNOMED RT roles.

Natural language statement	Description logic equivalent	Elaborated interpretation
Animals are kinds of thing. (“animal” is a subtype of “thing”)	$\text{Animal} \sqsubseteq \text{thing}$	All instances of animal are subtypes of thing
Frogs are kinds of animal. (“frog” is a subtype of “animal”)	$\text{Frog} \sqsubseteq \text{animal}$	All instances of frog are subtypes of animal
Green is a kind of color.	$\text{Green} \sqsubseteq \text{color}$	All instances of green are subtypes of color
Green-frogs are frogs that are at least partly green.	$\text{GreenFrog} \doteq \text{frog} \sqcap \exists \text{hasColor.green}$	greenFrog is defined as including instances of frog that also have some color that is an instance of green
Completely-green-frogs are frogs that are entirely green, (no other color).	$\text{CompletelyGreenFrog} \doteq \text{frog} \sqcap \forall \text{hasColor.green}$	completelyGreenFrog is defined as including instances of frog whose color or colors are all instances of green
Completely-green-frogs are kinds of green-frog	$\text{CompletelyGreenFrog} \sqsubseteq \text{greenFrog}$	
Animals that are at least partly green.	$\text{Animal} \sqcap \exists \text{hasColor.green}$	all instances of animal that also have some color that is an instance of green
Rough-skinned frogs.	$\text{frog} \sqcap \exists \text{skinTexture.rough}$	all instances of animal that also have some color that is an instance of green
Rough green frogs.	$\text{frog} \sqcap \exists \text{skinTexture.rough} \sqcap \exists \text{hasColor.green}$	all instances of frog that have some instance of skinTexture that is rough and also have some color that is green
Rough green animals	$\text{Animal} \sqcap \exists \text{skinTexture.rough} \sqcap \exists \text{hasColor.green}$	
Rough green animals are kinds of green animal.	$\text{Animal} \sqcap \exists \text{skinTexture.rough} \sqcap \exists \text{hasColor.green} \sqsubseteq \text{animal} \sqcap \exists \text{hasColor.green}$	

## 6. Appendix B: Concept Modeling Process

The foundation for many of the hierarchies and roles assigned to concepts in SNOMED RT is derived from the knowledge already established in SNOMED International (SNOMED versions 3.0-3.5). Development of SNOMED RT was initiated with a formal collaboration between the College of American Pathologists and the Kaiser Permanente Foundation Health Plan, Inc. to enhance SNOMED into a completely machine-readable controlled medical terminology for computer-based patient records. A team of physicians and nurses from Kaiser's Southern California, Northern California, and Rocky Mountain regions, together with CAP staff, have assigned explicit hierarchies and essential characteristics to SNOMED concepts, thus converting SNOMED International into SNOMED RT.

Specialized tools and processes have been developed that facilitate a distributed development of SNOMED by domain experts at remote sites. These tools and processes will support collaborations with professional societies and organizations that may wish to contribute to the SNOMED RT development effort.

Modeling is the process of defining concepts to reflect their unique meaning. A flowchart depicting the modeling process is shown in Figure 1.

Each concept in SNOMED RT is independently modeled by two domain experts following established guidelines.<sup>8</sup> The modeled (defined) concepts from the two modelers are integrated into a central database where their definitions are compared. If any differences are found, the two definitions are returned to both modelers, each of which independently considers the two definitions and then consolidates them into a single new definition. These new definitions are re-entered into the database, compared, and if a difference still exists, the definitions are again returned to each modeler. The process continues until both modelers either agree on a final definition, or if consensus cannot be reached, defer to a larger group of modelers. The end result is a concept definition which is semantically reproducible between a minimum of at least two individuals.

In the process of modeling, a concept is placed into an appropriate "is-a" hierarchy (or hierarchies if applicable) by assigning it to its closest parent concept. Once assigned, this child concept, by definition, assumes the properties of the parent.

Every concepts is assigned at least one hierarchical "is-a" relationship. In addition, certain concepts are also assigned roles to explicitly describe the concept's essential characteristics. For example, three roles, which originated from the multiaxial cross references in SNOMED International, are used for concepts in the SNOMED RT Disease hierarchy:

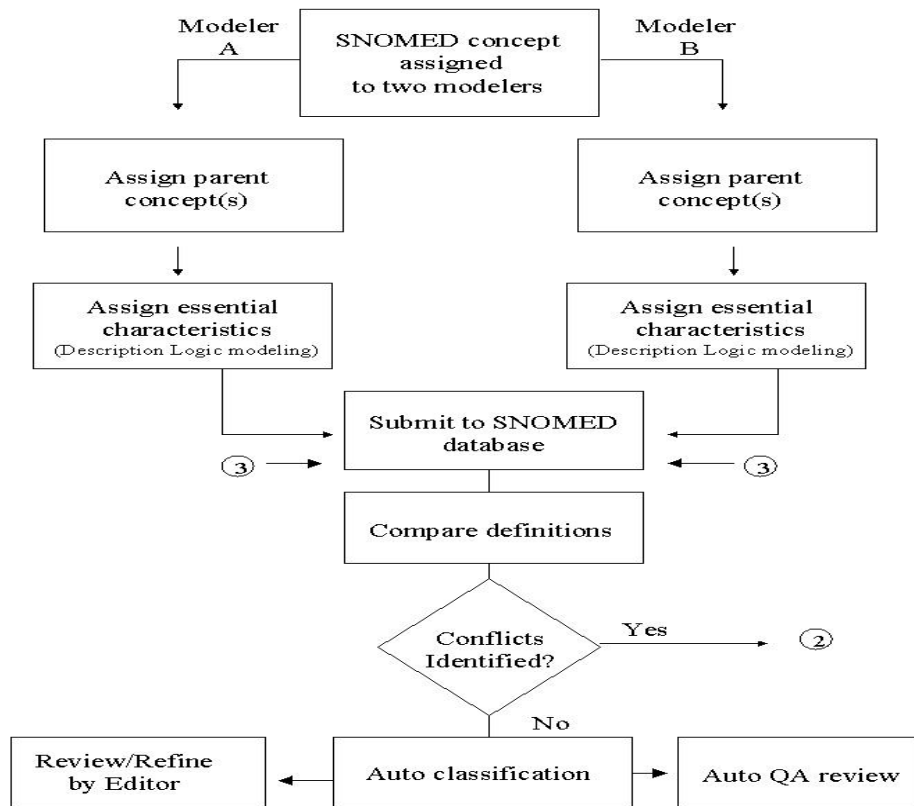
- Associated topography - the related anatomy
- Associated morphology - the morphologic change seen at the tissue or cellular level, affected by the disease or disorder; refers to the primary subject of the disease concept
- Associated etiology - the direct causative agent of the disease (does not include vectors, nor the method by which the etiology is introduced into the body)

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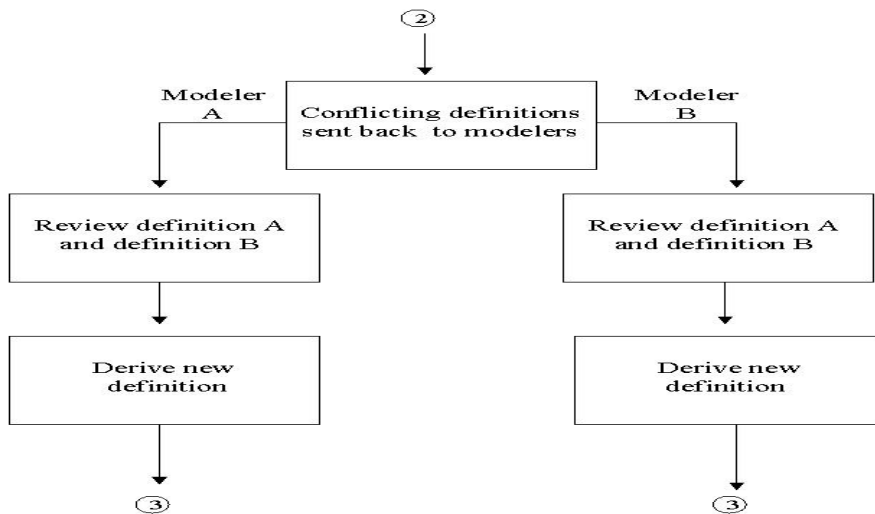
<sup>8</sup> Levy DH, Dolin RH, Mattison JE, Spackman KA, Campbell KE. Computer-facilitated collaboration: Experiences building SNOMED RT, Proc AMIA Annu Fall Symp. 1998.



Figure 1: SNOMED MODELING PROCESS



### Conflict Resolution



For example:

D2-02111: Allergic Rhinitis due to pollen

IS-A:	Allergic rhinitis
ASSOCIATED-TOPOGRAPHY:	Nose
ASSOCIATED-MORPHOLOGY:	Inflammation
ASSOCIATED-ETIOLOGY:	Pollen

"Is-a" specifies the hierarchical relationship. The closest parent concept to Allergic Rhinitis due to pollen is Allergic rhinitis. The next three lines are roles that define the essential characteristics of this concept.

The roles established to define findings and disorders may not be appropriate for defining other types of concepts, such as procedures or anatomy. Each "root" of a hierarchy may have different roles that are appropriate. These roles are carefully deliberated among the editors and modelers of SNOMED and only those which conform to the following characteristics will be considered for use in SNOMED RT:

The role must be

*understandable* to both modelers and ultimate users,

*reproducible* so that any two individuals can consistently and appropriately apply the role to any given concept with reproducible results

*useful* for aggregated analyses of outcomes, decision support, knowledge based practice guidelines, etc.

Two important points about the assignment of hierarchies and defining roles need to be noted:

1. For hierarchies, the parent concept must hold true "always," that is, in all but the most unusual situations (more than "98% of the time"). For example, in the procedure P1-19891 "Repair of Hammer Toe" one might expect the immediate parent concept to be P1-10100 "Incision of Bone" (ie, P-19891 IS-A P1-10100). However in about ten percent of cases, this procedure involves soft tissue only, therefore the 98% rule does not apply, and the more general concept P1-08000, Surgical Repair is the appropriate immediate parent concept (ie, P-19891 IS-A P1-08000).

The same rule holds true for assignment of role relationships. A role is applied when the value is known to be true virtually all of the time. For example, most cases of streptococcal pharyngitis are caused by Streptococcus group A. However more than 5% of these cases are caused by Streptococcus group C. Consequently, when defining the concept Streptococcal sore throat, Streptococcus group A is not chosen as a value for the ASSOC-ETIOLOGY role. A more general term, Streptococcus was selected.

2. Defining roles must be useful for aggregated analyses of outcomes, decision support, knowledge based practice guidelines, etc. in a clinical setting. Therefore, defining roles in SNOMED RT are assigned to those hierarchies where retrieval of clinical data is most useful and relevant (eg, procedure and diseases). Certain other hierarchies, such as Social Context, Morphology, Substances, Living Organisms, Biological Functions and Activities/Forces are all hierarchically organized, but only a limited number of these concepts are assigned defining roles.

## 7. Appendix C: Supplementary Definitions for Selected Concepts

The following table provides some supplementary definitions, sorted by SNOMEDId, for a few hundred concepts that SNOMED contributors felt should be given a textual definition. Although there remain many concepts that might benefit from such a definition, the intent here is to provide users with what exists so far, with the intention of expanding the definitions table as needed. Although it is unlikely that creating a definition for each concept will be necessary, these definitions provide supplemental information to clear up uncertainty or ambiguity for concepts where the terms (fully specified name, preferred name or synonyms) may not be enough.

SNOMEDId	Name	Definition
A-81050	X-ray	Electromagnetic radiation of wavelength between approximately 001 nm and 10 nm
A-81070	Light	Electromagnetic radiation in the visible range as well as parts of the ultraviolet and infrared ranges
A-81072	Visible light	Electromagnetic radiation in the visible range
A-81112	Radar	Electromagnetic radiation from a RAdio Detection and Ranging device
A-A1000	Accident	Accidental physical contact or exposure with potential or actual harmful effect
C-00224	Toxin	Toxic, noxious or poisonous substance that is produced by a living organism
C-200A0	Sand	Fine granular particles of rock or similar material
C-20554	Mineral spirits	Hydrocarbon solvents with flash points above 38 degrees C
C-21012	Amyl alcohol (commercial)	An alcohol obtained from refinement of fusel oil, contains mainly isopentyl alcohol and 2-methyl-1-butanol
C-21612	Methyl acetylene	Colorless gas with a sweet odor, used as fuel and shipped as compressed gas
C-21613	Methyl acetylene-propadiene mixture	A colorless gas with a characteristic foul odor, used as a fuel and shipped as a liquefied compressed gas
C-50000	Drug	Drugs, including drug products, generic drug names and drug categories
C-A6032	Frozen plasma product, human	Category of human frozen plasma products, regardless of time from donation to freezing
D0-00044	Scleredema	Hard non-pitting edema and induration of the skin; a finding associated with Buschke's disease
D0-01302	Cellulitis (disorder)	Inflammation that may involve the skin and or subcutaneous tissues, and or muscle
D0-01670	Dermatitis infectiosa eczematoides	Inflammation of skin adjacent to an infectious site by autoninoculation, appears as eczematous plaque appearance with or without vesicles
D0-22020	Intertrigo	Superficial dermatitis on opposed skin surfaces
D0-22138	Eosinophilic pustular folliculitis	A dermatosis with pruritic sterile papules and pustules that come together to form plaques with papulovesicular borders, and a tendency toward central clearing and hyperpigmentation, with spontaneous exacerbations and remissions. Histologically variable with folliculitis of follicle sheath and perifollicular dermis and spongiosis of follicular epithelium, with sometimes peripheral leukocytosis and or eosinophilia and or eosinophilic abscesses
D0-23010	Cutaneous lupus erythematosus	Disease of skin in someone with Lupus erythematosus, though not necessarily systemic or subacute
D0-40050	Lipodermatosclerosis	A decrease in lower leg circumference due to recurrent ulceration and fat necrosis causing loss of subcutaneous tissue in a patient with venous stasis disease
D0-40051	Localized lipodermatosclerosis	Recurrent ulceration and fat necrosis, associated with loss of subcutaneous tissue and a decrease in lower leg circumference
D0-52060	Dyshidrosis	Self limited vesicular eruption of palms and soles
D0-53824	Acquired digital fibrokeratoma	A keratotic cutaneous polyp containing abundant connective tissue
D0-75240	Photodermatitis	Dermatitis caused by exposure to sunlight
D0-75310	Calcaneal petechiae	Traumatic hemorrhage into heel that persists as black dots
D1-22350	Pathological dislocation of joint	Dislocation of joint caused by presence of another disease
D1-23665	Cervical rib syndrome	Thoracic outlet syndrome, either nerve or vessel compression, due to a cervical rib
D1-30000	Enthesopathy	Disorder occurring at the site of insertion of tendons or ligaments into bones or joint capsules
D2-01280	Surgical ciliated cyst	A cyst composed of maxillary sinus epithelium along a surgical line of entry

D2-61424	Lymphocytic pseudotumor of lung	Tumor like mass in lungs composed of fibrous tissue or granulation tissue with inflammatory cells
D3-16200	Round heart disease	A spontaneous cardiomyopathy of unknown etiology that affects healthy poultry
D3-30010	Cardiac dysrhythmia	Abnormality in rhythm of heartbeat, including rate, regularity and/or sequence of activation abnormalities
D3-80506	Peripheral cyanosis	Disorders characterized by slowing of blood flow to a body region in association with an increase in oxygen extraction from normally saturated arterial blood
D4-38016	Congenital partial portal-systemic shunt	Congenital portal-systemic shunt in which at least some portal blood perfuses the liver
D4-40131	Acrokerato-elastoidosis	A developmental disorder characterized by keratotic papules of skin of hands and soles with disorganization of dermal elastic fibers that does not appear to be due to trauma or sunlight
D4-40139	Howel-Evans' syndrome	A form of diffuse palmoplantar keratoderma that occurs between the ages of 5 and 15 and may be associated with the subsequent development of esophageal cancer
D4-51098	Kohlschutter's syndrome	Ameliogenesis imperfecta, mental retardation, and epileptic seizures
D4-A0655	Micropapilla	Congenital small optic disc with normal visual function
D4-A0806	Congenital blepharophimosis	A decrease in size of opening of the eye, not due to eyelid fusion, but rather lateral displacement of the inner canthi
D4-A0824	Microblepharia	Congenital abnormal vertical shortness of eyelids
D4-F1137	Amyelencephalus	Congenital absence of the spinal cord and brain
D5-15106	Abfraction	Noncarious lesion, where tooth is fatigued, flexed, and deformed by biomechanical loading of the tooth structure, primarily at the cervical region. These are usually wedge shaped lesions with sharp line angles, but sometimes are circular invaginations on occlusal surfaces
D5-21244	Bednar's aphthae	Symmetric excoriation of the hard palate often due to sucking in infants
D5-21613	Peripheral ossifying fibroma	A fibroma of the gums with calcification and possibly ossification
D5-42004	Obturation obstruction of intestine	Complete obstruction of the intestine due to the presence in the lumen of blocking material, such as tumor, fecalith, gallstone, or foreign body
D5-45211	Knight's disease	Infection of perianal region of skin following abrasion, which is named for the occurrence in horsemen
D5-60862	Intersigmoid hernia	Hernia of part of the intestinal tract through the intersigmoid recess or fossa
D5-90416	Pancreatempyrosis	Obstruction of the pancreatic duct leading to swelling of the pancreas as a whole
DA-30000	Epilepsy	A disorder characterized by recurrent seizures
DA-40020	Neuritis	Inflammation of a peripheral AND/OR cranial nerve
DA-42100	Erb-Duchenne paralysis	A disorder of the superior trunk of the brachial plexus or the fifth and sixth cervical spinal nerves or motor roots, resulting in weakness of proximal upper extremity musculature innervated by these nerve roots
DA-48100	Equine grass sickness	Autonomic dysfunction of unknown etiology in horses, with gut paralysis as primary manifestation
DA-70170	Ophthalmia nodosa	A granulomatous, inflammatory disorder of the eye, reaction to vegetable or insect hairs
DA-71725	Lipidemia retinalis	An abnormal milky appearance of arteries and veins of retina, for example due to lipids in blood greater than 5%, diabetes mellitus, or leukemia
DA-72546	Entropion uveae	Eversion of the margin of the pupil
DA-73661	Nuclear sclerosis	Increased density of lens that occurs with aging; precedes senile nuclear cataract
DA-78238	Raymond-Cestan syndrome	Abducent nerve paralysis with contralateral hemiparesis
DC-10190	Central cyanosis	A form of cyanosis that occurs when there is a decrease in oxygen saturation in the arterial blood, usually with an SaO <sub>2</sub> of below 75%
DC-38001	Erythrocytosis	Peripheral blood red cell count above the normal range
DC-60000	Blood coagulation disorder	Disorders involving the elements of blood coagulation, including platelets, coagulation factors and inhibitors, and the fibrinolytic system
DC-63000	Coagulation factor deficiency syndrome	Includes both quantitative and qualitative disorders of procoagulants
DC-64100	von Willebrand disease	Hereditary disorder resulting from a mutation at the VWF locus
DC-64101	von Willebrand disorder	Includes true von Willebrand disease with mutation at the VWF locus, as well as mimicking disorders with other mutations (pseudo VWD) and acquired von Willebrand syndrome
DC-64211	Pseudo von Willebrand disease	Any inherited disorder mimicking von Willebrand disease but lacking mutation at the VWF locus
DD-00001	Injury (disorder)	Disorder resulting from physical damage to the body
DD-12432	Bennett's fracture	Fracture and dislocation of the first metacarpal and the carpal-metacarpal joint

DE-00004	Post-infectious disorder	A disorder that follows infection but is distinct from the infection itself and its usual manifestations
DE-01200	Nosocomial infectious disease	Infection associated with hospitalization, not present or incubating prior to admission, but generally occurring more than 72 hours after admission
DF-000D3	Non-human disorder	Disorders which occur in animals but not in man
DF-000F9	Neurologic disorder of eye movements	Disorders characterized by eye movement abnormalities that are the result of brain, cranial nerve, or neuromuscular junction dysfunction
DF-00833	Giant axonal neuropathy	An autosomal recessive condition characterized by progressive degeneration of the central and peripheral nervous system with enlargement of axons
DF-10010	Adverse drug reaction	All noxious and unintended responses to a medicinal product related to any dose should be considered adverse drug reactions' From US FDA 'Guideline for Industry, Clinical Safety Data Management: Definitions and Standards for Expedited Reporting'
F-00000	Biological function	Any function or property that is not mainly morphologic or structural, including both measurable and observable features and physiologic actions
F-01001	Finding, conclusion AND/OR assessment	An assertion about the state of the patient (or the subject of study), including findings, diseases, disorders, observations, assessments, conclusions, inferences, and so forth
F-16340	Catch	A sudden pain, usually sharp, occurring during movement, or exacerbated by movement, and prompting cessation of movement
F-20000	Respiratory function	Any function involved in the exchange of oxygen and carbon dioxide between the atmosphere and the cells of the body
F-20160	Mouth breathing	Habitual breathing through the mouth, usually associated with obstruction of nasal passages
F-20370	Bohr effect	Right shift of the hemoglobin oxygen dissociation curve due to lower pH with increased carbon dioxide
F-23550	Fremitus	Vibration felt on the chest wall, either by examiner or subjective
F-24432	Reverse sneezing	An inhalation reflex stimulated by an irritation of the mucous membrane of the nose
F-25170	Electrophrenic respiration	Procedure that applies electrical stimulation to the phrenic nerve to achieve ventilation
F-31003	Finding of increased blood pressure	A finding of increased blood pressure, not necessarily hypertensive disorder
F-31004	Decreased blood pressure, not hypotension	A finding of decreased blood pressure, not necessarily hypotensive disorder
F-31730	Abdominal pulse	Pulse felt over the abdominal aorta
F-31760	Allorhythmic pulse	A pulse with repeated irregularity
F-32320	Cardiovascular shunt	Anomalous flow of blood between different parts of the circulation
F-35072	Abnormal third heart sound, S <sub>3</sub> >	Any abnormality of the third heart sound
F-35142	Abnormal fourth heart sound, S <sub>4</sub> >	Any abnormality of the fourth heart sound
F-35736	Austin Flint murmur	A mid-to-late diastolic murmur heard best at the cardiac apex, heard in cases of aortic insufficiency
F-35738	Graham Steell murmur	High-pitched diastolic murmur heard best at left sternal border, associated with pulmonary valve insufficiency
F-35760	Thrill	Vibration felt by examiner on the surface of the body
F-35820	Presystolic gallop	A 'galloping' sound on cardiac auscultation because of an abnormally audible fourth heart sound
F-35830	Protodiastolic gallop	A 'galloping' sound on cardiac auscultation because of an abnormally audible third heart sound
F-35854	Heart murmur configuration, plateau	Cardiac murmur with no significant crescendo or decrescendo
F-54160	Flatulence	Excessive gas in the digestive tract
F-54170	Flatus	Passage of gas by anus
F-62023	Hyperalbuminemia	Increased serum albumin concentration
F-62024	Hypoalbuminemia	Reduced serum albumin concentration
F-63007	Short chain fatty acid	Fatty acid with fewer than 10 carbon atoms
F-63008	Medium chain fatty acid	Fatty acid with 10 to 14 carbon atoms
F-63009	Long chain fatty acid	Fatty acid with 10 or more carbon atoms
F-8A080	Haagensen test	Breast examination for malignancy, patient leans forward and breasts examined for abnormal contour
F-A7923	Pleocytosis	Presence of greater than normal number of cells in the cerebrospinal fluid
F-A8870	Queckenstedt's test	Measurement of CSF pressure following compression of jugular vein
F-C0710	Agammaglobulinemia	Absence of the gamma fraction of serum globulin
F-C0720	Hypogammaglobulinemia	Decreased concentration of the gamma fraction of serum globulin

F-C30F9	Allergy	Known to have allergic reactions to particular substance(s)
F-D0110	Ineffective erythropoiesis	Increased destruction of erythrocyte precursors
F-D7300	Tissue factor	Tissue factor, the high-affinity receptor and cofactor for the plasma serine protease VII/VIIa
F-F5002	Paracusis	Altered sense of hearing, other than simple decreased hearing or deafness
F-F5080	Auditory area (sound intensity)	Range of sound intensity between the minimum audible intensity and the auditory pain threshold
G-8000	Specimen	Material (structure, substance, device) removed from a source (patient, donor, physical location, product)
J-14126	Imam	Muslim prayer leader
L-8812A	Canis lupus familiaris	Domestic dog subspecies
L-8A101	Equus	Horse, donkey, mule genus
L-8A122	Equus asinus asinus	Equus subspecies
L-8A144	Equus caballus gmelini X Equus caballus caballus	Intersubspecies equine hybrid
L-8B101	Sus	Swine genus
L-8B10A	Sus scrofa scrofa	Domestic pig subspecies
L-8B93A	Bos	Cattle genus
L-8B951	Bison bison X Bos taurus indicus X Bos taurus taurus	Intergenous hybrid of cattle
L-8B952	Bos taurus indicus X Bos taurus taurus	Intersubspecies cattle hybrid
L-8B953	Bos javanicus X Bos taurus indicus	Interspecies hybrid of cattle
L-8B986	Bison X Bos taurus taurus	Intergenous cattle hybrid
L-8C306	Capra hircus	Domestic goat
L-8C30A	Capra hircus hircus	Domestic goat subspecies
L-8C336	Ovis aries	Domestic sheep species
L-8C337	Ovis aries aries	Domestic sheep subspecies
L-8C338	Merino	Merino sheep breed group
L-92100	Anas	Duck genus
L-9210A	Anas platyrhynchos	Mallard duck species
L-92220	Anser	Goose genus
L-92222	Anser anser anser	Greyleg goose subspecies
L-9222A	Anser anser	Greyleg goose species
L-93790	Gallus gallus	Junglefowl
L-9379A	Gallus	Junglefowl genus
M-01444	Rupture	Disruption of continuity of tissue, not necessarily due to external forces, may be due to weakness in the tissue or excessive internal pressures
M-01471	Cutaneous patch	Skin lesion, greater than 2cm, flat, colored Differs from a macule only in size
M-01472	Cutaneous plaque	Skin lesion, greater than 2cm, flat, colored Differs from a macule only in size
M-03010	Nodule	A 1-5 cm firm lesion raised above the surface of the surrounding skin, differs from a papule only in size
M-03130	Papule	A small, solid lesion, less than 1cm in diameter, raised above the surface of the surrounding skin and hence palpable
M-04013	Macule	A flat lesion, less than 2cm in diameter, not raised above the surface of the surrounding skin
M-10000	Traumatic abnormality	A structure damaged by an external force
M-11000	Thermal injury	Injury due to increased heat
M-11100	Burn injury	Generic burn injury, including that due to excessive heat, as well as cauterization, friction, electricity, radiation, sunlight, and other causes
M-11106	Thermal burn	Burn injury due to excessive heat
M-13400	Sprain	Injury to a ligament due to movement of joint beyond normal range
M-31318	Ectropion	The structure representing the everted margin of a part
M-35100	Thrombus	Antemortem blood clot in the cardiovascular system
M-36320	Urticaria	A raised, erythematous papule or cutaneous plaque, usually representing short-lived dermal edema
M-36750	Vesicle	A small (less than 1 cm) fluid-filled lesion, raised above the plane of surrounding skin
M-36760	Blister	A fluid-filled, raised, often translucent lesion, greater than 1 cm in diameter
M-41601	Pustule	A vesicle filled with leukocytes
M-55090	Pathologic mineralization	Deposition of mineral in normally non-mineralized tissue
M-55400	Calcified structure	Structure with calcium deposition
M-55420	Pathologic calcification	Deposition of calcium in normally non-calcified tissue

P0-00080	Evaluation	Determination of a value, conclusion or inference by evaluating evidence
P0-00081	Measurement	An observation, by some objective method, of amount, number, quantity, size, level, extent, or magnitude, resulting in an ordinal or quantitative value
P0-00098	Physician service	Service provided by physician
P0-00100	Administrative procedure	Procedure related to the administrative aspects of health care, including admission, discharge, transfer, disposition, referral, business, legal, financial, quality review, peer review, data reporting, notification, and so forth
P0-04000	Observation	A procedure that determines a value, such as lab result or response to an action, typically for the purpose of evaluating a patient
P0-04001	Assisting	Helping the body perform a function it normally does on its own
P0-04002	Listening	An observation using the sense of hearing
P0-04003	Management procedure	A plan or recommendation for services, based on an evaluation
P0-04006	Stimulation	Procedure to arouse the body or any of its parts or organs to increase functional activity
P0-10000	Hospital admission	Performance of the steps necessary to admit a patient to a hospital
P0-20000	Patient discharge	Performance of the steps necessary to discharge a patient from a location of care delivery
P0-20301	Patient transfer	Performance of the steps necessary to transfer a patient between locations of care delivery
P0-80000	Chart review by physician	A chart evaluation performed by a physician
P0-80001	Chart related administrative procedure	An administrative procedure that involves a medical record chart
P0-80002	Chart evaluation by healthcare professional	An evaluation of a medical chart by a healthcare professional
P0-80500	Quality of care procedure	A procedure that assesses the quality of health care service delivery
P0-80600	Medical audit procedure	A quality of care determination performed retrospectively
P0-80660	Medical service audit	A medical audit of direct care providers
P0-80690	Ancillary service audit	A medical audit of ancillary services (such as physical therapy, dietary)
P0-806A0	Financial audit	A financial procedure that assesses a financial situation
P0-80800	Chart evaluation by non-healthcare professional	a chart related administrative procedure that checks a chart for completion and accuracy and conformance to chart policy
P0-80820	Chart review, verification of charges	A financial audit to review and/or verify charges
P0-80850	Chart opening	A chart related administrative procedure that involves opening the chart
P0-80860	Chart abstracting	A chart related administrative procedure that involves abstracting information from the chart
P0-80890	Chart completion by medical records	A chart related administrative procedure done by the medical records department
P0-90003	Medicolegal procedure	An administrative legal procedure
P0-A0200	Education	Providing knowledge to someone
P0-A0201	Training	An education that includes hands-on practice by the recipient of the education
P1-00000	Surgical procedure	Planned structural alteration of the body, usually requiring disruption of a body surface (usually skin or mucosa)
P1-00031	Revision	Repeating a prior procedure to correct or improve the results
P1-01000	Incision	Making a cut in something
P1-01001	Exploratory incision	An incision done for the purpose of performing an exploration
P1-01002	Exploration procedure	An observation of the body or a body part done by inspection and/or palpation
P1-01003	Dissection procedure	A separation of different structures along natural cleavage lines by dividing the connective tissue framework
P1-01008	Decompressive incision	An incision that relieves abnormal pressure on a structure
P1-01009	Reexploration procedure	A repeated exploration
P1-01012	Evacuation	Removal of the contents of a body cavity or container
P1-01013	Drainage	Evacuation of liquid contents by gravity
P1-01020	Transsection	A division made transversely across a long axis
P1-01027	Division	An incision that separates something into two or more parts
P1-01100	Puncture procedure	A procedure done by piercing or penetrating with a pointed object or instrument
P1-01130	Centesis	A puncture into a space with an aspiration of that space
P1-03000	Excision	Removal done with a cutting instrument
P1-03002	Complete excision	Complete excision and removal of an entire body organ
P1-03003	Removal	To take something off or out, to get rid of, to eliminate
P1-03004	Wedge resection	Excision of a wedge-shaped piece of tissue (often but not necessarily for diagnostic examination)

P1-0300B	Expulsion	Evacuation using positive pressure
P1-03030	Amputation	Excision of normal topography
P1-03038	Disarticulation	Amputation through a joint without cutting of bone
P1-03053	Evisceration	Radical excision of tissues and organs of a body cavity
P1-03056	Enucleation	A removal of an anatomic or pathologic structure in entirety without breakage
P1-03100	Biopsy	Removal of tissue for diagnostic examination
P1-03101	Excisional biopsy	Biopsy that removes an entire lesion, with or without surrounding tissue
P1-03102	Incisional biopsy	Biopsy that involves incision and removal of part of a lesion or organ, rather than excision of the entire lesion or organ
P1-03103	Open biopsy	Biopsy by open approach, as opposed to percutaneous or endoscopic methods
P1-03130	Aspiration	Extraction using negative pressure
P1-03140	Debridement	Removal of devitalized tissue
P1-03150	Curettage	Scraping done with a curette
P1-03153	Shaving	A scraping away of thin sections
P1-03154	Scraping	Removal from a surface by repeated strokes of an edged instrument
P1-04FFF	Introduction	Introduction of object AND/OR substance into or onto body, including injection, implantation, infusion, perfusion, transfusion, irrigation, instillation, insertion, placement, replacement, packing, intubation, catheterization, cannulation
P1-05000	Injection	Administration using positive pressure and a needle or other equipment to drive a substance into the body
P1-05015	Tattooing	An injection of indelible pigments
P1-05025	Inflation	Insufflation of a hollow organ or body cavity with gas, causing it to distend or swell
P1-05030	Infusion	An injection that is continuous
P1-05050	Irrigation	Administration that washes with a stream of liquid
P1-05060	Insufflation	An injection of a gas or powder into a body cavity by positive pressure
P1-05070	Instillation	Administration of a liquid, drop by drop, into or onto the body
P1-05080	Embolization	an injection of some substance into the circulation to occlude vessels, either to arrest or prevent hemorrhaging or to devitalize a structure or organ by occluding its blood supply
P1-05500	Implantation	Introduction of a non-biologic device
P1-05501	Reimplantation	Implantation that is being revised
P1-05502	Surgical implantation	Implantation of a device, either requiring or resulting in structural alteration of the body
P1-05530	Intubation	An insertion of a tubular device into a canal, hollow organ, or cavity
P1-07000	Endoscopy	an inspection done with an endoscope
P1-08000	Surgical repair	Restoring, to the extent possible, the natural anatomical structure
P1-08005	Augmentation procedure	Procedure to increase the size, shape or volume of a body structure
P1-08060	Exteriorization	To expose the inner surface of a structure to the external surface of the body
P1-08061	Marsupialization	A construction of a pouch, achieved by resecting the anterior wall of a cyst or other enclosed cavity and suturing the cut edges of the remaining wall to adjacent edges of skin
P1-08400	Closure	A repair that unites structures
P1-08413	Closure by staple	A closure done by stapling
P1-08420	Ligation	To bind with a ligature
P1-08421	Suture ligation	A ligation where the surgical suture serves as a ligature
P1-08460	Fixation	The act or operation of holding, suturing, or fastening in a fixed position
P1-08490	Stapling	An implantation of a staple
P1-08600	Construction	The act of building something
P1-08601	Reconstruction procedure	A reparative construction that builds or rebuilds a structure that should normally be present
P1-08610	Construction of anastomosis	A construction of an opening between two hollow structures, organs, or spaces, be they real or artificial
P1-08611	Construction of shunt	A construction of an alternate route of passage of a bodily substance
P1-08612	Construction of stoma	A construction of an abnormal passage between a cavity or hollow organ and the surface of the body
P1-08613	Construction of window	A construction of openings or fenestrae
P1-08617	Construction of interposition anastomosis	An anastomosis that places a tubular structure between the cut ends of a previously contiguous tubular structure
P1-08700	Fusion-stabilization and immobilization	A fixation that joins together two body parts rendering them immobile with respect to each other



P1-08702	Fusion	Procedure to cause two adjacent structures to be structurally joined together
P1-08703	Anchoring	Procedure to fix a mobile or flexible structure to a rigid or inflexible structure
P1-08710	Refixation	A fixation that is being revised
P1-08900	Diversion procedure	Procedure to divert the flow of body fluids, involves creation of a shunt
P1-0C000	Destructive procedure	Eradicating all or a portion of a body part
P1-0C002	Surgical avulsion	A removal done by tearing away or forcible separation
P1-0C015	Stripping	A removal done by peeling, often using a stripper
P1-0C025	Coagulation	A destruction of tissue by means that results in condensation of protein material
P1-0C026	Denervation	Destruction of the nerves supplying a body part, rendering the body part denervated
P1-0C027	Obliteration	A destruction of a natural space or lumen by induced fibrosis or inflammation
P1-0C080	Cauterization	A destruction of tissue by burning or searing with a thermal instrument, an electric current, or a caustic substance
P1-0C200	Thermocautery	A cauterization done with thermal energy
P1-0C400	Crushing	A destruction done by injurious pressure Note that this pressure can be mechanical, as in squeezing between two hard bodies, or can be a pressure wave, as is used to crush internal stones
P1-0C410	Litholapaxy	A crushing of calculi (stone)
P1-0C430	Emulsification procedure	A destruction achieved by turning a solid into an emulsion
P1-0C504	Chemodenervation	A denervation done using chemicals
P1-0C620	Laser beam photocoagulation	A photocoagulation using a laser beam
P1-0D000	Transplantation	To move body tissue or cells from donor site to recipient site
P1-0D010	Autogenous transplantation	A transplantation where the donor and recipient spots are part of the same organism
P1-0D012	Syngeneic transplantation	A transplantation where the donor and recipient spots are part of genetically identical organisms
P1-0D016	Allogeneic transplantation	A transplantation where the donor and recipient spots are from antigenically distinct individuals of the same species
P1-0D100	Bypass graft	A construction of a shunt using either biologic or synthetic material
P1-0D200	Transposition procedure	An autogenous transplantation that does not entirely sever the topographic object from the donor spot, at least until it is united at the recipient spot
P1-0E000	Manipulation	Skilled dextrous action of the hands directly applied to a body part
P1-0E100	Mobilization	A procedure that mobilizes or frees up an abnormally fixed structure
P1-0E150	Traction	The act of exerting a pulling force
P1-0E200	Manual reduction	A repair done via manipulation
P1-0E300	Extraction	Removal done by pulling
P1-0E350	Expression	An expulsion done by manipulation
P1-0E410	Dilation and stretching	A dilation and a stretching
P1-0E411	Stretching	Enlarging or distending a structure, increasing its internal wall stress
P1-0E420	Manual dilation and stretching	A dilation and stretching done by manipulation
P1-0E440	Probing	An exploration done using a probe
P1-0E450	Bougienage	A dilation done with a bougie
P1-0E501	Fitting procedure	A measurement or adjustment of a device or biologic material to the right shape or size so as to conform correctly when introduced or transplanted
P1-0E600	Application	Introduction of a substance or device to the surface of the body
P1-10887	Tenosuspension	Procedure to anchor a tendon to act as a suspensory ligament
P1-10C04	Osteoclasts	A destruction that purposefully results in a fracture of bone
P1-13860	Cervical arthrodesis	The stiffening of one or more cervical joints by operative means
P1-17A45	Pollicization of a digit	The act of making a thumb out of a digit [finger or toe]
P1-19376	Ostectomy, excision of tarsal coalition	Excision of the fibrous, cartilaginous, or bony fusion of two or more of the tarsal bones
P1-199B0	Midtarsal arthrodesis	Arthrodesis of one or more of the tarsal joints
P1-41D60	Intermediate delay of small flap at scalp	Delayed transfer flap-a flap graft that is partially rased from the donor bed to permit collateral circulation of the pedicle
P1-48120	Periprosthetic capsulotomy of breast	Division of a fibrous capsule surrounding a prosthetic breast implant
P1-48303	Periprosthetic capsulectomy of breast	Excision of a fibrous capsule surrounding a prosthetic breast implant
P1-78331	Excision of median bar of prostate by transurethral approach	Median bar-a fibrotic structure accross the neck of the prostate causing urethral obstruction
P1-79370	Excision of hydatid of Morgagni in male	Excision of appendix of testis - vestige of Mullerian duct

P1-82308	Vaginal enterocelectomy	Excision of an enterocele, a posterior vaginal hernia
P1-8280B	Latzko operation on vagina	Repair of vesicovaginal fistula
P1-82826	McIndoe operation for construction of vagina	Construction of an artificial vagina consisting of a mold covered with a split-thickness skin graft
P1-82827	Williams-Richardson operation for construction of vagina	A vulvovaginoplasty procedure described by Williams to create a vaginal canal
P1-82833	Harrison-Richardson operation on vagina	Vaginopexy according to Williams and Richardson is an abdominal colposuspension by strips from external oblique
P1-82909	Pereyra procedure including anterior colporrhaphy	Pereyra procedure: Needle suspension and suture of bladder neck for stress incontinence
P1-86E22	Crede maneuver	A method of external massage of the uterus to promote delivery of the placenta
P1-A4822	Iridenclieisis	Excision of part of the iris and part of the limbus to allow more aqueous to flow under the conjunctiva in glaucoma patients
P1-A4824	Iridotaxis	Stretching of the iris to increase the outflow of aqueous from the eye in glaucoma patients
P1-A5344	Erysiptake extraction of cataract by intracapsular approach	Intracapsular extraction of cataract using and erysiptake-an instrument used to aspirate a cataract
P1-A5820	Lens couching procedure	Obsolete procedure involving displacement of lens into vitreous for treatment of cataract
P2-00150	Photography of patient	An observation that generates a recording made from energy of the light spectrum
P2-01000	History taking	A clinically oriented interview of a patient or someone familiar with the patient
P2-01060	History taking, self-administered, questionnaire	A history taken by a self-administered questionnaire
P2-01400	Physical examination procedure	An observation of the body or a body part using one of the five human senses (eg inspection, palpation, percussion, auscultation)
P2-01500	Inspection	An exploration using the sense of sight, done with the eyes
P2-01510	Palpation	An exploration using the sense of touch
P2-01550	Percussion	A listening of the sounds produced in response to tapping the body surface
P2-01560	Auscultation	A listening to spontaneously generated body sounds
P2-01570	Optical transillumination	An inspection by the passage of light through tissues or a body cavity
P2-08000	Prescription	A legal order to dispense and possibly prepare a substance or physical object
P2-22100	Inhalation therapy procedure	An administration into the respiratory tract by inspiration
P2-22200	Mechanical ventilation	A mechanical respiratory assistance done by insufflation of the lungs
P2-22223	Jet ventilation procedure	Jet ventilation physically directs a high-velocity jet of humidified gas into the endotracheal tube at rapid frequencies, entraining additional fresh gas during insufflation
P2-22902	Artificial respiration	An assistance of respiration
P2-22905	Respiratory assist, manual	An artificial respiration done manually
P2-22906	Respiratory assist, mechanical	An artificial respiration done mechanically
P2-25010	Measurement of respiratory function	A procedure on the respiratory tract that observes pulmonary function
P2-25250	Measurement of lung volume	A pulmonary function test that measures lung volumes
P2-30600	Ballistocardiography	Obsolete method for determining cardiac output by measuring recoil of body due to cardiac contraction
P2-40300	Iontophoresis procedure	An administration into the tissues of an ionic substance by means of an electric current
P2-44010	Allergy testing	An immune system procedure that observes for evidence of hypersensitivity
P2-450F8	Administration	Introduction of a substance to the body
P2-68000	Transfusion	An infusion of blood or blood product
P5-C0900	Radioimmunotherapy	Radiation therapy using radiolabelled antibodies
P7-00040	Functional assessment	An evaluation of the performance of an organ, organ system, or body part
P7-10000	Physiatric manipulation	A manipulation done by a physiatrist
P7-11000	Osteopathic manipulation	A manipulation done by an osteopath
P7-12000	Chiropractic manipulation	A manipulation done by a chiropractor
P8-80770	Reline lower partial denture, laboratory	Refitting a denture by replacing the denture base while keeping the occlusal relationship of the teeth the same
P8-85460	Crown, porcelain fused to noble metal	Crowning-preparation and covering of the natural crown of a tooth with a veneer consisting of a metal, plastic resin or porcelain or combinations
S-11033	Unmarried	Not currently married
S-11040	Widowed state	An unmarried person whose spouse has died

T-02660	Skin of hand, including finger	Skin region including some skin of finger AND some additional non-finger skin
T-03660	Subcutaneous tissue of hand, including finger	Subcutaneous tissue including some tissue of finger AND some additional non-finger tissue
T-11039	Epiphyseal line	The location of the epiphyseal growth plate subsequent to its ossification
T-12762	Tarsal bone	Any bone that is part of the tarsus
T-13007	Endomysium	Fine connective tissue sheath around a muscle fiber
T-15624	Manubriosternal synostosis	The connection between the manubrium and sternum that has progressed from a symphysis to bony union (synostosis)
T-17441	Flexor tendon of wrist	Tendons involved in flexing the wrist joint, excluding flexor tendons that pass through the wrist that flex the fingers
T-21370	Inferior nasal turbinate	Shell-shaped structure of lateral inferior nasal cavity, including bone and covering mucous membrane
T-21380	Middle nasal turbinate	Shell-shaped structure of lateral middle nasal cavity, including bone and covering mucous membrane
T-21390	Superior nasal turbinate	Shell-shaped structure of lateral superior nasal cavity, including bone and covering mucous membrane
T-21391	Supreme nasal turbinate	Shell-shaped structure of lateral nasal cavity above the superior nasal turbinate, including bone and covering mucous membrane
T-21420	Agger nasi	Ridge on the lateral internal nasal wall due to the ethmoidal crest of the maxilla
T-44000	Pulmonary artery	Includes pulmonary trunk, left and right main pulmonary arteries, and all their branches
T-44004	Mediastinal pulmonary artery	Includes pulmonary trunk and left and right main pulmonary arteries
T-45010	Carotid artery	One of the common carotid, internal carotid or external carotid arteries
T-48300	Vein of thorax	Vein located within the thorax
T-48501	Right pulmonary vein	One of the great vessels draining venous blood from the right lung
T-48502	Left pulmonary vein	One of the great vessels draining venous blood from the left lung
T-48581	Vein of lung	Any vein draining the lungs, including pulmonary veins proper and their tributaries
T-49215	Antecubital vein	A vein located in the antecubital fossa
T-50100	Digestive tract	Entire digestive tract including mouth, esophagus, stomach, and intestines
T-50101	Gastrointestinal tract	Esophagus, stomach, small intestine and large intestine together as a single entity
T-50110	Upper gastrointestinal tract	Esophagus, stomach and duodenum
T-50120	Lower gastrointestinal tract	Jejunum, ileum, colon, rectum and anal canal
T-51010	Vestibule of mouth	The part of the oral cavity external to gums and teeth and internal to cheeks and lips
T-51020	Oral cavity proper	The part of the oral cavity internal to the teeth and bounded posteriorly by the palatoglossal arch
T-53130	Root of tongue	The part of the tongue that is on the floor of the mouth, and is not covered by mucous membrane
T-53131	Base of tongue	The pharyngeal part of the tongue, forming the anterior wall of the oropharynx
T-54026	Clinical crown of tooth	Portion of tooth exposed above gums, the part above the clinical root
T-54061	Coronal pulp of tooth	Part of the pulp of tooth that is within the crown portion of the pulp cavity
T-545A1	Carnassial tooth	Tooth adapted to shear flesh
T-56500	Crop	Dilated part of esophagus for food storage in birds
T-58049	Crypt of Lieberkühn	Denotes the pits or crypts, but not the glands that lie beneath them
T-58140	Enteroendocrine cell	Endocrine cell of the gut
T-59261	Pelvic appendix	Appendix which is oriented posteriorly and inferiorly in to the pelvic cavity
T-70001	Urinary system	Organs of urine formation and secretion
T-A0050	Visual system	The eye, ocular adnexa, afferent visual pathways, efferent visual pathways and pupil innervation pathways
T-A1110	Meninges	The three membranes that surround the brain and spinal cord, consisting of the dura mater, arachnoid, and pia mater The pia and arachnoid in combination are referred to as the leptomeninges
T-A1600	Brain ventricle	The four ventricles of the brain, including the two lateral ventricles, the third ventricle and the fourth ventricle
T-A9814	Hepatic plexus	An unpaired autonomic plexus that is part of the celiac plexus that lies on the hepatic artery and its branches in the liver
T-A9815	Splenic plexus	An autonomic plexus that is a subdivision of the celiac plexus that accompanies the splenic artery
T-A9816	Gastric plexus	Autonomic plexi that are part of the celiac plexus that lies on the greater and lesser curvatures of the stomach

T-A9817	Pancreatic plexus	An autonomic plexus that is a subdivision of the celiac plexus and accompanies the pancreatic arteries
T-A9818	Adrenal plexus	An autonomic plexus that is a subdivision of the celiac plexus that accompanies the adrenal artery
T-A9819	Renal plexus	An autonomic plexus that is a subdivision of the celiac plexus that accompanies the renal artery
T-A981A	Ureteral plexus	An autonomic plexus that is derived from the celiac plexus, more specifically renal and hypogastric plexi, that accompanies the ureteric artery to the ureter
T-A981B	Testicular plexus	An autonomic plexus that is a subdivision of the aortic plexus, or derived from it, that accompanies the testicular artery
T-A981C	Ovarian plexus	An autonomic plexus that is a subdivision of the aortic plexus, or derived from it, that accompanies the ovarian artery
T-A9820	Superior mesenteric plexus	An autonomic plexus that branches from the aortic plexus, that sends nerves to intestines and with the vagus forms subserous, myenteric and submucous plexus
T-A9821	Celiac plexus	An autonomic plexus that is a superior subdivision of the aortic plexus that runs anterior to aorta at the level of the celiac trunk T12 contains celiac ganglia and most visceral afferents pass through it
T-A9822	Aorticorenal ganglia	A part of the celiac ganglion that is semidetached and contains sympathetic neurons that innervate the kidney
T-A9830	Inferior mesenteric plexus	An autonomic plexus that branches from the aortic plexus, that sends nerves to descending colon, sigmoid, and rectum along the path of the inferior mesenteric artery
T-A9831	Superior rectal plexus	An autonomic plexus that branches from the inferior mesenteric plexus, accompanies superior rectal artery to rectum
T-A9840	Auerbach's plexus	A subdivision of the enteric plexus that lies within the tunica muscularis of the intestinal tract
T-A9841	Meissner's plexus	Part of the enteric plexus situated in the intestinal submucosa
T-A9842	Iliac plexus	Autonomic plexus derived from the aortic plexus accompanying iliac arteries
T-A9843	Femoral plexus	An autonomic plexus accompanying the femoral artery and derived from the iliac plexus
T-A9850	Inferior hypogastric plexus	An autonomic plexus formed by the junction of the hypogastric nerve and the splanchnic nerve on each side, supplies pelvic viscera
T-A9851	Hypogastric nerves	Nerves in the pelvis that connect the superior hypogastric plexus to the inferior hypogastric plexus
T-A9860	Superior hypogastric plexus	A continuation of the aortic plexus that leads to the right and left hypogastric nerves
T-A9861	Pelvic ganglia	Sympathetic and parasympathetic ganglia within pelvic plexi
T-A9862	Medial rectal plexus	A subdivision of inferior hypogastric plexus, maybe derived from it, that supplies nerves to the rectum
T-A9864	Prostatic sympathetic plexus	Autonomic plexus that run through the capsule of the prostate and are derived from the inferior hypogastric plexus and supply the cavernous nerves of the erectile tissue of penis
T-A9866	Uterovaginal plexus	Autonomic plexus with ganglia derived from inferior hypogastric plexus that supplies uterus, vagina, ovary, erectile tissue of vestibule and urethra
T-A9867	Vaginal nerves	Nerves running from uterovaginal plexus to vagina that are both sympathetic and parasympathetic
T-A9868	Vesical plexus	An autonomic plexus derived from inferior hypogastric plexus to supply sympathetic nerve fibers to urinary bladder, ureter, ductus deferens, and seminal vesicle
T-A9869	Cavernous nerves of penis	Two nerves that supply sympathetic and parasympathetic innervation to vascular structures of corpus cavernosum stimulating erection, derived from prostatic plexus
T-A986A	Cavernous nerves of clitoris	Nerves that supply sympathetic and parasympathetic innervation to erectile tissues of clitoris, derived from uterovaginal plexus
T-AA003	External axis of eyeball	A line segment connecting anterior pole of cornea to posterior pole of sclera
T-AA008	Muscular fascia of eyeball	Fascia enclosing the extraocular muscles
T-AA00B	Soft tissues of orbit	Soft tissues enclosed within orbital region
T-AA079	Vitreous chamber	The eye cavity that contains the vitreous
T-AA081	Vitreous body	Composite structure of hyaluronic acid gel within a stromal network of collagen fibrils
T-AA083	Hyaloid canal	A canal that runs from optic disc to lens that contains the hyaloid artery in the fetus
T-AA084	Hyaloid fossa	A depression of the anterior surface of the vitreous body where the lens fits
T-AA100	Tunica fibrosa of eyeball	Outer coating of eyeball, has parts cornea and sclera

T-AA101	Anulus tendineus communis	Orbital structure, a fibrous ring that is the origin of the rectus muscles
T-C4310	Intrapulmonary lymph node	Lymph node within the lung
T-C4340	Paratracheal lymph node	Lymph node along the trachea, may be in either the thorax or the neck
T-C4365	Esophageal lymph node	Lymph node along the esophagus, may be in either the mediastinum or the neck
T-D0060	Body organ	An anatomical structure that consists of the maximal set of organ parts so connected to one another that together they constitute a self-contained unit of macroscopic anatomy, distinct both morphologically and functionally from other such units Together with other organs, an organ constitutes an organ system or a body part An organ is divisible into organ parts but not organs (Examples: femur, biceps, liver, heart, aorta, sciatic nerve, ovary)
T-D0066	Viscus	A large organ in the thorax, abdomen or pelvis
T-D1209	Infrapalpebral fold	The sulcus (furrow) below the lower eyelid
T-D1217	Sublingual space	A potential space in the floor of the mouth, the part of the submandibular space above the mylohyoid muscle
T-D1219	Submaxillary space	A potential space of the floor of the mouth, part of the submandibular space below the mylohyoid muscle
T-D121A	Submental space	A potential space of the floor of the mouth, the medial part of the submaxillary space
T-D121B	Masticator space	A potential space containing the pterygoid and masseter muscles
T-D1602	Anterior portion of neck	Neck anterior to the vertebral column, including pharynx, larynx and anterior surface
T-D2220	Shoulder	The body part defined by the shoulder joint and its surrounding structures
T-D2500	Hip region	The body part defined by the hip joint and surrounding structures, including the region from the iliac crest to the thigh
T-D6242	Obstetrical canal	The birth canal, consists of uterine cervix, vagina, and vulva
T-D8000	Upper extremity	Upper extremity, including shoulder, arm, forearm, wrist and hand
T-D8200	Upper arm	Upper extremity between shoulder and elbow
T-D8300	Elbow	The body part defined by the elbow joint and surrounding structures
T-D8600	Wrist	The body part defined by the wrist joint and surrounding structures
T-D9000	Lower extremity	Lower extremity including hip, thigh, leg, ankle and foot
T-D9040	Femoral region	Anterior region of the thigh
T-D9200	Knee	The body part defined by the knee joint and its surrounding structures
T-D9400	Lower leg	Lower extremity from knee to ankle
T-F1200	Extraembryonic membranes	The membranes which surround the embryo but are not involved in formation of the embryo itself

## 8. Appendix D: User Feedback

Comments and suggestions regarding the content of SNOMED RT are encouraged. All suggestions will be evaluated, and those deemed appropriate will be considered for inclusion in the next scheduled release of SNOMED RT.

Suggestions can be submitted to

SNOMED International Division  
College of American Pathologists  
325 Waukegan Road  
Northfield, IL 60093  
email: [snomed@cap.org](mailto:snomed@cap.org)

Because SNOMED RT is a controlled vocabulary, suggestions for new term additions require sufficient information to ensure that the meaning of the term is clear, unambiguous and adheres to SNOMED's internal logic and structure. The following information is requested when submitting a suggestion to add or change the content of SNOMED RT:

Suggestions to add a new concept

- Concept preferred name
- Fully specified name
- Nearest SNOMED parent concept ID
- Text definition or literature (eg, MedLine) reference
- Synonyms (optional)
- Logical children (optional)
- Other siblings (optional)
  - Additional relevant information (optional)
  - Name of person to contact regarding this request
- Contact phone number
- Contact e-mail address

Suggestions to add a new synonym

- Synonym name
- SNOMED concept ID under which synonym is to be assigned
- Text definition or literature (eg, MedLine) reference
- Name of person to contact regarding this request
- Contact phone number
- Contact e-mail address

#### Remove a synonym from an existing concept

- Term (ie, name of synonym)
- SNOMED Description ID
- Reason for removal (incorrect/inappropriate, obsolete, redundant, ambiguous)
- Recommended action
  - eg, Reassign as a synonym for another concept (must specify existing Concept ID);
  - Do not reassign to another concept (must specify what existing DescriptionID to refer to)
- SNOMED DescriptionID to which the removed/retired term should refer
- Additional relevant information (optional)
- Name of person to contact regarding this request
- Contact phone number
- Contact e-mail address

#### Corrections to concept assignments in the Relationships Table

- Relationship to be addressed
- Recommended action
- Literature reference
- Additional relevant information
- Name of person to contact
- Contact phone number
- Contact e-mail address

#### Other errors (eg, spelling corrections)

- ConceptID and/or DescriptionID containing the error
- Description of the error
- Suggested correction
- Additional relevant information
- Name of person to contact
- Contact phone number
- Contact e-mail address

## 9. ACKNOWLEDGEMENTS

### Contributors to SNOMED<sup>®</sup> RT

**Kent A. Spackman, MD, PhD**  
**Chair, SNOMED Editorial Board**  
**Scientific Director**

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**Keith E. Campbell, MD, PhD** who designed and established the technical infrastructure and editing environment for SNOMED RT and was instrumental in initiating the partnership between the College of American Pathologists and the Kaiser Permanente Convergent Terminology Group.

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#### SNOMED International Scientific Staff

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**E. Joshua Schraeder, RRA**  
Lead Data Administrator

**Corey Smith, MS**  
Data Administrator



**Kaiser Permanente Convergent Medical Terminology Group  
(1995-present)**

**Colorado Region**

**John Fedack, MD**  
Clinical Information Systems

**Carly Kirby, RN \***  
Clinical Information Systems

**Aaron Snyder, MD \***  
Family Practice

**Bruce Fisch, MD \***  
Clinical Information Systems

**Cynthia B. Lundberg, RN**  
Clinical Information Systems

**Jeff Rose, MD \***  
Clinical Information Systems

**Northern California Region**

**Alan Abilla, RN**  
KP-CIS project, KP-IT and Emergency Dept.  
KP Walnut Creek Medical Center

**Enrique Hernandez, MD**  
OSCR project, KP NCAL Regional Offices

**Gerry Lazzareschi, MD**  
Division Chief, CIS and  
Emergency Dept., KP Santa Rosa Medical Center

**Mary Lush, RN, PhD \***  
Director Home Care & SNF QA&I  
CA Division

**Keith E. Campbell, MD, PhD \***  
Consultant

**Peter Hendler, MD**  
Web Portal Services, KP-IT and  
Rheumatology, KP Fremont Medical Center

**David Levy, MD**  
Division Chief, CIS for KP Walnut Creek/Martinez  
Medical Centers  
Internal Medicine, KP Walnut Creek Med. Ctr.

**James Resneck, MD**  
Ophthalmology  
KP Fremont Medical Center

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**Robert Clements, MD**  
Internal Medicine  
Baldwin Park Medical Center  
Southern California Permanente Medical Group

**Robert Dolin, MD**  
Department of Internal Medicine and Permanente  
Clinical Systems Development

**Jonathan Lukoff, MD, FAAP**  
Department of Pediatrics  
Southern California Permanente Medical Group

**Carol M. Correia, RN, MS, CAN**  
Permanente Clinical Systems Development

**Bruce J. Goldberg, MD**  
Department of Allergy and Clinical Immunology  
Southern California Permanente Medical Group

**Christine Zingo, RN, MS**  
Permanente Clinical Systems Development

**Northwest Region**

**John Beebe \***  
Oracle Database Administrator, CMT

**Steven Lester, MD**  
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Kaiser Permanente Northwest

**Brad Hochhalter \***  
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**\* past CMT affiliation**

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University Reference Laboratory

#### John Mattison, MD - Consultant

Kaiser Permanente

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Director, SNOMED Business Development and Licensing  
College of American Pathologists

## ACKNOWLEDGEMENT OF PAST CONTRIBUTORS

### SNOP - Systematized Nomenclature of Pathology (1965)

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Bulent Celasun - Gulhane Military Medical Academy and School of Medicine; Ankara, Turkey  
L. David Wise - International Federation of Teratology Societies  
American Dental Association Advisory Committee on Dental Electronic Nomenclature, Indexing, and Classification

