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SNOMED CT Editorial Guide

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The logo for SNOMED International, featuring the word "SNOMED" in a large, bold, white sans-serif font above the word "International" in a smaller, white sans-serif font, both set against a solid blue square background.

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The Editorial Guide provides the information necessary to model terms in *SNOMED CT*. It is for those who edit content in the International Release, but it may also be useful to those creating extensions. It is a working document, subject to change and revision.

SNOMED CT is distributed in sets of electronic files. Supporting software tools are not necessarily provided directly by SNOMED International.

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1 SNOMED CT

What is SNOMED CT?

SNOMED CT is a high-quality, comprehensive, international, logic-based reference terminology that is used to present clinically relevant information. It began with the union of NHS Clinical Terms Version 3 and SNOMED RT; this provided the initial scope which has since been updated to reflect contemporary clinical practice and changes in medical technology.

Content development is provided by expert clinicians driven by the requirements of user communities. This includes core content for use internationally and content relevant to national extensions for local implementation.

Its logic-based definitions represent terminological knowledge, or what is always true about the meaning of concepts. It consists of codes, that correspond to concepts, arranged in a polyhierarchical manner, as well as relationships between the concepts, which further define the meaning.

Description logic

Description logic (DL) is the formal foundation of meaning in *SNOMED CT*. The way that concepts have been modeled in *SNOMED CT* permits them to be represented using description logic. A DL *reasoner* is used to classify *SNOMED CT*. The DL reasoner also helps test expressions for subsumption and equivalence.

Why use SNOMED CT?

It supports semantic interoperability and multi-purpose use within electronic health applications (primarily electronic health records or EHRs) and has many advantages over other terminologies. They include:

- Consistent, and formal expansion of, content through centralized authoring and maintenance (International Release)
- Flexibility to meet most terminological requirements based on national, regional, language, application, or customer (Extensions)
- Clear, singular meaning of concepts
- Reliable, consistent, and reproducible clinical documentation
- Enhanced high-quality healthcare delivery to individuals and populations

(See also, Appendix: *SNOMED CT Requirements*)

1.1 Intended Use

SNOMED CT is intended to be used in healthcare:

- To provide effective and comprehensive coverage of terms
- As a terminological resource
- For implementation in electronic health applications

The purpose of *SNOMED CT* is to represent clinically relevant information reliably and reproducibly in electronic health applications, (most often electronic health records or EHRs) to support:

- Delivery of multidisciplinary, high-quality healthcare to individuals and populations
- Optimal retrieval, processing, and rendering of clinical information
- Effective use of clinical information consistently and reproducibly
- Use of clinical information for statistical and reporting purposes

Context

Context is an important part of representing clinically relevant information.

When entered in an EHR, concepts in the Procedure and Clinical finding hierarchies have the following default contexts.

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

When a concept is entered into an EHR, the information in the health record structure or its information model, can provide the context.

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

Guidance for Electronic Health Application Users

Designers and implementers of electronic health applications need guidance to identify which fields within their record structure will critically affect the meaning of concepts. They require open strategies to preserve meaning if concepts are retrieved or transferred and to allow detection of equivalence to constructs derived from alternative approaches.

(see also *Situation with Explicit Context* section)

1.2 Scope

SNOMED CT has an international and multilingual scope and can be localized to represent meanings and terms unique to particular organizations or localities. There are three dimensions to the scope of *SNOMED CT*:

SNOMED CT is not intended to cover all medical knowledge. Content that is strictly non-human is out of the scope of *SNOMED CT*.

Examples of non-human content,

- Egg-related coelomitis (disorder)
- Dehorning (procedure)
- Bone structure of wing (body structure)

Neither does *SNOMED CT* attempt to capture probabilistic or uncertain knowledge.

Structure of Domain Coverage

SNOMED CT includes 19 *domains* arranged in a polyhierarchical structure. Each hierarchy is an ordered organization of concepts linked together through *ISA relationships*. Each concept may have one or more parents.

The hierarchical arrangement is helpful for locating concepts, grouping similar concepts, and conveying meaning. For example, if we see the concept *cell* under the concept *anatomic entity* we will understand the intended meaning as different than if it appeared under the concepts *room* or *power source* (Desiderata for Controlled Medical Vocabularies in the Twenty-First Century by J.J. Cimino published in *Methods of Information in Medicine* 1998:37:394-403).

Concepts are linked to their more general parent concept codes directly above them in a hierarchy. Concepts with more general meanings are usually presented as being at the top of the hierarchy and then at each level down the hierarchy, the meanings become increasingly more specific or specialized.

The domains contain all of the components (clinical, administrative, database structure, as well as other components that express how the domains relate to each other) necessary to create *SNOMED CT* concepts and maintain the database structure.

Definition	Notes	Examples
<p>A <i>domain</i> is a set of concepts which the Concept Model permits to be defined or refined, using a particular set of attributes and ranges</p> <p>Some domains do not have attributes and ranges, but may if a concept model is created</p>	<p>A domain, to which an attribute can be applied, is typically defined to include concepts in one or more branches of the subtype hierarchy</p>	<p>The domain of 116676008 Associated morphology (attribute) is defined as subtype of 404684003 Clinical finding (finding) </p> <p>The range of values of 116676008 Associated morphology (attribute) is subtypes of 49755003 Morphologically abnormal structure (morphologic abnormality) </p>

The following table lists the domains, definitions, and examples. **Those without a Concept Model are marked with an asterisk.**

Domains			
	Domain/Top-level Hierarchy (alpha-sorted)	Examples	
1	Body Structure	<ul style="list-style-type: none"> Anatomical or acquired body structure Morphologic abnormality (subtype of body structure) 	<ul style="list-style-type: none"> 450807008 Entire back (body structure) 52988006 Lesion (morphologic abnormality)
2	Clinical Finding	<ul style="list-style-type: none"> Clinical finding: normal/abnormal observations, judgments, or assessments of patients Disorder: always and necessarily an abnormal clinical state 	<ul style="list-style-type: none"> 39579001 Anaphylaxis (disorder) 167222005 Abnormal urinalysis (finding)
3	Environment and Geographical Location*	<ul style="list-style-type: none"> Environment: types of environments Geographical Location: named locations such as countries, states, or regions 	<ul style="list-style-type: none"> 405607001 Ambulatory surgery center (environment) 223581004 China (geographic location)
4	Event	<ul style="list-style-type: none"> Occurrences impacting health or health care; not procedures or interventions 	<ul style="list-style-type: none"> 242039002 Abuse of partner (event) 2641000119104 Exposure to chlamydia (event)
5	Observable Entity	<ul style="list-style-type: none"> Information about a quality/property to be observed and how it will be observed 	<ul style="list-style-type: none"> 423493009 Age at diagnosis (observable entity) 416125006 Concentration of hemoglobin in erythrocyte (observable entity)

Domains			
6	Organism	<ul style="list-style-type: none"> Organisms of significance to human and animal medicine; use in modeling cause of disease 	<ul style="list-style-type: none"> 3265006 Genus Candida (organism) 710877000 Beta lactam resistant bacteria (organism)
7	Pharmaceutical/Biological Product	<ul style="list-style-type: none"> Drug products (not Substances) 	<ul style="list-style-type: none"> 400687000 Infliximab 100mg/vial powder for reconstitution injection (product) 317222006 Product containing only cimetidine 200 mg/1 each oral tablet (clinical drug)
8	Physical Force*	<ul style="list-style-type: none"> Forces applied to the body that may cause injury 	<ul style="list-style-type: none"> 57955009 Hot weather (physical force) 285719001 Mechanical abrasion (physical force)
9	Physical Object*	<ul style="list-style-type: none"> Physical devices relevant to health care, or to injuries/accidents 	<ul style="list-style-type: none"> 15237007 Sitz bath chair, device (physical object) 69861004 Firearm, device (physical object)
10	Procedure	<ul style="list-style-type: none"> Procedure: activities performed in the provision of health care (includes medical history-taking, physical examination, diagnostic and therapeutic interventions, training and education, and counseling) Regime/therapy (subtype of procedure): set of procedures focused on a single purpose on one patient over time (e.g. repeated administration of drug in a small dose for an indefinite period of time) 	<ul style="list-style-type: none"> 54321008 Cardiac flow imaging (procedure) 386513007 Anesthesia management (regime/therapy)
11	Qualifier Value*	<ul style="list-style-type: none"> One of several possible values for an attribute used to define concepts 	<ul style="list-style-type: none"> 90734009 Chronic (qualifier value) 255412001 Appearances (qualifier value)
12	Record Artifact*	<ul style="list-style-type: none"> Clinical documents, or parts thereof 	<ul style="list-style-type: none"> 445673000 Original report (record artifact) 41000179103 Immunization record (record artifact)

Domains			
13	Situation with Explicit Context	<ul style="list-style-type: none"> • Concepts that include context information; a subtype of the situation to which it applies with an attribute associating it with the relevant clinical finding or procedure • May be used to represent conditions/ procedures that already occurred, haven't yet occurred, or refer to someone else (not patients) 	<ul style="list-style-type: none"> • 169589005 Antenatal care: history of infertility (situation) • 407565004 Angiotensin II receptor antagonist not tolerated (situation)
14	SNOMED CT Model Component*	<ul style="list-style-type: none"> • Concepts and attributes necessary to organize and structure SNOMED CT terminology and its derivatives 	<ul style="list-style-type: none"> • 900000000000442005 Core metadata concept (core metadata concept) • 900000000000454005 Foundation metadata concept (foundation metadata concept) • 106237007 Linkage concept (linkage concept) • 370136006 Namespace concept (namespace concept)
15	Social Context*	<ul style="list-style-type: none"> • Social conditions and circumstances related to healthcare • Subtypes include: ethnic group, life style, occupation, person, racial group, religion/ philosophy, social concept 	<ul style="list-style-type: none"> • 116060000 Eating habit (life style) • 58626002 Legal guardian (person) • 415794004 Unknown racial group (racial group) • 35359004 Family (social concept)
16	Special Concept*	<ul style="list-style-type: none"> • Inactive and navigational (support locating concepts in hierarchies) concept codes 	<ul style="list-style-type: none"> • 363664003 Erroneous concept (inactive concept) • 394899003 Oral administration of treatment (navigational concept)
17	Specimen*	<ul style="list-style-type: none"> • Entities that are obtained (usually from patients) for examination or analysis 	<ul style="list-style-type: none"> • 373193000 Lymph node from sentinel lymph node dissection (specimen) • 258441009 Exudate sample (specimen)
18	Staging and Scales*	<ul style="list-style-type: none"> • Assessment and tumor staging scales 	<ul style="list-style-type: none"> • 273472005 Functional status index (assessment scale) • 254294008 Tumor-node-metastasis (TNM) head and neck tumor staging (tumor staging)

Domains		
19	Substance	<ul style="list-style-type: none"> Active chemical constituents of allergens, agents, substances, chemicals, drugs, and materials (not Pharmaceutical/Biological Products)
		<ul style="list-style-type: none"> 116272000 Dietary fiber (substance) 64856004 Digestive system fluid (substance)

Granularity

The scale, or level of detail, in a terminology is called *granularity*. Concepts and meanings range from very general, or coarse, to very specific, or fine. *SNOMED CT* has multiple granularities, which is an important component of terminologies that are multi-purpose. The broader meanings are useful for aggregation (e.g. Clinical Finding, Procedure, etc.), but are not intended for recording individual patient data.

The progressive levels of refinement are used to meet clinical data requirements. There are, however, limits to the degree of precoordination of certain types of complex statements.

In general, concepts in *SNOMED CT* should name things that exist in the real world. The concepts are usually names or short noun phrases, not complete sentences or paragraphs.

SNOMED CT is intended to be used with electronic health applications that can support full clinical statements, along with their attributions, dates, times, and statement interrelationships. It may be challenging to balance *SNOMED CT* content with the needs of those using electronic health applications. For example, some older applications may require concepts outside of the scope of *SNOMED CT*. *SNOMED CT* tries to maximize its usefulness and at the same time minimize precoordination.

Knowledge Representation

Knowledge representation in *SNOMED CT* involves modeling what we know about concepts to be necessarily true. Concepts are logically defined by their relationships to each other. Some knowledge provides valuable clues to the diagnostician, while not necessarily always present, i.e. it is uncertain or probabilistic knowledge.

For example,

- 22298006 |Myocardial infarction (disorder)|

Its terminological knowledge includes the following:

- IS A: 64572001 |Disease (disorder)|
- Finding site: 74281007 |Myocardium structure (body structure)|
- Associated morphology: 55641003 |Infarct (morphologic abnormality)|

These additional pieces of knowledge are variably present and therefore represent uncertain or probabilistic knowledge about myocardial infarction:

- Crushing substernal chest pain
- Diaphoresis
- Arrhythmia
- ST-segment elevation on EKG
- Elevated cardiac enzymes

For example,

- 74400008 |Appendicitis (disorder)|

Its terminological knowledge includes the following:

- IS A: 64572001 |Disease (disorder)|
- Finding site: 66754008 |Appendix structure (body structure)|
- Associated morphology: 23583003 |Inflammation (morphologic abnormality)|

These additional pieces of knowledge are variably present and therefore represent uncertain or probabilistic knowledge about appendicitis:

- Central abdominal pain that migrates to the right lower quadrant
- Rebound tenderness over McBurneys point
- Anorexia
- Nausea
- Elevated white blood count

1.3 Semantic Interoperability

Semantic Interoperability

The overall semantic interoperability of electronic health applications is achieved through the combined functioning of the information architecture of the application and the terminology that populates it. A basic principle of *SNOMED CT* is to create and maintain semantic interoperability of clinical information. *Semantic interoperability* is the capability of two or more systems to communicate and exchange information. Each system should be able to interpret the meaning of, and effectively use, received information. To achieve this goal, the meaning of the information must be agreed upon, consistent, and clearly expressed.

URU - Understandable, Reproducible, Useful

There are three basic operational criteria that help determine *SNOMED CT*'s ability to create and sustain semantic interoperability. The content must be:

- **Understandable.** Healthcare providers must be able to communicate the meaning of concepts such that they are unambiguous and understood by recipients without reference to inaccessible, hidden or private meanings. Concepts should be universally understood.
- **Reproducible.** It is not enough for one individual to say they think they understand a meaning. It must be shown that multiple people understand and use the meaning in the same way.
- **Useful.** The meaning must have some demonstrable use or applicability to health or healthcare.

2 Authoring

Modeling philosophy of SNOMED CT

SNOMED CT authors use a *zero-based, proximal primitive* approach when modeling or editing logical definitions of concepts, i.e. a concept is newly defined, as opposed to inheriting the definition from the parent and then refining it. This is accomplished by assigning the immediate proximal primitive parent and attribute relationships based on their relevance to the defining characteristics of the concept, again, instead of relying on inheritance and refinement of relevant attributes from immediate, sufficiently defined supertypes.

The steps are as follows:

- The author states the proximal primitive supertype/s.
- The author states all of the defining *attribute-value pairs* required to express the meaning of the concept.
 - An attribute-value pair is explicitly stated, even if it is already present on a supertype concept.
 - The attribute-value pairs are grouped as required.
- The classifier infers all appropriate proximal supertype/s.
 - With sufficiently defined concepts, the subtypes are also inferred.

Advantages of the approach

- Enhances ability to maintain content
- Supports identification of equivalences

Content that does not conform

SNOMED CT contains content that does not conform to the current modeling patterns. A project to correct these non-conforming concepts is currently underway.

Exceptions

Exceptions exist where the current concept model is not expressive enough to represent critical defining characteristics of a concept that would allow for its sufficient definition.

For example, disorders where the clinical manifestations are variably present (i.e. genetic diseases)

Authoring information

2.1 Does It Belong In SNOMED CT?

The guiding principle underlying the creation of a clinical reference terminology is the facilitation of semantic interoperability. To this end, content in *SNOMED CT* must represent unambiguous, clinically relevant information which can be exchanged and understood internationally. A reproducible and consistent approach to incorporating terminology into electronic health applications is, therefore, mandatory.

The International Release includes content necessary for international conformance and interoperability (The International Release was formerly and is colloquially known as *the core*). The range of concepts, attributes, qualifiers, and other components of *SNOMED CT* is comprehensive compared to classification systems. This supports the terminological needs of those using *SNOMED CT* with electronic health applications.

Addition of new content to *SNOMED CT* requires careful consideration. Changes and additions to the International Release of *SNOMED CT* follow a formal process executed by the *SNOMED CT* authors.

Extensions

Extensions are created, structured, maintained, and distributed in accordance with *SNOMED CT* specifications and guidelines to ensure compatibility with the *SNOMED CT* International Release. Members may create, maintain, and distribute extensions to address specific national, regional, and language requirements. Affiliates may also create, maintain, and distribute extensions to meet the needs of particular software solutions and customers.

The Extensions Guide, part of the Technical Implementation Guide, on the SNOMED International website at: <http://www.snomed.org/snomed-ct/learn-more> has documentation on adding content through extensions.

Criteria for inclusion in the International Release

For content to be included in the International Release, the following criteria must be met:

Broad Use. It must be applicable within and across healthcare disciplines internationally.

Provision of Use Case. Changes and additions must follow *SNOMED CT* Content Request Service (CRS) Guidelines. It is very important to incorporate a clear justification for any change or addition request for the International Edition of *SNOMED CT*.

Principle of URU

Understandable. The terminology must be able to communicate to recipients the intended meaning of the healthcare provider in terms that are unambiguous and comprehensible without reference to inaccessible, hidden, or private meanings.

Reproducible. Concepts should be names that are human-understandable representations of the codes. It is not enough for an individual to say they think they understand a meaning. It must be shown that multiple people interpret and use the meaning in the same way.

Useful. The meaning must have demonstrable use or applicability to health or healthcare.

SNOMED CT names classes of things

SNOMED CT concepts should name *classes of things*. Concepts that refer to a particular instance are unacceptable.

For example, *Doctor Jones pre-operative order set* should not be included because it is an individual instance, not a class.

References

Content must be submitted with:

- Definitions and literature references. All reference material must be publicly available. Wiki references are unacceptable.
- Evidence of international applicability. Without international applicability, a concept should, instead, be added to the submitter's extension.

Change Requests

For details on SNOMED International CRS Customer Guidance, search for *Change or Add to SNOMED CT* on the IHTSDO website at: <http://www.snomed.org/snomed-ct/learn-more>.

(See also Appendix: *Principles for Accepting Content in the International Release*)

2.1.1 When Is Content Rejected?

The following information provides specifics on content rejection.

Fully specified name (FSN)

An FSN should conform to spelling, language, and style guidelines. It should also have parent codes that conform to editorial guidelines and show where in the hierarchy it belongs.

In general, an FSN should **not** have the following (there are exceptions, which are covered in this guide):

- Abbreviations or acronyms
- Hyphens
- Duplicate concepts
- Ambiguity
- The word OR
- Forward or backslash (/ \)
- Precoordinated numeric ranges
- General British (GB) spelling
- Plural form
- Procedures or clinical findings in past tense
- Reference to a particular instance

Classification system-derived phrases

Concept submissions that contain certain classification system-derived phrases in their FSNs are not accepted. Concepts with unclear, unspecified, or ambiguous meaning should not be used. It includes:

Not otherwise specified (NOS)

- For example, Mental disorder, *not otherwise specified*

Not elsewhere classified (NEC)

- For example, Chronic hepatitis, not elsewhere classified

Not mentioned

- For example, Attention deficit disorder *not mentioned* of hyperactivity

With or without

- For example, Tubal pregnancy *with or without* intrauterine pregnancy

Full statements or sentences

Concepts should be names or short noun phrases. Full statement or sentences are unacceptable.

Disjunctives

Concepts with the disjunctives (*or*, *and/or*) are unacceptable. Instead, there should be separate concepts. There are limited exceptions as follows.

! Exceptions

Disjunctives may be used if the:

- The referent is a single thing, but there isn't a name for it.

For example,

- 774007 |Structure of head and/or neck (body structure)|
- The concept is an intensional navigational aggregate.

For example,

- 707861009 |Structure of skin and/or skin-associated mucous membrane (body structure)|
- The concept is based on an authoritative source, but not a classification system.

See *Conjunction and Disjunction* for the use of disjunctives, including their use with anatomical concepts.

Numeric ranges

In general, content that depends on numeric ranges should not be used for precoordination.

For example,

- There may be too many possibilities
 - A finding of number of lesions might have ranges of *1, 2 to 5*, and *greater than 5; 1 to 2, 3 to 10*, and *greater than 10*, or etc.
- There may be possible changes to reference ranges or systems of units
 - The normal serum sodium concentration is usually defined as 135 to 145 mEq/L. Low serum sodium should not use the phrase *serum sodium less than 135 mEq/L*. (It should use a phrase such as *serum sodium concentration below reference range*)
 - A body mass index (BMI) score as an indicator of obesity

! Exception: acceptable numeric range

A standard definition with a fixed numeric range, i.e. the range is an explanation or definition of the score, may be acceptable.

For example,

- A histologic scoring system with a score of *1* when there are *0 to 5 mitoses per high power field*, and a score of *2* when there are *6 to 10*, and etc
- The Tumor, Node, Metastases (TNM) Classification of Malignant Tumor

Proprietary names

Proprietary names include brand name drugs and devices and some clinical forms or tools.

Brand name of drugs and devices. Proprietary names are the names that have been assigned to products, usually drugs and devices, by their corporate producers. They do not require a license from the producer.

It is both necessary and useful to include proprietary names in a health terminology. However, they should not be included in the International Release, but instead in National Extensions. This is because proprietary names may refer to different products depending on the country and the meaning of these names are dependent on the country or jurisdiction in which the product is approved.

✓ Modeling

A brand or trade name may stand for a category of product and not the particular brand itself. These *proprietary* names may be included in the International Release as descriptions (non-FSN descriptions). They should not be included in FSNs.

For example,

- Kleenex, band aid, popsicle

Clinical forms, tools, or assessment scales. The owner of a form or tool may be an individual or organization that created it; the healthcare organization that employed the individual; or it may be a commercial organization to which the rights were assigned.

Names of clinical forms, tools, or assessment scales (e.g. *the XYZ Test*) do not require a license from the owner.

Questions. Questions within a form or tool generally qualify for copyright protection (except in the case of the simplest of forms).

Answers. Very simple answers on a form or tool (e.g. *yes* or *no*) do not require owner permission. However, more substantial answers may infringe on the owner's copyright. This usually does not apply to individual answers, but almost always to entire sets of answers.

Scores. The principles that apply to individual answers also apply to the overall score generated by a clinical form or tool. The incorporation of numbers does not infringe on the copyright. However, when each possible score has an associated textual description and all possible scores and descriptions are incorporated into *SNOMED CT*, a license is required.

For example,

- 443807003 |EuroQoL five dimension questionnaire (assessment scale)| is a *SNOMED CT* concept. However, these scores are subject to copyright protection, therefore cannot be added to *SNOMED CT*:
 - EuroQol Five Dimension (youth) doing usual activities score
 - EuroQol Five Dimension (youth) feeling worried, sad or unhappy score

Non-human content

To be included in the International Release content must be useful in human medicine. Strictly non-human content may be included in extensions. Criteria for non-human content to be included in the International Release include the following:

Diseases, Findings, and Procedures. Occurs in both humans and animals.

Substances. Causes poisonings and adverse effects in humans.

Organisms. All organisms are included in the International Release.

Procedures: by complexity or count

Procedures categorized by complexity. Procedure concepts with modifiers representing complexity are not allowed in the International Release; this means the amount of effort required or based on realm-specific definitions (e.g. simple arthrodesis, simple repair, complex repair).

! Exception

Procedures that use *simple* or *complex*, defined with reproducible meanings are allowed; they are based on what is done to or for the patient, rather than how much effort is expended.

For example,

- 172043006 |Simple mastectomy (procedure)|; Reproducibly defined as the removal of all breast tissue without removal of axillary contents. Differentiated from modified radical, radical, skin-sparing, and subcutaneous variants of mastectomy.

Counts of the number of procedures. Many procedure classifications focus on resources required to complete; this may be for reimbursement or tracking purposes (e.g. placement of one stent versus placement of two stents). This information should be part of patient documentation and is not allowed in the International Release.

Order of procedures. The order of procedures, e.g. primary or first, second, and etc. should be excluded.

Abbreviations

Abbreviations are shortened forms of words or phrases. Because they may not be understood by all users, they allow for misinterpretation. Consequently they are not permitted in FSNs. They may be used in preferred terms or synonyms if they are accompanied by the fully expanded term.

! Exceptions

Abbreviations are allowed in FSNs when they are:

- Part of an official name of an organization or instrument
- Part of the approved name for bacterial subspecies

For example,

- 398620001 |Salmonella enterica subsp. indica (organism)|

Acronyms. Acronyms are a specific type of abbreviation. They are formed from the initial letters of words and pronounced as words.

! Exception

An acronym is allowed when it has become a word in its own right, i.e. included in dictionaries; understood without expansion to its original full form.

For example,

- 122456005 |Laser device (physical object)|

Eponyms

Eponyms are names that are derived from proper names (usually the person who made the discovery or created the original description). They are found in many areas of health terminology, including anatomic structures, morphologic abnormalities, diseases, findings, and procedures.

For example,

- Rutherford Morrison's pouch, vein of Galen, Aschoff body, Kell blood group, Down syndrome, Moro reflex, and Whipple procedure.

It is neither desirable nor possible to completely avoid using eponyms in a health terminology; although, if possible, they should be avoided. This helps to improve clarity of meaning and to facilitate translation to other languages. FSNs should be full descriptions, whereas synonyms may be eponymous terms.

For example,

- *Infant startle reflex* would be the FSN and *Moro reflex* would be the synonym.

It is permitted and encouraged to include eponyms as descriptions (non-FSN terms) whenever they are understandable, reproducible, and useful in a given context.

Exceptions

Exceptions require careful consideration since eponym meanings may change over time. Reasons for exceptions are:

- The full description is exceptionally long and unwieldy.

For example,

- 233230003 |Hemi-Fontan operation (procedure)| instead of *bidirectional Glenn shunt with end-to-side anastomosis of proximal superior vena cava to right pulmonary artery with isolation from right atrium*. (However, this should be added as a text definition).

- The eponym is the only precise, clinically relevant name available.
- A non-eponymous name would necessarily be vague or subject to misinterpretation.

For example,

- 118599009 |Hodgkin's disease (disorder)| and 118617000 |Burkitt's lymphoma (disorder)| are both clear.

Hyphens

Hyphens should not be used in FSNs, with rare exceptions.

For example,

- In the morphology hierarchy, where categories need to be distinguished from specific *subtypes*; 416500007 |Malignant glioma - category (morphologic abnormality)| is allowed to differentiate it from a specific morphology of 74532006 |Glioma, malignant (morphologic abnormality)| as defined by ICD-O.

2.1.2 Adjudication for Content Requests

There are processes for making decisions about adding or changing content in *SNOMED CT*.

Change requests

All change requests, whether for new content or for change to existing content, go through a request submission approval process. It involves review by authors to determine that there is:

- International applicability
- Compliance with Understandable, Reproducible, Useful (URU) principles
- No duplication with existing content
- No link to existing larger projects, as detailed in a Content Tracker document
- No conflict with existing collaboration agreements (e.g. *Logical Observation Identifiers Names and Codes (LOINC)* agreement)

Legacy concepts

Legacy concepts, i.e. concepts not in the current draft/work-in-progress version of *SNOMED CT*, may not follow current guidelines. Requests based on legacy concepts are unacceptable.

Appeals, deferrals, and resolution

Appeals. Requests that are rejected may be appealed by the submitter.

Deferrals. Requests may be deferred for a number of reasons including questions about:

- How to model the concept; which attributes may be used
- Concept meaning
- Literature reference missing or inadequate
- Use Case unclear
- Size of required change (attached to a Content Tracker)

Resolution. Resolution of deferrals may result in a decision delay requiring:

- A larger project or work item or
- Referral, internally, to other groups for decision. This depends on the complexity of the request and understanding of the wider impact.

Results of adjudication are received by email from the Content Request System (CRS).

Simpler issues can be resolved expeditiously (e.g. by a ruling from the Head of Terminology).

2.2 Concept Model Overview

The *Concept Model* is used to specify logical definitions of *SNOMED CT* concepts. It is based on a combination of formal logic and editorial rules. It includes the attributes and values that may be applied to the concepts.

Definition	Note
The set of rules that determines the permitted sets of relationships between particular types of concepts	The <i>Concept Model</i> specifies the attributes that can be applied to concepts in particular domains and the ranges of permitted values for each of these attributes. There are also additional rules on the cardinality and grouping of particular types of relationships

2.2.1 Root and Top-level Concepts

Concept

A *concept* is defined as a clinical idea to which a unique concept identifier has been assigned. Concepts are associated with descriptions that contain human-readable terms describing the concept.

Term

A *term* is defined as a human-readable phrase that names or describes a concept. A term is one of the properties of a description. Other properties of a description link the term to an identified concept and indicate the type of description, e.g. Fully Specified Name, Preferred Term, Synonym.

Concepts are linked to their more general parent concepts directly above them in a hierarchy. More general meanings, are usually at the top of the hierarchy. Descending levels of the hierarchy contain more specific or specialized meanings.

Concepts are logically defined by their relationships to each other.

In *SNOMED CT*, the default meaning of a concept is defined above. However, a concept may have other meanings in *SNOMED CT*, such as an:

- Abbreviated name for the concept identifier. For clarity, this should be referred to as an *identifier (ID)*, or *code*, e.g. *concept identifier (ID)* or *concept code*.
- Idea or class of real-world entities (common usage meaning). For clarity, this should be referred to as an *idea* or *meaning*, e.g. a *clinical idea*, *clinical meaning*, or *code meaning*.

The root concept

The concept file includes a special concept referred to as the *root concept*. It is the single concept that is at the top of the *SNOMED CT* concept hierarchy. All other concepts are descended from this root concept via at least one series of relationships of the Relationship type 116680003 |Is a (attribute)|, i.e. all other concepts are regarded as subclasses of this concept. The root concept code is 138875005 |SNOMED CT Concept (SNOMED RT+CTV3)|, with the preferred term (PT), *SNOMED CT*Concept.

Features of the root concept

All other *SNOMED CT* concepts are subtypes of the root concept. Unlike other *SNOMED CT* concepts, the root concept is not a subtype of any other concept.

- ▼ ● SNOMED CT Concept
 - ● Body structure (body structure)
 - ● Clinical finding (finding)
 - ● Environment or geographical location (environment / location)
 - ● Event (event)
 - ● Observable entity (observable entity)
 - ● Organism (organism)
 - ● Pharmaceutical / biologic product (product)
 - ● Physical force (physical force)
 - ● Physical object (physical object)
 - ● Procedure (procedure)
 - ● Qualifier value (qualifier value)
 - ● Record artifact (record artifact)
 - ● Situation with explicit context (situation)
 - ● SNOMED CT Model Component (metadata)
 - ● Social context (social concept)
 - ● Special concept (special concept)
 - ● Specimen (specimen)
 - ● Staging and scales (staging scale)
 - ● Substance (substance)

Top-level concepts

Concepts that are directly related to the root concept by a single relationship of the Relationship type 116680003 |Is a (attribute)| are referred to as *top-level concepts*. All other concepts are descended from at least one top-level concept via at least one series of relationships of the Relationship type 116680003 |Is a (attribute)|, i.e. all other concepts represent subclasses of the meaning of at least one top-level concept.

Top-level metadata concepts

A concept that is directly related to the root metadata concept, 900000000000441003 |SNOMED CT Model Component (metadata)| by a single relationship of the relationship type IS_A. All metadata concepts are descended from at least one Top-Level Metadata concept via at least one series of relationships with Relationship type IS_A. Metadata codes represent structural information about the terminology itself. The top-level metadata concepts represent broad groups of metadata.

2.2.2 Subtype Relationships

Role of subtype relationships

Subtype relationships provide the main semantic hierarchy that relates concepts to one another. All active concepts, except the root concept, have subtype relationships with one or more concept. Each of these relationships indicate that a concept is a subtype of another concept.

Representation of subtype relationships

Subtype relationships are expressed in the same way as other *SNOMED CT* relationships. They are identifiable by their fully specified names, e.g 116680003 |Is a (attribute)|.

For example,

- 53084003 |Bacterial pneumonia (disorder)| is a subtype of 233604007 |Pneumonia (disorder)| because it is a subtype of 312342009 |Infective pneumonia (disorder)| which is also a subtype of 233604007 |Pneumonia (disorder)|

2.2.3 Sufficiently Defined vs Primitive Concept

Sufficiently defined

A concept is *sufficiently defined* if its defining characteristics are adequate to define it relative to its immediate supertypes. A sufficiently defined concept is defined in the context of its hierarchy.

Primitive

A concept which is not sufficiently defined is *primitive*. A primitive concept is a formal logic definition that is inadequate to distinguish it from similar concepts. A primitive concept does not have enough defining relationships to computably distinguish it from more general concepts (supertypes).

2.2.4 Defining Characteristics

Role of defining characteristics

Defining characteristics represent the values of a range of relevant attributes. Depending on the nature of the concept, they may include etiology, topography, method, etc.

The attributes that can be applied depend on the domain of the concept. For example, a procedure may have a method, and a disorder may have an etiology, but a procedure cannot have an etiology, and disorder cannot have a method. Defining characteristics using a particular attribute will be applied consistently to all concepts to which it is relevant. Note that this design principle may not be fully realized for all attributes in each release.

Representation of defining characteristics

Defining characteristics are represented as relationships. The fields are used as follows:

- SourceId refers to the concept to which a defining characteristic applies;
- TypeId indicates the nature of the defining attribute;
- DestinationId refers to the concept that represents the value of that attribute.

Relationships

The defining characteristics can be divided into 116680003 |Is a (attribute)| relationships and defining attribute relationships.

The IS_A relationship (also called supertype-subtype or parent-child relationship) builds the hierarchies in *SNOMED CT*. Every concept has at least one IS_A relationship to a supertype or parent concept.

Exception

138875005 |SNOMED CT Concept (SNOMED RT+CTV3)| has no supertype or parent relationship.

Each concept in *SNOMED CT* is logically defined through its relationships to other concepts. A *relationship* is defined as an association between a source concept and a destination concept. The type of association is indicated by an attribute concept. It is the relationships that make up the defining characteristics of the concepts. A *defining characteristic* is a relationship to a target concept that is always necessarily true for any instance of the source concept.

For example, the defining relationships of the concept 53442002 |Gastrectomy (procedure)| include:

- 116680003 |Is a (attribute)| = 65801008 |Excision (procedure)|
- 260686004 |Method (attribute)| = 129304002 |Excision - action (qualifier value)|
- 405813007 |Procedure site - Direct (attribute)| = 69695003 |Stomach structure (body structure)|

2.2.5 Attributes

- Not all hierarchies in *SNOMED CT* have defining attributes.
- Many attributes apply to top-level domain hierarchies; some to more than one.
- Some apply to a lower-level, or more specific, domain hierarchies.
- Primitive concepts in other hierarchies may be attribute values in top-level hierarchies.

Attribute hierarchy

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

For example,

- Procedure Site
 - Procedure Site - Direct
 - Procedure Site - Indirect
- Procedure Device
 - Direct Device
 - Indirect Device

Procedure Device also has more specific attributes, *Using Device* and *Using Access Device*.


- Procedure Morphology
 - Direct Morphology
 - Indirect Morphology

Attribute		
Definition	Notes	Example
Represents a characteristic of the meaning of a concept or the nature of a refinement	<p>An attribute has a name which is represented by a concept. All of the concepts that can be used to name attributes are subtypes of the concept 410662002 Concept model attribute (attribute) </p> <p>An attribute is assigned a value (attribute value pair) when used in the definition of a concept or in a postcoordinated expression</p> <p>The permitted range of values depends on the rules specified in the concept model</p>	<ul style="list-style-type: none"> 116676008 Associated morphology (attribute)

Range		
Definition	Note	Example
A constrained set of values that the Concept Model permits to be applied to a specific attribute when that attribute is applied to a concept in a particular domain	The range of permitted values that can be applied to an attribute is typically defined to include concepts in one or more branches of the subtype hierarchy	<ul style="list-style-type: none"> The range for values of 116676008 Associated morphology (attribute) is a subtype of 49755003 Morphologically abnormal structure (morphologic abnormality)

2.2.6 Qualifying Characteristic

A *qualifying characteristic* is expressed by an attribute-value pair. The attribute may have one value, from a range of values, based on the domain's Concept Model. If a particular qualifying characteristic is applied to a concept, the resulting expression represents a more tightly defined subtype of that concept.

 Clinical expressions using *SNOMED CT* concepts can be of two types: precoordinated expressions, which use a single *SNOMED CT* concept identifier; and postcoordinated expressions, which contain more than one *SNOMED CT* concept identifier.

For example,

- It might be possible to qualify a disorder such as 53084003 |Bacterial pneumonia (disorder)| according to its clinical course (373933003 |Acute onset (qualifier value)| or 90734009 |Chronic (qualifier value)|) or severity (255604002 |Mild (qualifier value)|, 6736007 |Moderate (severity modifier) (qualifier value)|, or 24484000 |Severe (severity modifier) (qualifier value)|)
- 125605004 |Fracture of bone (disorder)| can be refined by qualifying it with 12611008 |Bone structure of tibia (body structure)| to represent the concept 31978002 |Fracture of tibia (disorder)|

2.3 Editing and Modeling: General

The following links provide information about concepts and how to model them.

2.3.1 Description and Definition

Description

- A concept has multiple associated *descriptions*.
- Each description has a *description type* and a unique numeric *description identifier*.
- Fully specified name (FSN) and synonym (SYN) are description types in *SNOMED CT*.
- A preferred term (PT) is a synonym that has been marked as preferred.
- Each description may be marked as preferred for use in particular languages or dialects.

For example,

22490002 Bleeding from mouth (disorder)	
Description type	Description
FSN	Bleeding from mouth (disorder)
PT	Bleeding from mouth
SYN	Bleeding in mouth
SYN	Bleeding of mouth
SYN	Oral hemorrhage
SYN	Oral haemorrhage
SYN	Stomatorrhagia
241563001 Computed tomography of upper limb (procedure)	
Description type	Description
FSN	Computed tomography of upper limb (procedure)
PT	CT of upper limb
SYN	Computed tomography of upper limb

Definition

A *definition* is a textual description applied to some *SNOMED CT* concepts that provides additional information about the intended meaning or usage of the concept. Definitions are not mandated and are considered for addition on a case by case basis and if required to differentiate a concept from its related concepts.

For example,

- The definition for the concept 11530004 | Brittle diabetes mellitus (finding) | is *diabetes mellitus in which there are frequent, clinically significant fluctuations in blood glucose levels both above and below levels expected to be achieved by available therapies.*

URLs

URLs that point to definition sources are unacceptable.

2.3.2 Fully Specified Name

Noncompliant descriptions

These guidelines should be applied to new content. While there are many terms in the existing content that are not in compliance with this guidance, the process of correcting existing content will be carried out as time and resources permit.

Fully specified name (FSN) definition

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

An FSN **is** one type of description, unique among active descriptions in *SNOMED CT*. It provides the meaning of a concept so that it is unambiguous and stable across multiple contexts. Consequently, it is not always clinician friendly or in common use.

In the majority of cases, where the FSN is clinician friendly and in common use, a description matching the FSN should be added to the concept. This description is not required to be the preferred term (PT). In certain instances, where the FSN does not provide a clinically useful description, a matching description without the semantic tag is unnecessary.

For example,

- FSN: Repair of common bile duct (procedure) - *the meaning*
- PT: Choledochoplasty - *commonly understood clinical name*

This is marked as *preferred* in the US English Language *Reference Set*. Therefore, choledochoplasty is the *preferred term* for this *concept* in US English.

Each new content request should have an FSN that conforms to spelling, language, and style guidelines. It should also have *SNOMED CT* parent concepts that conform to editorial guidelines and show where in the hierarchy it belongs. In the Content Request System (CRS), if the meaning of the FSN is unclear or the parent codes are not provided, authors should request the information from the submitter.

A well formed FSN includes:

- Correct US, not (General British) GB spelling
- Singular, not plural form
- Procedures in present, not past tense
- A *semantic tag* in parentheses at the end

An FSN with an approved disjunctive (although not often used), e.g. Traumatic **and/or** non-traumatic injury of back (disorder), should have lower case *and/or*.

An FSN should **not** have:

- Abbreviations or acronyms
- Hyphens
- Duplicate concepts
- Ambiguity
- The word OR (not including the disjunctive *and/or*)
- Forward or backslash (/ \)
- Precoordinated numeric ranges
- Reference to a particular instance
- Reason or indication for a procedure, unless this directly impacts the method

Exceptions

Exceptions that should not be amended include:

- Trademark names
- Latin names of organism
- Scientific names

Semantic Tags

Semantic tags are part of FSN descriptions. They are placed in parentheses at the end of FSNs when authoring concepts. They indicate the domain to which a concept belongs. For example, body structure, disorder, or specimen.

The purpose of semantic tags is to disambiguate concepts which have the same commonly used word or phrase.

For example,

- Hematoma (morphologic abnormality)
- Hematoma (disorder)

Uniqueness

The FSN is unique among active concepts. Creating a synonym to match the FSN is no longer mandatory because the Authoring Platform (SCA) automatically creates a matching description to the FSN. Authors then determine the clinical usefulness of the matching description. Those that are useful are maintained in *SNOMED CT*; those that are not useful are removed. SCA displays a warning when the matching description is removed; this does not prevent the author from saving the concept.

The FSN should provide a linguistic representation of the concept in an unambiguous way. It is considered an anchor for the representation of meaning of a concept, to which modelers can refer, when assigning a logic-based definition. The FSN does not necessarily follow the usual phrasing used in clinical practice; it may be phrased differently and may be longer and more fully spelled out in order to represent the meaning as clearly as possible and globally communicate the intended meaning of the concept.

Unambiguous

A single term may have more than one meaning. Therefore, FSNs should be checked for ambiguity.

For example, immunosuppression may mean the state of being immunosuppressed or it may mean the procedure of applying immunosuppressive therapy.

The following FSNs are clear and acceptable.

For example,

- Benign neoplasm of clavicle (disorder)
- Excision of cyst of spleen (procedure)

The following FSNs are ambiguous and should be inactivated.

For example,

- Standing in water side toward (finding); does not indicate *which side of what is toward what*
- Lumbar ache - renal (finding); does not convey whether the lumbar ache is specifically a renal etiology or is merely located in the renal area

Minor Changes - only the FSN changes but not the concept

Minor changes, those changes that do not change the meaning of the FSN, are allowed without inactivating the concept. They may include:

- Capitalizing, i.e. from lower to upper case or upper to lower case
- Changing punctuation
- Changing spelling
- Replacing an acronym with its expansion (only if it is commonly understood and not ambiguous)
- Expanding an abbreviation
- Correcting word order without changing the meaning (only for an error)
- Correcting typos
- Removing *the* from concept string
- Aligning with editorial policy e.g. change *appendectomy* to *excision of appendix*

Some FSN changes are necessary for style consistency; again, only if they do not change the meaning. They may include:

- Changing semantic tag type, if it occurs within a single top-level hierarchy

For example,

- A finding tag to a disorder tag
- A procedure tag to a regime/therapy tag

Other examples,

- A substance or product name to reflect the International Nonproprietary Name (INN)
- The current scientific name of an organism

✔ Modeling tips

Specific to SNOMED CT Authoring platform - If DescriptionType is *FSN*, then any change to any character of the concept string requires a new Description with a new unique identifier. This is true even with minor changes to the concept string. The concept ID does not change in this instance.

Order of actions when creating a new FSN, keeping concept:

1. Add new description, set case significance
2. Change description type to FSN
3. DO NOT SAVE
4. Inactivate old FSN
5. NOW SAVE

Major Changes - When to inactivate the concept

Major changes to FSNs require inactivation of the concept. The following are examples of major changes, when:

- Changing the FSN changes the meaning
- The FSN is ambiguous
- Modeling is more specific than the FSN meaning
- The FSN meaning is more specific than the modeling; inactivation is determined case-by-case as this could simply be a primitive concept which cannot be defined
- Moving to a different top-level hierarchy
- Changing the common name to the scientific name
- Ancestors and descendants (if any) of the concept are inconsistent with what is implied by the FSN - inactivate concepts

International FSNs

The FSN for a concept in the International Release is designated an *International FSN*. The International FSN is considered the *gold standard* for interpretation of the meaning of the concept, from a linguistic standpoint.

The logical definitions, represented using the concept model, should represent the same meaning. Spelling of the International FSN follows United States (American) English spelling conventions. Other English language spelling and conventions, such as Great Britain (UK) English, may be represented in preferred terms and other descriptions. They should be appropriately tagged using the Language Reference Set mechanism.

For example,

- 191268006 |Chronic anemia (disorder)|
 - FSN: Chronic anemia (disorder)
 - US PT: Chronic anemia
 - GB PT: Chronic anaemia
- 414545008 |Ischemic heart disease (disorder)|
 - FSN: Ischemic heart disease (disorder)
 - US PT: Ischemic heart disease
 - GB PT: Ischaemic heart disease

Acronyms

Acronyms are easily misinterpreted. For this reason, all acronyms are unacceptable in FSNs.

For example, the FSN should be the expanded form, Computed tomography of chest (procedure), however as a preferred term, CT of chest (procedure) is acceptable.

If there is an acronym in an existing FSN, the FSN DescriptionId is inactivated and a new FSN is created (regardless of whether or not the acronym was in parentheses with the expanded form). The replacement FSN concept has the expanded description with the acronym entirely removed. Inactivating the ConceptId is not necessarily required, unless the FSN had significant ambiguity before changing it to its expanded form.

Imported FSNs

Before any changes are made to an FSN, imported directly with an extension (local) ID, the submitter should be notified and confirmation sought that no loss of meaning has occurred. This helps to ensure that the original meaning is understood and maintained. Authors should:

- Adhere to naming conventions.
- Advise the submitter of changes and confirm that they are acceptable.
- Check for existing concepts with the same FSN; the term may be added as a preferred term or synonym.

Original submitter

Changes to existing *SNOMED CT* concepts do not necessitate notifying the original submitter.

2.3.3 Preferred Term

A *preferred term (PT)* is the description that is deemed to be the most clinically appropriate way of expressing a concept in a clinical record. It represents a common word or phrase used by clinicians to name a concept in clinical practice or in the literature. It is the synonym that is *preferred* in a language or dialect.

The use of a description can vary between different languages, dialects and contexts. A description may be preferred in some dialects, acceptable in others, and may not be used in some dialects. A Language Reference Set is used to specify the descriptions that are preferred or acceptable in each language or dialect.

A concept may have two descriptions marked as PT, one for each language.

For example, 32849002 |Esophageal structure (body structure)| has

- PT: Esophageal structure (US)
- PT: Oesophageal structure (GB)

A PT for one concept may also be a synonym for another concept.

For example,

- 84162001 |Cold sensation quality (qualifier value)| has a preferred term of *cold*
- 82272006 |Common cold (disorder)| also has a synonym of *cold*

In both concepts, *cold* represents a common clinical phrase used to capture the meaning of the concept.

The PT is indicated by the acceptabilityId field, for a particular language or dialect.

2.3.4 Synonym

In *SNOMED CT*, a *synonym (SYN)* is a description that is an acceptable way to express the meaning of a concept in a particular language or dialect, i.e. it is a word or phrase, other than the FSN, that represents a concept. Unlike FSNs, synonyms are not required to be unique.

Each concept may have one or more synonyms.

For example,

- US English synonyms for 22298006 |Myocardial infarction (disorder)| are:
 - Myocardial infarction
 - Cardiac infarction
 - Heart attack
 - Infarction of heart
 - MI - myocardial infarction
 - Myocardial infarct

✔ **Modeling**

A synonym may not change to, i.e. replace, an existing FSN.

Duplicate terms as synonyms

In most cases, it is unacceptable to add the same term as a synonym to more than one concept. However, some terms have more than one meaning and can be synonyms for more than one concept.

When concepts have the same term as synonyms, they are checked to determine whether or not they are duplicates. If they are duplicates, one concept is inactivated with a historical association link of SAME_AS to the other concept.

A synonym with a single meaning may be, erroneously, associated with more than one concept. If the concepts are not duplicates, the synonym should be retained with only one of the concepts and inactivated on the others.

! **Exceptions**

Although uncommon, a term may be acceptable as a synonym for two or more concepts. This depends on the context.

For example,

- *Fundus* in the context of obstetrics vs ophthalmology

Narrower synonym

When a synonym is more specific than the FSN, it does not have the same meaning, and should be inactivated. The description inactivation value of 723278000 | Not semantically equivalent component (foundation metadata concept) | is used.

For example:

- FSN: Removal of device (procedure)
- SYN: Replacement of prosthetic device (procedure) - more specific meaning than the FSN

Broader synonym

When a synonym is more general than the FSN, and there is no context in which it has the same meaning as the FSN, the synonym should be inactivated. The description inactivation value of 723278000 | Not semantically equivalent component (foundation metadata concept) | is used.

For example,

- FSN: Sprain (morphologic abnormality)
- SYN: Joint injury - more general meaning than the FSN

However, a more general synonym is acceptable when there is a context in which the synonym has the same meaning as the FSN.

For example:

- FSN: Entire fundus uteri (body structure)
- SYN: Fundus in the context of obstetrics - same meaning as the FSN

2.3.5 Proximal Primitive Modeling

A *proximal primitive (PP)* concept is the nearest *primitive supertype* (parent) concept to the concept in question.

- For some, but not all concepts, it is a top level concept e.g. Procedure.

- The PP supertype may also be an intermediate primitive concept located between the top level concept and the concept in question.
- There may be more than one PP supertype for a concept.

PP supertype modeling approach

In *SNOMED CT*, there is a preferred approach when creating or changing the logical definition of a concept. The author states the:

- Proximal primitive supertypes
- Attribute-value pairs required to express the meaning
 - An attribute-value pair is explicitly stated for the concept, even if it is already present for a supertype concept.
 - Attribute-value pairs are grouped as required.

The classifier infers all appropriate proximal supertypes.

- With sufficiently defined concepts the subtypes are also inferred.
- The author reviews the inferences to confirm that they are appropriate.

For example,

- The *stated* view of 702499000 |Computed tomography of humerus (procedure)|. The PP supertype for this concept is 71388002 |Procedure (procedure)|. It has been modeled with one stated supertype and two attribute value pairs in a relationship group.

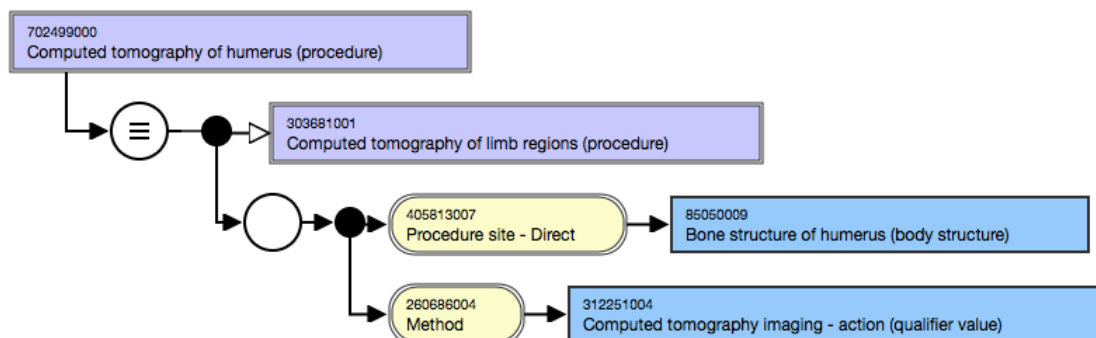


Figure 2.3.5-1: Stated view

The *inferred* view shows the logical definition of the concept. By using the stated relationships (for this concept and other concepts currently in the terminology) the classifier infers three defined proximal supertypes:

- Radiography of humerus (procedure)
- Computed tomography of upper arm (procedure)
- Computed tomography of bone (procedure)

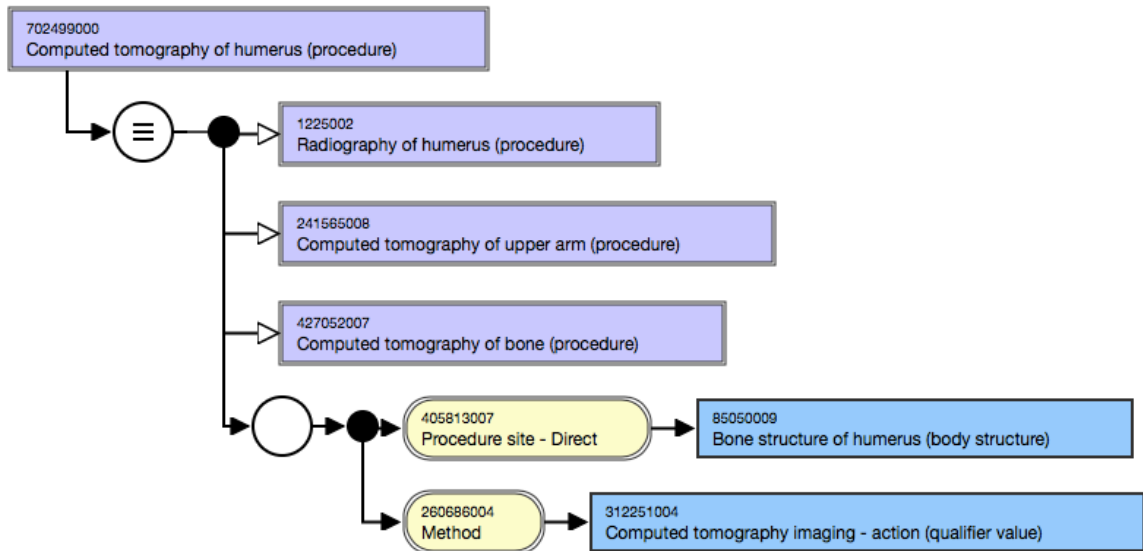


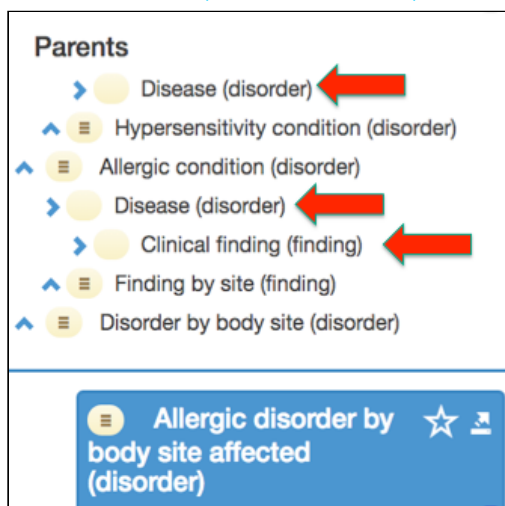
Figure 2.3.5-2: Inferred view

Multiple potential proximal primitive supertype concepts

Where more than one potential PP supertype is identified for a concept, authors should check the primitive supertypes for subsumption of one or more other primitive supertypes. Any subsuming concept is not a PP supertype.

For example,

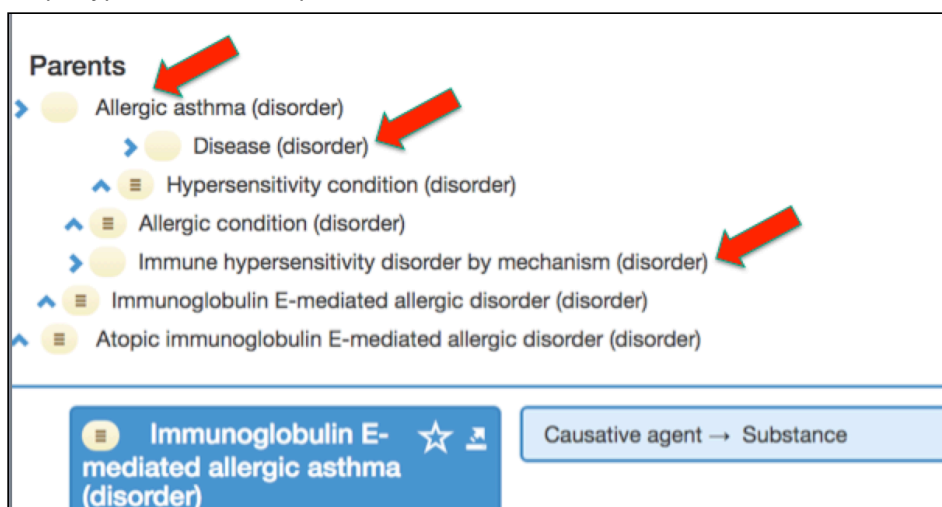
- There is more than one potential PP supertype for 421095001 |Allergic disorder by body site affected (disorder)|. 64572001 |Disease (disorder)| is subsumed by 404684003 |Clinical finding (finding)|, therefore 64572001 |Disease (disorder)| is the PP supertype concept.



For example,

- There are three potential primitive supertypes of the concept 424643009 |Immunoglobulin E-mediated allergic asthma (disorder)|. 64572001 |Disease (disorder)| subsumes 389145006 |Allergic asthma (disorder)| and 427439005 |Immune hypersensitivity disorder by mechanism (disorder)|, so it is not a PP supertype. Neither 389145006 |Allergic asthma (disorder)| nor 427439005 |Immune

hypersensitivity disorder by mechanism (disorder) are subtypes of each other, so both are the PP supertypes for this concept.



2.3.6 Intermediate Primitive Concept Modeling

Concepts that cannot be sufficiently defined using the current concept model are called *primitive concepts*. Primitive concepts cannot have subtypes automatically assigned by the classifier. Instead, each relevant concept must be identified and the IS_A relationship authored manually, in order to create the relationship between the subtype concept and the primitive supertype concept.

When a primitive concept is a child of one or more concepts and a parent of one or more concepts, it is known as an *intermediate primitive*.

For example,

- 116223007 |Complication (disorder)|

All children of this concept have an IS_A relationship making it difficult to determine all related children. Hence, all relevant subtypes may not be present.

Identifying all members during development of a subset or all relevant content for data retrieval is less than optimal. When adding new concepts, potential *primitive parents* need to be identified and the IS_A relationship stated. The author must locate all relevant *supertype primitive* concepts in the current content and create the relationships.

Given the potential implications of this manual process, the addition of an intermediate primitive concept is prohibited unless:

- There is no other option and the concept is clinically necessary.
- The impact of adding the concept has been fully explored and understood.
- The impact is manageable and there is a management plan, including an extensional definition for the direct sub-concepts.

For the International Release, such requests are assessed case-by-case.

2.3.7 Grouper Concept

Grouper concepts provide a definition for subtypes that are always and necessarily true.

Grouper concepts may only be added with the approval of the Head of Terminology. The grouper concept must be sufficiently defined and clinically useful for the purpose of organizing content for an intensional reference set (e.g. *disease of colon and all of its descendants*) or in Expression Constraint Language (ECL) 128524007 |Disorder of colon (disorder)|.

Grouper concepts should not be confused with *Navigational concepts*.

Navigational concepts are not accepted in *SNOMED CT*. In the past, a navigation concept was used to group other concepts without explicit regard for defining attributes (since there were none). They were created to assist with navigation through hierarchies.

Anatomy concepts

Anatomy concepts have separate rules.

If a grouper concept is added to *SNOMED CT*, it must adhere to the following rules:

- The concept must not be created with the hierarchical tag, (navigational concept).
- The concept must use the semantic tag for the relevant hierarchy e.g. (finding), (procedure).
- The concept must not have stated subtypes. All subtypes must be inferred by the classifier.
- A primitive grouper concept cannot be added, unless approved by the Head of Terminology.
- The grouper concept will ONLY be added if it can be sufficiently defined.

Where grouper concepts already exist, the following criteria apply:

- If it can be sufficiently defined, remodel it and reassign existing stated subtypes to a new proximal primitive parent.
- Currently primitive and cannot be sufficiently defined, identify it for additional review.

Exception

Primitive grouper concepts may be added in a hierarchy without a robust concept model.

For example,

- Not robust enough to handle the needs of genomics (i.e. genetic diseases for which we cannot state, *the majority of cases of this disease present with X*)
- Where there are variances in the clinical manifestations

Modeling

If the addition of a grouper concept duplicates a concept in the navigational hierarchy, 363743006 | Navigational concept (navigational concept), the navigational concept should be inactivated.

2.3.8 Relationship Group

A *relationship group* combines an attribute-value pair with one or more other attribute-value pairs.

- Multiple attributes-value pairs may be grouped together in relationship groups, and multiple relationship groups may be created, to sufficiently define concepts.
- When creating new concepts or revising existing ones, each attribute type included in a relationship group may only be present once, e.g. two Associated morphology attributes cannot be in the same relationship group.
- Relationship groups originated to add clarity to:
 - Clinical finding concepts which require multiple Associated morphology attributes and multiple Finding site attributes; and
 - Procedure concepts which require multiple Method attributes and multiple Procedure site attributes.
- Relationship groups are not limited to Clinical finding and Procedure concepts.
- There is no limit to the number of Relationship groups that may be added to a concept.

✔ **Modeling**

As with all authoring activities, grouping the attribute-value pairs is performed in the stated view.

Ungrouped attributes

An attribute-value pair that is not in a relationship group is considered to be in a group on its own. When attribute-value pairs are not grouped their meanings are interpreted separately. For example, in the following diagram the Associated morphology is Hemorrhage and the Finding site is Uterine structure. However, it cannot be interpreted that the site of the Hemorrhage is the Uterine structure.

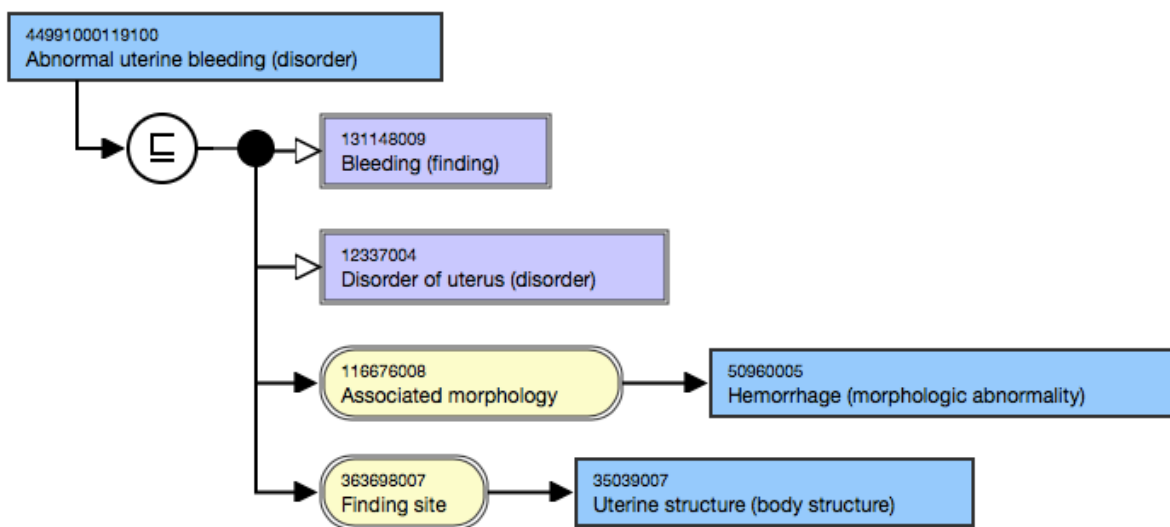


Figure 1: Ungrouped attributes values: Hemorrhage (morphologic abnormality) and Uterine structure (body structure)

Impact of relationship grouping on inheritance

Relationship groups refine inheritance, i.e a grouped set of attributes is more specific than the same attributes that are not grouped. This is important when considering subsumption. The following diagrams demonstrate the impact of grouping/failing to group consistently, using the concepts [50434004 |Excision of lesion of aorta \(procedure\)|](#) and one of its supertypes, [63296004 |Excision of aorta \(procedure\)|](#).

The meaning of the supertype concept, [63296004 |Excision of aorta \(procedure\)|](#) (where the relationships are grouped) is interpreted as: a procedure with an excision on the aortic structure. This is because the attributes, Procedure Site - Direct and Method are grouped.

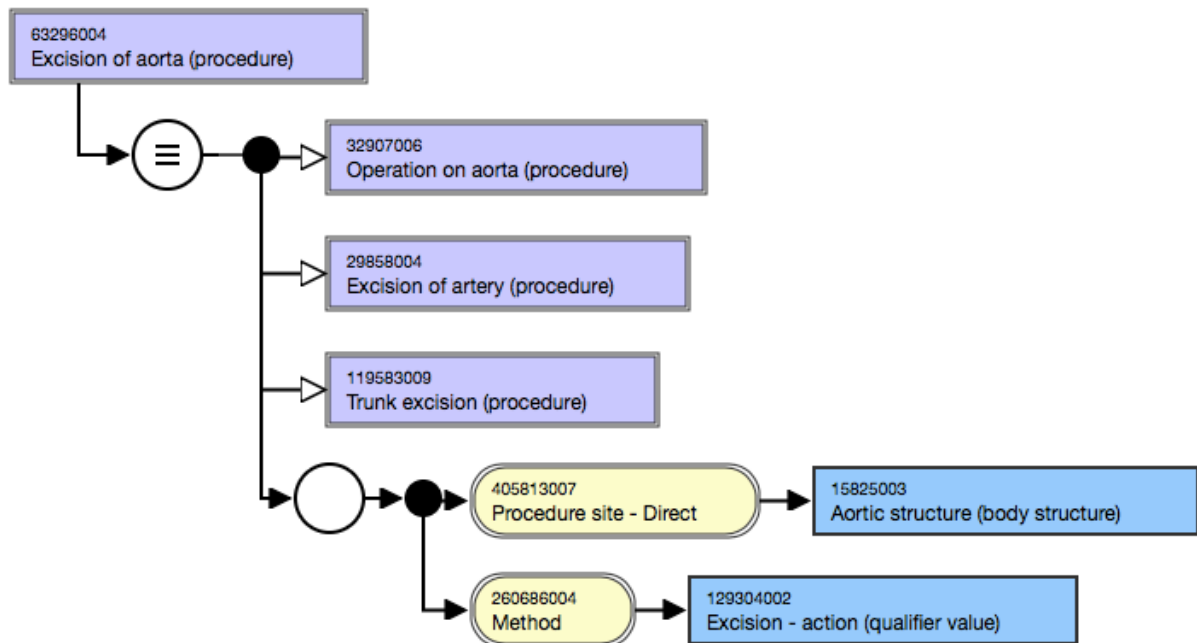


Figure 2: The supertype concept: Excision of aorta (procedure) with attribute-value pair grouping

In the following diagram, the more general supertype concepts, 65801008 |Excision (procedure)| and 118809006 |Procedure on aorta (procedure)| are the proximal supertype concepts.

50434004 |Excision of lesion of aorta (procedure)| is a logical subtype of 63296004 |Excision of aorta (procedure)|. However, the attributes of the concept 50434004 |Excision of lesion of aorta (procedure)| are not grouped. Thus, the classifier interprets the definitions as non-related and 50434004 |Excision of lesion of aorta (procedure)| is not inferred as a subtype of 63296004 |Excision of aorta (procedure)|. This is because the attribute-value pairs in the subtype concept are not grouped, i.e. are not explicitly stated. From a machine-processing perspective, each attribute value pair is considered a group on its own, i.e. there is an excision but nothing else is known about the excision. This results in the concept, 63296004 |Excision of aorta (procedure)|, being interpreted more broadly.

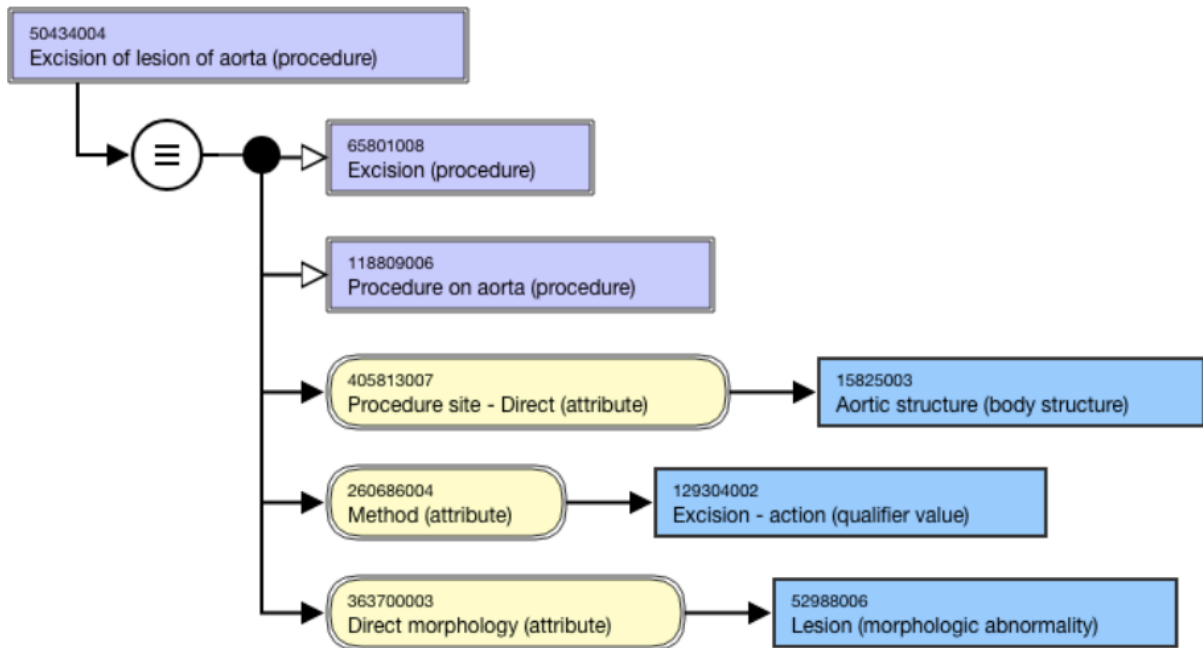


Figure 2.3.8-3: The subtype concept: Excision of lesion of aorta (procedure) without attribute-value pair grouping

In the following diagram the attributes of the concept 50434004 |Excision of lesion of aorta (procedure)| are grouped. An author that explicitly states that the excision is of a lesion found in the aortic structure, by grouping the attribute-value pairs, provides the necessary information for the classifier. This enables 50434004 |Excision of lesion of aorta (procedure)| to be inferred as a subtype of 63296004 |Excision of aorta (procedure)|.

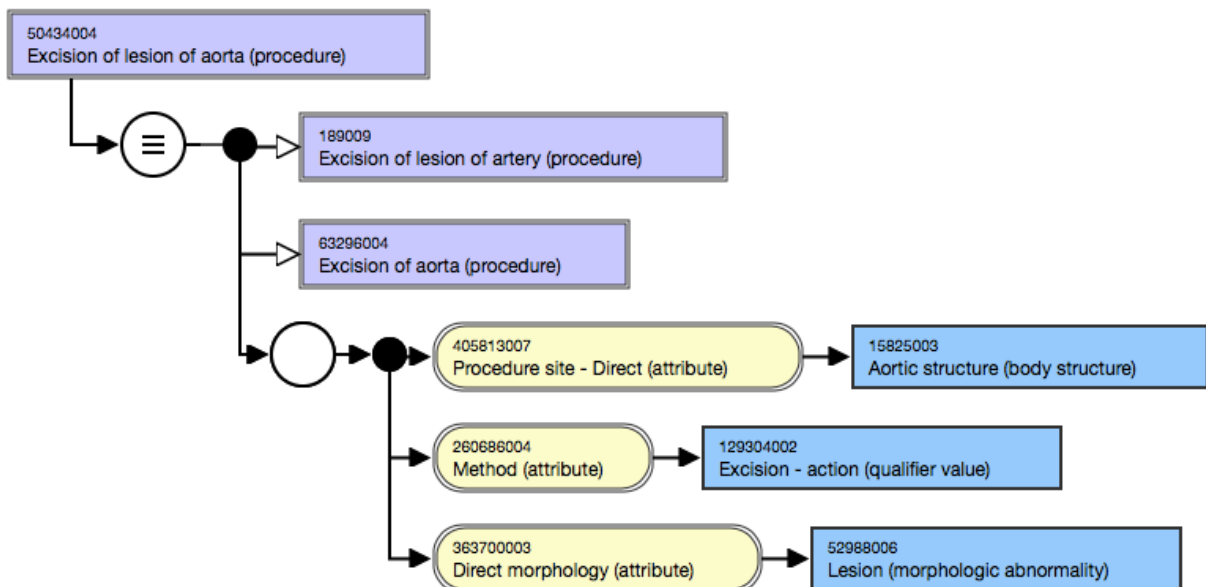


Figure 2.3.8-4: The subtype concept: Excision of lesion of aorta (procedure) with attribute-value pair grouping

Same attributes in separate relationship groups

Each Relationship group should only contain one instance of an attribute. This is because two of the same attributes in a relationship group is not the same as one attribute with one target value that captures the combined meaning of the target values, as illustrated in the following diagram.

Two Finding site attributes are required to support the location of 53627009 |Closed fracture of radius AND ulna (disorder)|. Each 363698007 |Finding site (attribute)| attribute, and its respective target value, are placed in a Relationship group, together with the attribute 116676008 |Associated morphology (attribute)|, with a target value of 20946005 |Fracture, closed (morphologic abnormality)|.

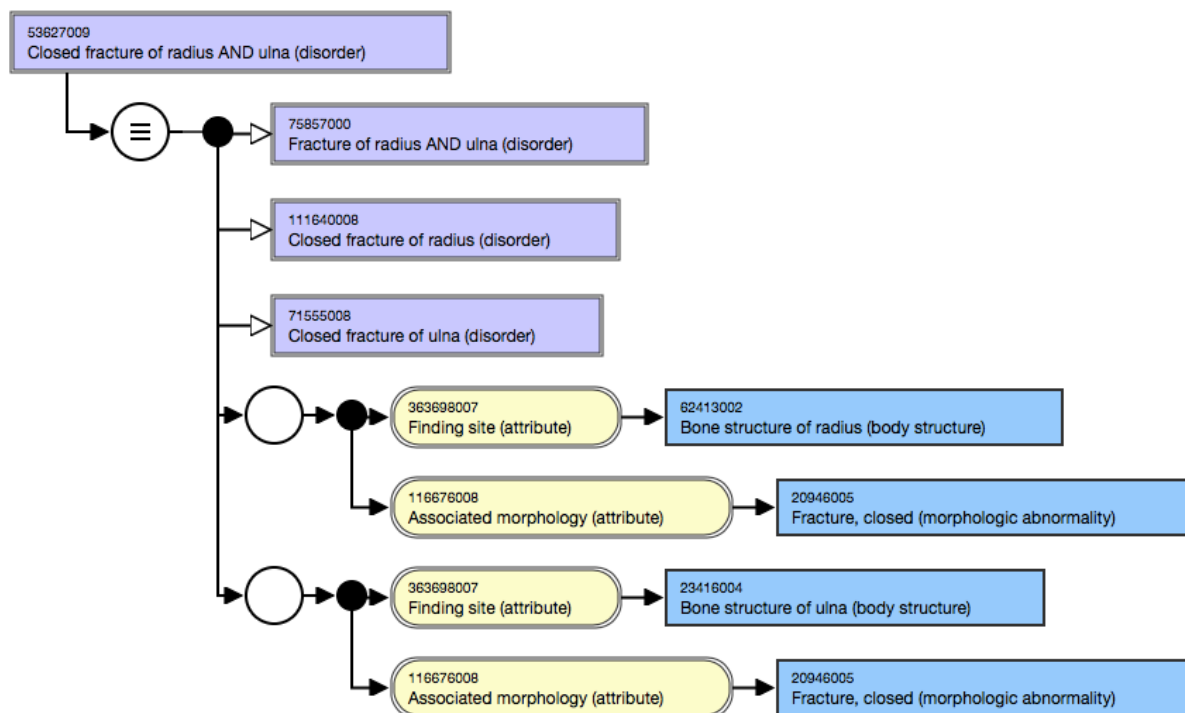


Figure 2.3.8-5: Same attributes, two separate relationship groups

Procedure hierarchy

In the Procedure hierarchy, a relationship group is usually a way of combining attributes about a particular Method.

In the concept, 302619004 |Cholecystectomy and exploration of bile duct (procedure)| in the following diagram, the Relationship groups clarify that there is exploration of the bile duct, and excision of the gall bladder. Without the Relationship groups, the appropriate relationships between the attributes would be unclear, i.e. the exploration of the bile duct vs. gallbladder and the excision of the bile duct vs. the gall bladder.

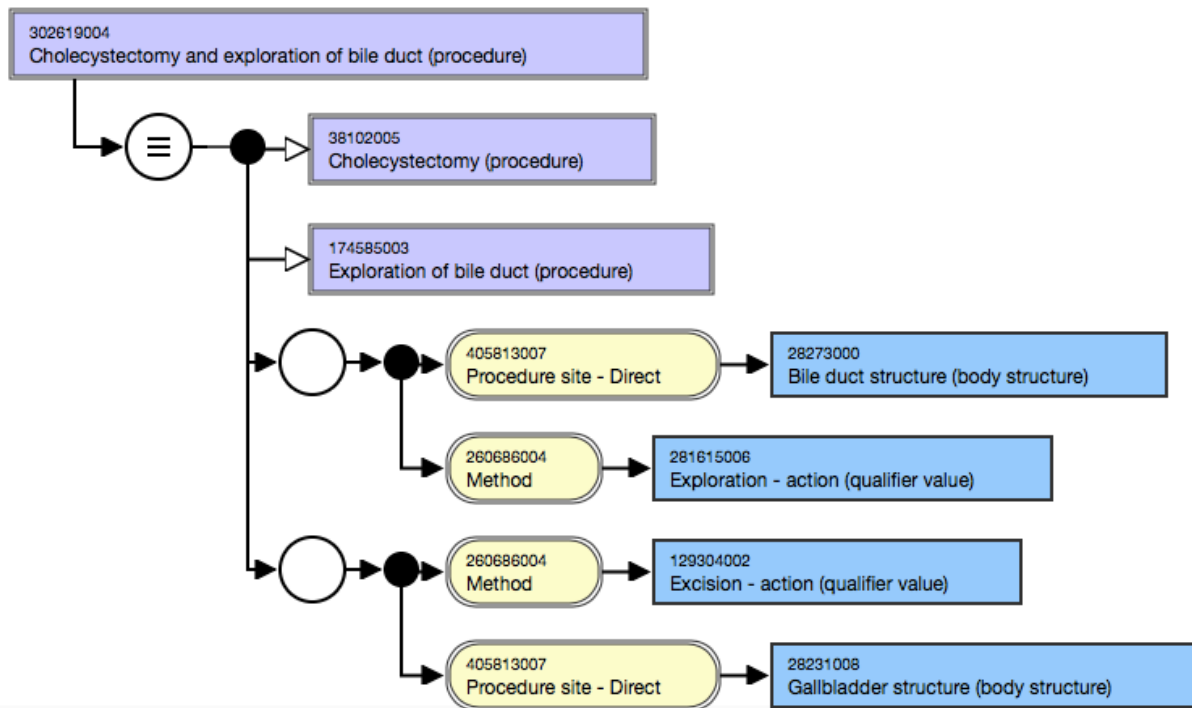


Figure 2.3.8-6: Procedure relationship group: combining attributes about a Method

✓ Modeling

When there is no Method stated, the Procedure site or (subtype, Procedure site-direct, Procedure site-indirect), is always grouped with Procedure morphology (or subtype, Direct morphology, Indirect morphology) for that site.

Clinical Finding hierarchy

In the Clinical finding hierarchy:

- The 363698007 |Finding site (attribute)| and 116676008 |Associated morphology (attribute)| attributes are always grouped when both are present and related.
 - As with Procedure Relationship groups, when there is more than one 363698007 |Finding site (attribute)| or 116676008 |Associated morphology (attribute)| attribute, then more than one Relationship group is required.
 - 246454002 |Occurrence (attribute)| concept and/or the 246075003 |Causative agent (attribute)| attributes, that are also stated and related to the 363698007 |Finding site (attribute)| and 116676008 |Associated morphology (attribute)| attributes, should be included in that Relationship group.
 - As in the following diagram, when the 246075003 |Causative agent (attribute)| attribute is an organism, the 370135005 |Pathological process (attribute)| attribute is also included in that Relationship group, with the target value of 441862004 |Infectious process (qualifier value)| or 442614005 |Parasitic process (qualifier value)|.
- The Interprets/Has interpretation attribute pair are always grouped together where both are present and they are related. The attribute pair is used to define Clinical finding, i.e. it provides additional information about the Clinical finding. It is most often used to define observation results or describe the analysis used to determine the observation. Interprets/Has interpretation is not grouped with any other attributes.

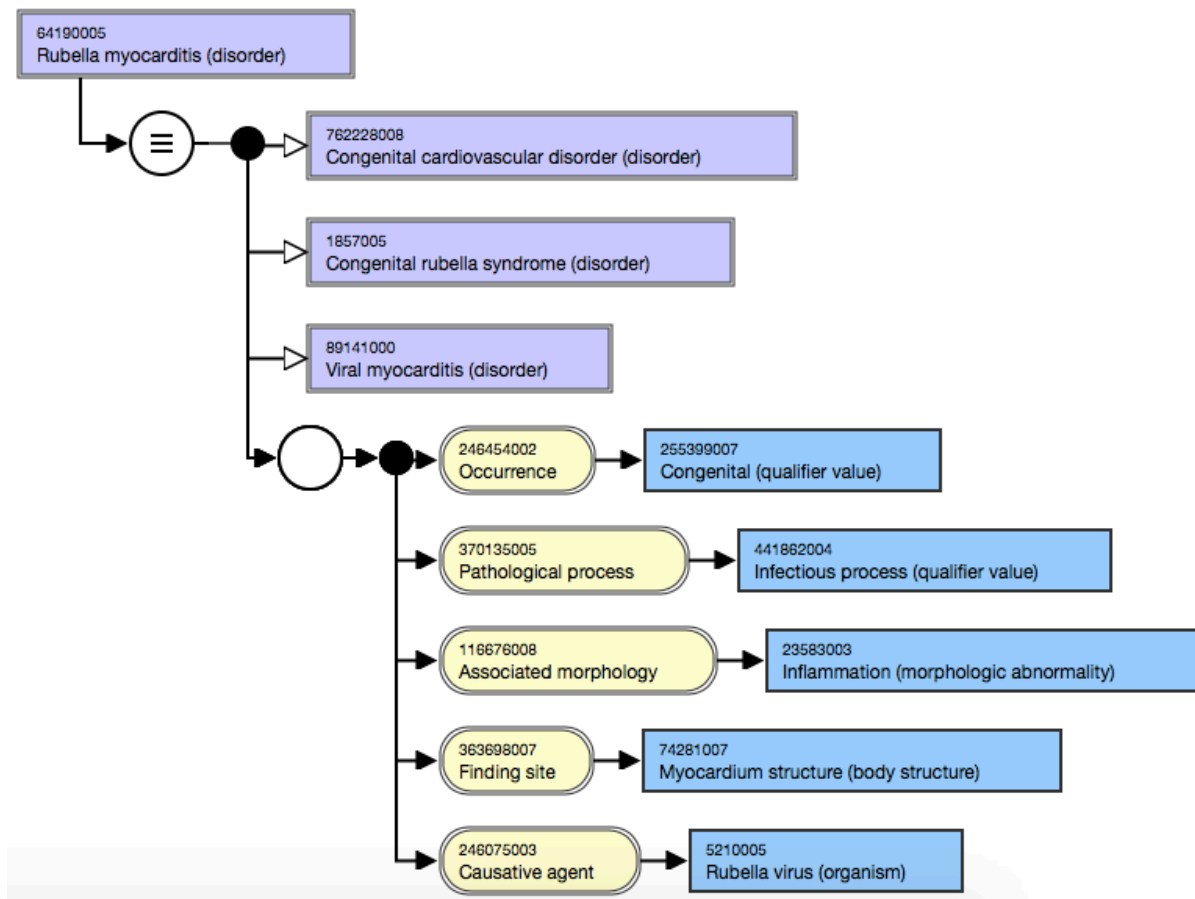
- The Finding method/Finding informer attribute pair are also grouped together where both are present and they are related.

Modeling

The following attributes are not grouped by authors:

- Due To
- After
- Clinical Course

Figure 2.3.8-7: Clinical finding with Causative agent and Pathological process attributes



Situation with Explicit Content hierarchy

For Finding with Explicit Context concepts the following four attributes are grouped:

- 408729009 |Finding context (attribute)|
- 246090004 |Associated finding (attribute)|
- 408731000 |Temporal context (attribute)|
- 408732007 |Subject relationship context (attribute)|

For example, 704008007 |No family history of asthma (situation)| /S A Situation with explicit context,

- 408729009 |Finding context (attribute)|, 410516002 |Known absent (qualifier value)|

- 246090004 |Associated finding (attribute)|, 195967001 |Asthma (disorder)|
- 408731000 |Temporal context (attribute)|, 410511007 |Current or past (actual) (qualifier value)|
- 408732007 |Subject relationship context (attribute)|, 444148008 |Person in family of subject (person)|

For Procedures with Explicit Context concepts the following four attributes are grouped:

- 408730004 |Procedure context (attribute)|
- 363589002 |Associated procedure (attribute)|
- 408731000 |Temporal context (attribute)|
- 408732007 |Subject relationship context (attribute)|

For example, 704503005 |Advice given about pelvic floor exercise (situation)| *IS A* Procedure with explicit context,

- 408730004 |Procedure context (attribute)|, 385658003 |Done (qualifier value)|
- 363589002 |Associated procedure (attribute)|, 420227002 |Recommendation to (procedure)|
- 408731000 |Temporal context (attribute)|, 410512000 |Current or specified time (qualifier value)|
- 408732007 |Subject relationship context (attribute)|, 125676002 |Person (person)|

Observable entity hierarchy

Relationship grouping is not permitted when modeling concepts in the Observable entity hierarchy.

2.3.9 Conjunction and Disjunction

In *SNOMED CT*, *and* is used in descriptions to represent the operator for logical conjunction. Concepts with the disjunctives (*or*, *and/or*) are unacceptable. Instead, there should be separate concepts. There are limited exceptions where *and/or* is used to represent the operator for inclusive disjunction. This helps to avoid confusion with the literal use of *or* in common language, i.e. only one of two operands is true; rarely both operands are true.

Common usage: and, or

In logic and mathematics, *and* is the truth-functional operator of conjunction. The *and* of a set of operands is true, if and, only if all of its operands are true. *Or* is the truth-functional operator of inclusive disjunction. The *or* of a set of operands is true, if and, only if one or more of its operands is true.

Conjunction and Disjunction			
	<i>and</i>	<i>or</i>	<i>and/or</i>
<i>SNO MED CT</i>	Conjunction: And <ul style="list-style-type: none"> • A set of operands is true, if and, only if all of its operands are true • A and B are true 	Not allowed in <i>SNOMED CT</i>	Inclusive disjunction: And/or <ul style="list-style-type: none"> • A set of operands is true, if and, only if one or more of its operands is true • Either A or B is true or • Both A and B are true

Anatomical structure hierarchy

Conjunction and disjunction are commonly used in the anatomical structure hierarchy.

For example, 419605007 |Structure of ankle and/or foot (body structure)| represents adjacent regions of ankle and foot by a single concept. It is inclusive disjunction because any structures of ankle, foot, or both are true

subconcepts. *Entire ankle and foot* as a conjunction means the ankle and foot as a whole. The concept represents the entirety of this single region though there is no dedicated name.

Following the anatomy SEP (Structure/Entire/Part) model (full discussion in appendices), structure means all or any part of an anatomic entity, which is inclusive disjunction. *Structure of ankle and foot* represents all or part of *entire ankle and foot*. Therefore, any structures of ankle, foot, or both are true subconcepts of *structure of ankle and foot*. *Structure of ankle and foot* has the same meaning as *structure of ankle and/or foot*. The use of *and/or* is actually redundant for structure concepts like 419605007 |Structure of ankle and/or foot (body structure)|.

Inclusive disjunction

Structure of ankle and foot was previously used. These descriptions were changed to *and/or* to explicitly indicate *inclusive disjunction*. This supports users who are unfamiliar with the interpretation of *structure* in the SEP model.

And

The *and* represents conjunction in disorders and procedures that can be interpreted as co-occurrent. It can be read as *both* in common usage. It would be *all* if it refers to more than two disorders or procedures.

For example,

- 75857000 |Fracture of radius AND ulna (disorder)| represents the occurrence of a *fracture of radius* and a *fracture of ulna* at the same time or event. In other words, fracture of both radius and ulna. The concept should be modeled using two finding site relationship groups: Bone structure of radius in one and Bone structure of ulna in the other.

And/or

The *and/or* represents disjunction in disorders and procedures, i.e. one or more of the parts is involved.

For example,

- 65966004 |Fracture of forearm (disorder)|

The concept does not specify which bone of forearm is fractured. It is a break in *one or both of the radius and/or ulna* per the ICD definition. It would subsume fracture of radius, fracture of ulna, and fracture of both radius and ulna.

Modeling

The use of *and/or* in a description with disjunction should be lower case.

2.3.10 Changes to Components

Concepts, descriptions, and target values may be changed for a variety of reasons.

2.3.10.1 Concept Inactivation

Concept inactivation values

Depending upon the combination of the type of component and the reason for inactivation, a specific Inactivation reason has to be selected.

Inactivation reason	Association type	Notes
Ambiguous	<i>Possibly equivalent to</i>	<ul style="list-style-type: none"> • Applies to a concept that is ambiguous • The target component is an active concept that represents one of the possible meanings of the inactive concept • Multiple rows are used to refer to each of the possible meanings of the ambiguous concept • Previously referred to as <i>May Be A</i>
Component moved elsewhere	<i>Moved to</i> association reference set (foundation metadata concept)	<ul style="list-style-type: none"> • Applies to a component that has been moved to, or is pending a move to, another namespace • The target component identifies the target namespace, not the new component
Duplicate component	<i>Same as</i> association reference set (foundation metadata concept)	<ul style="list-style-type: none"> • Applies to a component that is a duplicate • The target component identifies the active component that this component duplicates
Erroneous component	<i>Replaced by</i> association reference set (foundation metadata concept)	<ul style="list-style-type: none"> • Applies to an erroneous, obsolete, or other inactive component for which there is a single active replacement • The target component identifies the active component that replaces this component
Limited component	<i>Was A</i> - not to be used when creating new content	<ul style="list-style-type: none"> • A concept must retain <i>Limited= Was A</i>. Make sure to check results after inactivating a target concept and restore the <i>Limited</i> status of any affected concepts <p>and</p> <ul style="list-style-type: none"> • When the target of a <i>Was A</i> is inactivated, retain the <i>Was A</i> and use the next proximal primitive parent as the replacement target concept
Outdated component	<i>Replaced by</i> Association reference set (foundation metadata concept)	<ul style="list-style-type: none"> • Applies to an erroneous, obsolete, or other inactive component for which there is a single active replacement • The target component identifies the active component that replaces this component
Non-conformance to editorial policy	No association required	<ul style="list-style-type: none"> • Applies to a concept which does not adhere to the Editorial guidelines

2.3.10.2 Description Inactivation

Description inactivation values

Depending upon the combination of the type of component and the reason for inactivation, a specific Inactivation reason has to be selected.

Inactivation value	Definition	Example
Not semantically equivalent component (foundation metadata concept)	A description does not represent the same meaning as the concept's Fully Specified Name (FSN)	The FSN Removal of device (procedure) has the synonym, Replacement of prosthetic device (procedure). The synonym has a more specific meaning than the FSN, so it should be inactivated
Outdated component (foundation metadata concept)	A component is no longer current, useful, appropriate or acceptable	The synonym <i>Funny looking kid</i> was inactivated from 112630007 Abnormal facies (finding)
Erroneous component (foundation metadata concept)	A component contains a technical error	Case significance changes, <i>Alpha</i> where the lower case <i>a</i> should have been used Spelling errors, a description where <i>Asthma</i> is misspelled <i>Assthma</i>
Nonconformance to editorial policy component (foundation metadata concept)	A component fails to comply with the current editorial guidance	The concept Urine: turbid (finding) was inactivated and replaced by 167238004 Turbid urine (finding)

Order of selection of inactivation values

When there is more than one reason to inactivate a description, the order of preference for the inactivation value is as follows:

1. 723278000 |Not semantically equivalent component (foundation metadata concept)|
2. 900000000000483008 |Outdated component (foundation metadata concept)|
3. 900000000000485001 |Erroneous component (foundation metadata concept)|
4. 723277005 |Nonconformance to editorial policy component (foundation metadata concept)|

2.3.10.3 Target Values

Limited *Was A*

Prior practice permitted the use of *Limited* as a reason for inactivation with a value of *Was A* for the Association type. This is no longer permitted. However, when a concept with Limited status is inactivated, as the result of a related inactivation, the relationship *Limited - Was A* has to be restored. This applies to users of the Single Concept Authoring (SCA) Tool.

Considerations for *range* concepts

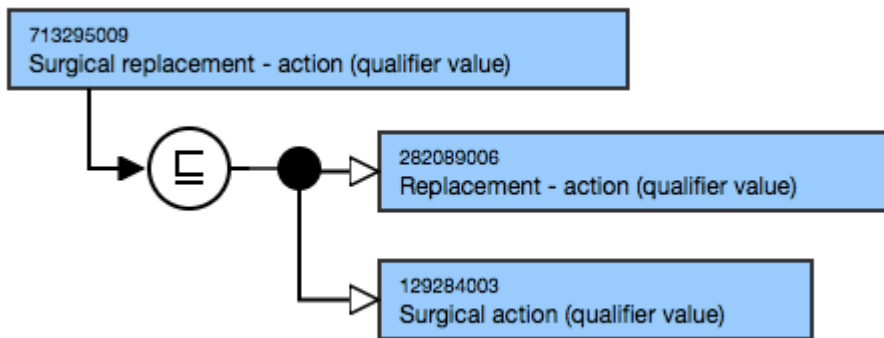
Concepts that are used as a target value in an attribute relationship impact the placement of the source concept of the relationship. Some concepts, for example, those in the Qualifier value hierarchy, are created to support the definition of other concepts.

Review after addition of new attribute value

Creation of a new concept that will be used as the target value in an attribute relationship requires an author to determine if there are active concepts in the *domain* hierarchy that should also use the new concept as a target value.

For example,

The creation of a concept 713295009 |Surgical replacement - action (qualifier value)| would require a review of current active concepts that represent surgical replacement procedures; that were previously modeled with the attribute relationship Method = *Replacement - action*.



A concept that represents a surgical replacement procedure that currently has the relationship Method = 282089006 |Replacement - action (qualifier value)|, would require inactivation of the relationship and creation of a new relationship Method = 713295009 |Surgical replacement - action (qualifier value)|.

2.4 Editing and Modeling: Specific Domain Hierarchies

SNOMED CT is arranged as a polyhierarchy. A *hierarchy* is defined as an ordered organization of concept codes linked together through IS A relationships. Concept codes are linked to their more general parent concept codes directly above them in a hierarchy. Concepts with more general meanings are usually located at the top of the hierarchy and then at each level down the hierarchy the meanings become increasingly more specialized.

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

Domains

The following are the 19 domains, arranged in alphabetical order. ***Those without Concept Models are marked with an asterisk.**

! Modeling: precoordination patterns

SNOMED CT relies on the rules for *usefulness* to avoid excessive precoordination (see *Does It Belong in SNOMED CT?*).


Approved precoordination patterns have been created and are available at: [Precoordination Pattern JIRA Project](#). For additional information about the fields used in precoordination, see: [What the fields in the Precoordination Pattern JIRA Project mean](#).

2.4.1 Body Structure

Definition	Examples
Includes Anatomical structures and Morphologic abnormalities (subtype of body structure)	Body structure <ul style="list-style-type: none"> 38033009 Amputation stump (body structure) 91134007 Mitral valve structure (body structure) Morphologic abnormality <ul style="list-style-type: none"> 189955008 Biopsy wound (morphologic abnormality) 31470003 Adenosarcoma (morphologic abnormality) Cell <ul style="list-style-type: none"> 250293008 Agranular white blood cell (cell) 57184004 T lymphocyte (cell) Cell structure <ul style="list-style-type: none"> 4897009 Cell membrane, prokaryotic (cell structure) 362293000 Entire axon (cell structure)

The body structure domain includes anatomical structures, as well as morphologic abnormalities, as follows:

- Body structure (body structure)
 - Anatomical or acquired body structure (body structure)
 - Anatomical organizational pattern (body structure)
 - Anatomical site notations for tumor staging (body structure)
 - Body structure, altered from its original anatomical structure (morphologic abnormality)
 - Nonspecific site (body structure)
 - Normal anatomy (body structure)
 - Topography not assigned (body structure)
 - Topography unknown (body structure)

 Concepts under 258331007 |Anatomical site notations for tumor staging (body structure)| require review and reallocation.

2.4.1.1 Body Structure Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 123037004 Body structure (body structure)	
Domain Constraint	<< 123037004 Body structure (body structure)
Parent Domain	-
Proximal Primitive Constraint	<< 123037004 Body structure (body structure)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 123037004 |Body structure (body structure)|

Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
123005000 Part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733928003 All or part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733930001 Regional part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733931002 Constitutional part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733932009 Systemic part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733933004 Lateral half of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)

✓ Modeling: Part of

For all Body structure (body structure) concepts, *Part of* is an approved attribute which can be populated with the range of qualifier values including *Body structure (body structure)* or its subtypes.

Domain Information for 91723000 Anatomical structure (body structure)	
Domain Constraint	<< 91723000 Anatomical structure (body structure)
Parent Domain	123037004 Body structure (body structure)
Proximal Primitive Constraint	<< 91723000 Anatomical structure (body structure)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 91723000 Anatomical structure (body structure)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
123005000 Part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
272741003 Laterality (attribute)	0	0..1	0..0	<< 182353008 Side (qualifier value)
733928003 All or part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733930001 Regional part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733931002 Constitutional part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733932009 Systemic part of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)
733933004 Lateral half of (attribute)	0	0..*	0..0	<< 123037004 Body structure (body structure)

✓ Modeling: Laterality

For all Anatomical structure (body structure) concepts, *Laterality* is an approved attribute which can be populated with the range of qualifier values including *Side (qualifier value)* or its subtypes.

2.4.1.2 Anatomical Structure Modeling

Section links

General anatomical concepts

- Body parts, body regions
- Surface regions
- Abdominal regions
- Abdominal cavity, pelvic cavity
- Organs, organ system subdivisions
- Cell, tissue, organ
- Tree structured organs
- Hollow tree organs

Cardiovascular system

- Cardiac valves, normal and malformed
- Systemic, pulmonary circulation
- Arterial
- Venous
- Central, peripheral, cerebrovascular systems
- Common carotid artery, artery of neck
- Intracranial, extracranial vascular system
- The word artery
- The word vein
- Trunk of vein, vein as a tree structure

Digestive system

- Upper aerodigestive tract
- Biliary tract
- Tongue

Endocrine system

Genitourinary system

- Urinary system/tract
- Urinary tract proper
- Lower urinary tract

Integumentary system

- Skin, skin-associated mucosa
- Skin regions, skin of named body part
- Scalp

Soft tissue

Lymphatic, Hematologic, Hematopoietic systems

Lymphatic system

Lymphoid system

Immune system

Mononuclear phagocyte system

Dendritic cell system

Hematologic system

Hematopoietic system

Blood

Regional lymph nodes of lungs

Musculoskeletal system

Skeletal system, bony skeleton

Bone

Non-ossified bone

Bone marrow, bone cavity

Structure of (named bone), bone structure of (named bone)

Long bone, short bone

Sternum, manubrium, body, xiphoid

Teeth, maxilla, mandible

Joints, joint regions

Shoulder girdle

Intertarsal joint structure

Arm, leg and upper, lower extremities

Shoulder and hip regions, upper and lower limbs

Axilla

Tendon

Muscle function

Nervous system

Nerve

Supratentorial brain

Respiratory system

Respiratory tract

Upper aerodigestive tract

Upper respiratory tract

Lower respiratory tract

Lower respiratory system

Interarytenoid fold or larynx

Nasal turbinates

Ear

Eye

Choroid

Retinal vein

Orbital region

Many terms that refer to body systems or tracts are used imprecisely in clinical practice and in medical publications. Ambiguities frequently arise with many of these terms.

We have made the following definitions and distinctions in order to achieve internal consistency of the terminology. We recognize that it may not be possible to get universal consensus for the names for each of these concepts. The goal is to be consistent and clear in defining the meaning of each concept, and to allow users and system designers to present the terms that best reflect these meanings in their own implementations.

General anatomical concepts

Body parts, body regions

SNOMED CT uses the Foundation Model of Anatomy (FMA) definition of *body part* and *body part subdivision* for some concepts. For example, the joint regions discussed below are classified as body part subdivisions, since that is what is intended by the diseases and procedures that use these terms 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, our interpretation of the word *region* is based on common usage and is intended as a three-dimensional structure, *not* the FMA two-dimensional definition of body region. In other words, these regions are not simply surface regions (skin), but also include the three dimensional underlying structures (subcutaneous tissues, bones, muscles, tendons, fascia, vessels and etc.).

Surface regions

Many concepts contain the phrase *surface region*. These could be interpreted as massless (immaterial) mathematical surfaces, but a clinical terminology would have no direct use for such meanings in clinical records. They could be interpreted as having mass (not immaterial), but the depth then is arbitrary. Should it be just skin deep, or should it include deeper layers of the surface? If only skin deep, the meaning of these concepts would overlap with concepts for skin regions. If deeper, the meaning would possibly be the same as the generic structure concepts.

Inactivation

Most surface region concepts will be retired as ambiguous/*possibly equivalent* to their corresponding concepts that are clearly not immaterial, including x structure, entire x, and skin of X. Where the x structure codes do not currently exist, they will be created, without the surface region phrase.

Abdominal regions

The named regions of the abdomen are by tradition divided horizontally by the transpyloric plane and the interspinous plane, and vertically by the midclavicular plane. The lateral regions are therefore bounded above by a plane that is inferior to the ribs. In contrast, the flank is the lateral region of the abdomen bounded above by the ribs. Thus some parts of the hypochondriac regions, which are superior to the transpyloric plane but inferior to the ribs, would be considered also part of the flank. The hypogastric region is also sometimes called the pubic region.

Abdominal cavity, pelvic cavity

The term *abdominal cavity* has two meanings, one including the *pelvic cavity*, the other excluding it. *Abdominal cavity structure* includes both. *Abdominal cavity proper* excludes the pelvic cavity.

Organs, organ system subdivisions

The FMA definition of *body organ* is also used. Organs include individual bones, joints, muscles, arteries, veins, lymph vessels, nerves, and etc. Concepts that include groups of organs are frequently used in *SNOMED CT*. In most cases, these have been part of the subsumption hierarchy (IS A hierarchy) of the particular organ type, that is, they are *kinds of organs*.

For concepts that refer to the *collection of organs* (rather than organs in a collection), there is another concept that is a, kind of, *organ system subdivision*. Many such collections don't yet have corresponding organ system subdivision concepts. The default is to interpret concepts as denoting organs, rather than organ system subdivisions.

Collections of Organs with/without Organ System Subdivisions	
Organ	Organ system subdivision
Vertebra (bone of vertebral column)	Spine (subdivision of skeletal system)
Cervical vertebra	Cervical spine (subdivision of spine)
Third cervical vertebra	No corresponding organ system subdivision concept
Bone of skull	Skull (subdivision of skeletal system)
Bone of thoracic cage	Thoracic cage (subdivision of skeletal system)
Rib	No corresponding organ system subdivision concept
Third rib	No corresponding organ system subdivision concept
Right third rib	No corresponding organ system subdivision concept
Quadriceps femoris muscle	No corresponding organ system subdivision concept
Quadriceps femoris muscle, left	No corresponding organ system subdivision concept
Vastus medialis muscle	No corresponding organ system subdivision concept

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.

Tree structured organs

Arteries, veins, nerves, and the bronchi form tree-like structures that distribute across multiple regions. Because of their size and links with other structures, they require slightly different modeling. FMA divides tree structured organs as: *organs with organ cavities* and *organs that are solid*.

Hollow tree organs

Organ with organ cavity has a subtype, *hollow tree organ*. The hollow tree organs are:

- Tracheobronchial
- Biliary
- Vascular
 - Arterial
 - Systemic arterial
 - Pulmonary arterial
 - Venous

- Systemic venous (superior, inferior, and 4 cardiac trees)
- Pulmonary venous (superior and inferior left and superior and inferior right)
- Portal venous
- Lymphatic (right lymphatic duct and thoracic duct)

Among the solid organs, there is one category, *neural*, that is tree-structured (see below: Nervous system; neural tree).

Laterality, Digits

For information on laterality, see: [5. Laterality](#)

See also [8. Naming convention for anatomy \(draft\)](#) for information on naming concepts referring to digits

Combined anatomic structure

If two body structures are needed to fully define the finding site for a condition, then a combined anatomic structure should be created to represent that body structure.

Body systems

Cardiovascular system

Cardiac valves, normal and malformed

There are a number of concepts in the anatomy hierarchy that represent congenital cardiac malformations. This content was developed in cooperation with IPCCC (International Pediatric and Congenital Cardiac Code).

The following pairs of cardiac valve concepts do not represent the same thing and are siblings, not super- or subtypes, to each other:

- 11124005 |Atrioventricular valve (body structure)| vs. 279316009 |Atrioventricular (non-mitral, non-tricuspid) valve structure (body structure)|
- 91134007 |Mitral valve structure (body structure)| vs. 312523009 |Left (non-mitral) atrioventricular valve structure (body structure)|
- 46030003 |Tricuspid valve structure (body structure)| vs. 244344000 |Entire right (non-tricuspid) atrioventricular valve (body structure)|

Atrioventricular (non-mitral, non-tricuspid) valves represent body structures which were anatomically abnormal from the beginning of their development. They are not called mitral/tricuspid valve although they perform the same function as their normal counterpart would. They are also represented using the term *not morphologically mitral/tricuspid valve*.

For example,

- 459176007 |Abscess of right atrioventricular (not morphologically tricuspid) valve (disorder)| represents an abscess of the right atrioventricular valve that has been developed abnormally from the beginning vs. 431189009 |Abscess of tricuspid valve (disorder)|.

For a normally developed mitral/tricuspid valve, the term *left/right atrioventricular valve* can be used interchangeably. They are true synonyms. However, they cannot be used for abnormally developed valves, i.e. left atrioventricular (non-mitral)/right atrioventricular (non-tricuspid) valves.

Systemic, pulmonary circulation

The *systemic circulatory system* is the combined arterial and venous circulation that begins where blood leaves the left ventricle and ends where blood enters the right atrium. It excludes the coronary circulation. The heart chambers are also considered part of the circulatory system.

The *pulmonary circulation* is the combined arterial and venous circulation that begins where blood leaves the right ventricle and ends where blood enters the left atrium.

Arterial

81040000 |Pulmonary artery structure (body structure)|: Any artery of the pulmonary circulation, i.e. arteries carrying unoxygenated blood from the heart to the lungs. They include the trunk, right and left branches of the pulmonary artery (which are within the mediastinum), and all of their branches (which tend to occur at or past the hilum and are therefore regionally within the lung).

128260003 |Pulmonary artery within lung (body structure)|: Any artery of the pulmonary circulation that is regionally within the lung, the boundary being defined by the hilum.

45341000 |Structure of trunk of pulmonary artery (body structure)|: The main pulmonary artery (one of the *great vessels* that enter the heart) carrying blood from the right ventricle and dividing into right and left main pulmonary arteries (some dictionaries consider this synonymous with pulmonary artery).

Venous

430757002 |Structure of pulmonary vein great vessel (body structure)|: There are four pulmonary veins that enter the left atrium, two on each side. These are what is intended by the name |pulmonary vein| (*great vessels* that enter the heart).

In common usage, any vein that is part of the lung may be referred to as a pulmonary vein, but *SNOMED CT* has a separate concept:

122972007 |Pulmonary venous structure (body structure)|: This means any vein that drains the lung. A synonym is *vein of lung*. *Pulmonary veins* are vein of the lung, but *pulmonary vein* and *vein of lung* are not synonyms.

No concept

There is no concept for *pulmonary vein within lung*.

Central, peripheral, cerebrovascular systems

The term *central vascular* is not in common use. In fact, the term does not appear in *SNOMED CT*. However, the term *peripheral vascular* is very common, and therefore it requires a definition that (by default) sets the boundary between central and peripheral vascular systems.

The simplest definition of the peripheral vascular system is the vascular system that is not central; and then the central vascular system includes the pulmonary circulation, coronary circulation, cerebrovascular system, thoracic aorta, superior vena cava, inferior vena cava, and mediastinal blood vessels.

Peripheral vascular disease is often distinguished from cerebrovascular disease and coronary artery disease. These are the three major categories of diseases caused by problems in vascular circulation in general, and atherosclerosis, in particular. As a result of this clinical distinction, the cerebrovascular system is excluded from the peripheral vascular system.

Cerebrovascular is commonly defined in two ways: the blood vessels *in* the brain, or the blood vessels that *supply* the brain (including those within the brain). Because cerebrovascular disease includes extra-cranial occlusions of the vertebral and carotid arteries, we define the cerebrovascular system as those vessels involved in the supply and drainage of blood to the brain. Convention does, however, tend to exclude the innominate artery - which gives rise to the left common carotid and the arch of the aorta which gives rise to the right common carotid. Convention also excludes the subclavian arteries which give rise to the vertebral arteries.

Common carotid artery, artery of neck

The common carotid artery has a left and right component. The right common carotid artery has no thoracic portion (it arises from the brachiocephalic trunk behind the right sternoclavicular joint). The left common carotid artery has a thoracic portion (It arises from the arch of the aorta). Thus, the common carotid artery (not specifying laterality) is not exclusively an artery of the neck. This is because of the thoracic portion of the left common carotid artery. Then, artery of neck region includes the cervical part of left common carotid artery and all of the right common carotid artery.

Intracranial, extracranial vascular system

Some vascular trees are located wholly within the cranial cavity, but some (internal carotid; vertebral) cross the boundary between extra- and intra-cranial. Intracranial segments of such vascular trees must be individually identified as such, and the entire vascular tree must not be categorized as either extra- or intra-cranial.

Tree-structured organs

See *tree-structured organs* above, re: regional sections of venous and arterial tree organs.

The word *artery*

The word *artery* has three different meanings. In modeling *SNOMED CT* concepts that refer to arteries, it is necessary to decide on a case-by-case basis which of these meanings is intended.

Meanings of artery		
Meanings	Notes	Examples
An arterial trunk: a single tube	The most common in clinical use. The meaning of the word <i>artery</i> in injuries and operations is clearly a single tube, the trunk of the named artery, or trunk of the named arterial branch.	A puncture wound of the femoral artery affects the femoral arterial trunk. A grafting into the popliteal artery is done into the popliteal arterial trunk. Occlusions of arteries are located by naming the trunk where the occlusion occurs. Occlusions may affect circulation beyond the trunk, however, collateral circulation often mitigates the effects. Thus, it is incorrect to interpret <i>artery</i> to mean the entire subtree in any of these usages.
An arterial tree organ	There are only two complete arterial tree organs (the systemic arterial tree arising at the aortic valve, and the pulmonary arterial tree arising at the pulmonary valve) that are readily named as such. They are seldom referred to by disorders or procedures.	NA
An arterial trunk, plus all its branches	When modeling, it is challenging to differentiate when <i>trunk</i> vs. <i>trunk plus branches</i> is intended.	NA

Artery

This clinical usage of *artery* varies from the definition of the FMA, which defines *artery* as a subdivision of an arterial tree (organ) which consists of branching sets of tubes (arterial trunks) that form a tree; together with other arterial trees (organ parts), it constitutes an arterial tree (organ). The FMA definition corresponds to the third meaning of *artery* above.

The word *vein*

The word *vein* has three different meanings. In modeling *SNOMED CT* concepts that refer to veins, it is necessary to decide on a case-by-case basis which of these meanings is intended.

Meanings of vein	
Meanings	Notes
A venous trunk	As with the clinical usage of the word <i>artery</i> , clinical usage of the word <i>vein</i> generally refers to the trunk and not the entire tree
A venous tree organ	There are only eleven venous tree organs that are readily named as such.
A venous trunk, plus all its branches	When modeling, it is challenging to differentiate when <i>trunk</i> vs. <i>trunk plus branches</i> is intended.

Vein

This clinical usage of *vein* varies from the definition of the FMA, which defines *vein* as a subdivision of a venous tree (organ) which consists of branching sets of tubes (venous trunks) that form a tree; together with other venous trees (organ parts), it constitutes a venous tree (organ). The FMA definition corresponds to the third meaning of *vein* above.

Trunk of vein, vein as a tree structure

Because *trunks of veins*, not *venous trees*, have been used to organize the vein hierarchy, there are implications for regional classes.

For example, the internal jugular vein is a vein of the neck, but its entire *venous tree* extends into the head. The internal jugular vein *venous tree* is not strictly part of the neck, even though the internal jugular vein *venous trunk* is strictly part of the neck.

Tributaries are also modeled as direct tributaries of the trunk. A tributary of a named vein is part of the *venous tree* of the named vein, but not part of the *venous trunk* of the named vein. Some veins that are part of the *venous tree*, and therefore might be regarded as indirect tributaries, are not modeled as direct tributaries of the *trunk of the vein*. Direct tributary is the intended meaning of tributary.

Inactivation

All concepts with the name pattern *vein x and its tributaries* were inactivated due to ambiguity about their meanings. They have *MAYBE A* links to *structure of vein x* and *entire vein x*.

Digestive system

Digestive tract is the same as alimentary tract, and 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, exocrine pancreas, gallbladder, and biliary tract.

Gastrointestinal tract has two meanings in common usage. One that does and one that does not include the esophagus. The usage that includes the esophagus would more correctly be named esophago-gastrointestinal tract. Endoscopists frequently use this meaning, even though it is contrary to some dictionary definitions and does not follow strict lexical interpretation (which does not include the esophagus).

Upper gastrointestinal (GI) tract. When describing upper GI bleeding and upper GI radiographic and endoscopic procedures the upper GI tract includes the esophagus, stomach, and duodenum. The upper GI tract does not include the more restricted *stomach-intestine* entity.

Lower gastrointestinal (GI) tract. When describing lower GI bleeding, lower GI radiographic and endoscopic procedures, and lower GI output from ileostomies and colostomies, the lower GI tract includes the jejunum, ileum, cecum, colon, rectum and anal canal. The ligament of Treitz may be used as the division between upper and lower GI tracts (and the division between the duodenum and jejunum).

Also, since the upper GI tract is said to end at the duodenum-jejunum junction, and there is no concept meaning middle GI tract, the jejunum can be inferred to be in the lower GI tract.

Information

See *J Vasc Interv Radiol* 9:747 for an example of inclusion of the jejunum and distal tract as part of the lower GI tract.

Upper aerodigestive tract; 119253004 | Upper aerodigestive tract structure (body structure) |.

The *SNOMED CT* concept 361922007 |Entire upper aerodigestive tract (body structure)| has the meaning based on the following reference: *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* (Upper aerodigestive tract cancers, *Cancer* 1995 Jan 1;75 (1 Suppl): 147-53). This definition matches the tumors included in the *CAP Cancer Checklist* for upper aerodigestive tumors. The esophagus, or at least the cervical esophagus, may be included, but not in *SNOMED CT*.

Biliary tract

Biliary tract. Includes the gallbladder, intrahepatic and extrahepatic bile ducts, and common bile duct. It does not include the liver. *SNOMED CT* uses *biliary system* as a synonym for *biliary tract*. *SNOMED CT* has another concept that does include the liver, 732049009 |Entire liver and biliary system (body structure)|.

Mouth. Mouth has several different meanings including mouth region, oral region of the face, and rima oris.

Mouth region. Includes structures surrounding the oral cavity, as well as structures of the oral region of the face.

Modeling

Use *mouth region* for most disorders with a finding site of *mouth*.

Oral region of face. Includes the skin and subcutaneous tissue of the lips and perioral region, the orbicularis oris muscle, and the vessels and nerves in these structures.

Rima oris. The opening of the mouth.

Tongue

The four regional parts of the tongue are the ventrum (inferior surface), dorsum, root, and body. The *root 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.

Endocrine system

The endocrine system is composed of the endocrine pancreas, pineal body, paraganglia, paraaortic bodies, parathyroid glands, endocrine ovaries, endocrine testes, adrenal glands, pituitary gland, thyroid gland, juxtaglomerular apparatus of the kidneys, and some diffuse neuroendocrine structures. Certain parts of the thymus produce endocrine hormones, but the thymus itself is not part of the endocrine system.

Genitourinary system

Urinary system/tract

The urinary system includes the organs that form and excrete urine, the kidneys, ureters, bladder, and urethra. The male urinary system includes the prostatic urethra (since it is a male urinary outflow structure).

In common usage, *urinary system* and *urinary tract* are used interchangeably. However, in *SNOMED CT*, this is not the case, i.e. they are not synonyms. The two concepts are: [122489005 |Urinary system structure \(body structure\)|](#) and [431938005 |Structure of urinary tract proper \(body structure\)|](#).

Urinary tract proper

The urinary tract proper includes the organs involved in the excretion of urine including the renal pelvis (but not the rest of the kidney), ureters, bladder, and urethra. It is used for disorders affecting the flow of urine (as opposed to its formation) or the urothelium, the lining of the urinary tract.

For example,

- [41368006 |Disorder of urinary tract proper \(disorder\)|](#)
- [249273002 |Finding of urinary tract proper \(finding\)|](#)
- [7163005 |Urinary tract obstruction \(disorder\)|](#)
- [255150000 |Carcinoma in situ of urinary tract proper \(disorder\)|](#)

Upper urinary tract

The upper urinary tract consists of the kidneys and the ureters (to the juncture with the bladder). Since upper urinary tract infections include kidney infection, the upper urinary tract must include the kidney.

Upper urinary tract proper

The upper urinary tract proper is the part of the urinary tract proper. It includes only part of the kidney, the renal pelvis, and the ureters.

For example,

- [25990002 |Renal pelvis structure \(body structure\)|](#) has a parent, [431491007 |Structure of upper urinary tract proper \(body structure\)|](#).

Lower urinary tract

The lower urinary tract, [19787009 |Lower urinary tract structure \(body structure\)|](#), is the urinary system below the junction of the ureter with the bladder. It consists of the bladder and urethra. Lower urinary tract and lower urinary system are the same. The male and female specific components are located under male urinary outflow structure and female urinary outflow structure, respectively.

Genitourinary system

The genitourinary system includes the entire urinary system, as well as the genital system.

Genital system

The genital system includes internal genital organs and external genitalia.

Prostate lobes

The *posterior lobe* of the prostate is described in newborns but does not persist in the adult. [113295002 |Structure of lobe of prostate \(body structure\)|](#) includes three lobes, left and right lateral, and medial.

Integumentary system

Skin, skin-associated mucosa

This is an example of a body structure that is used to group related terms. The concept [707861009 |Structure of skin and/or skin-associated mucous membrane \(body structure\)|](#) intentionally employs *disjunction* (inclusive *Or*). It includes structures in the deep layers, but excludes non-skin mucosal epithelium, e.g. bronchial, gastrointestinal, and genitourinary sites of squamous cell neoplasms. The [400199006 |Structure of skin and/or surface epithelium \(body structure\)|](#) concept is used to represent the sites of these neoplasms.

Skin and/or skin-associated mucosa is intended for use in dermatology. It is not intended to subsume all mucosal structures, which are under Mucous membrane structure (body structure).

Diseases of the skin

For the meaning of *diseases of the skin*, refer to the draft of ICD-11: *Diseases of the skin incorporate conditions affecting the epidermis, its appendages (hair, hair follicle, sebaceous glands, apocrine sweat gland apparatus, eccrine sweat gland apparatus and nails) and associated mucous membranes (conjunctival, oral and genital), the dermis, the cutaneous vasculature and the subcutaneous tissue (subcutis).*

Skin regions, skin of <named body part>

Since the phrase *skin of finger* can mean *some or all of the skin of finger* (if interpreted as a *structure*, rather than *entire* in the *The StructureEntirePart (SEP) model*, we could use *IS-A* to represent the relationship between skin of finger and skin of hand. Thus, skin of finger *IS-A* skin of hand, *IS-A* Skin structure of upper extremity, *IS-A skin region*. The word *region* is not used in all of these names, because it may refer to the *entire* region or a *part of a* region.

Scalp

Formal definitions of scalp include layers beneath the skin. Therefore we make a distinction between 41695006 | Scalp structure (body structure) | and 43067004 | Skin structure of scalp (body structure) |.

Soft tissue

There are at least three different use cases and meanings, and thus categories, for the phrase *soft tissue*. They include:

- **Tumors.** *Soft tissue* gives rise to similar types of neoplasms of mesenchymal stem cell origin, generally called *soft tissue neoplasms*. This accounts for the inclusions/exclusions of the category. *Non-neoplastic masses* arising in soft tissue are included in the WHO Classification of Soft Tissue Tumours.
 - For tumors, *soft tissue* is defined as non-epithelial extraskeletal tissue of the body, exclusive of the mononuclear phagocyte system, glia, and supporting tissue of various mesenchymal organs. Other explicit inclusions are: fibrous tissue, fascia, ligaments, tendons, tendon sheaths, synovia, bursae, skeletal muscle, smooth muscle, fatty tissue, adipose tissue, blood vessels, lymph vessels, peripheral nerves, sympathetic and parasympathetic nerves, and ganglia, as well as subcutaneous tissue. Skin, skeletal cartilage, pleura, and the pericardium, peritoneum, central nervous system, endocrine glands, and viscera are excluded.
- **Sites of non-bone disorders and injuries of the limbs, head, neck, and body wall.** Skeletal cartilage, as well as all non-bone structures of the limbs, and subcutaneous tissue and fat are included. Skin and lymph nodes are not included. For the head, neck and torso, mononuclear phagocyte system, central nervous system, endocrine glands, viscera, and supporting tissues are excluded.
- **Structures identified in images.** Soft tissue include everything except for mineralized bone tissue and teeth.

Lymphatic, Hematologic, Hematopoietic systems

Lymphatic system / 89890002 | Structure of lymphatic system (body structure) |. Set of structures through which lymph flows. It includes 59441001 | Structure of lymph node (body structure) | and 83555006 | Structure of lymphatic vessel (body structure) |. It supports the categorization of findings, disorders and procedures that relate to the flow of lymph.

Lymphoid system / 122490001 | Lymphoid system structure (body structure) |. Set of structures with groups of lymphoid cells, including those in the intestines, marrow, liver, and other locations, and the lymph nodes, spleen, thymus, and tonsils and adenoids; excludes the lymph vessels. It supports categorization of lymphomas.

Immune system / 116003000 | Structure of immune system (body structure). All of the lymphoid system, as well as the mononuclear phagocytic system; the immune system also includes cellular and sub-cellular components involved in cellular and humoral immunity.

Mononuclear phagocytic system / 127908000 | Mononuclear phagocyte system structure (body structure). Collection of true macrophages, distributed widely in the body (splenic and lymphoid sinusoids, liver Kupffer cells, pulmonary alveolar macrophages, osteoclasts, macrophages in serous membranes, and microgliaocytes); also endothelial cells that line hematopoietic tissues.

Dendritic cell system / 127909008 | Dendritic cell system structure (body structure). Collection of antigen-presenting cells, including the following: epidermal Langerhans, dendritic reticulum, and interdigitating. Class I histiocytoses (Langerhans cell histiocytosis) are disorders of the dendritic cell system.

Hematologic system / 414387006 | Structure of hematological system (body structure). Bone marrow, the lymphoid system, the hematopoietic system, and the terminal cells of all lineages of the hematopoietic system (red cells, white cells, platelets, histiocytes, plasma cells, etc). Disorders of the hematologic system do not necessarily include disorders of the hemostatic system, even though bleeding and thrombosis are usually categorized as *hematologic*.

Hematopoietic system / 57171008 | Hematopoietic system structure (body structure). Structures and cells responsible for erythropoiesis, granulocytopenia, monocytopenia, thrombocytopenia, and lymphopoiesis. Refers to the immature 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*). *SNOMED CT* considers leukocytes, erythrocytes, and platelets *the result* of hematopoiesis, but not blood-forming, otherwise leukocytosis would become a disorder of hematopoiesis, whereas it can arise simply from a demargination of white cells following stress. *SNOMED CT* has a concept named 419333002 | Cellular component of blood (substance) |; note that platelets are not actually cells, but are *cellular components*.

✓ Modeling

Hematopoietic should be differentiated from *hematologic*, since the terminal cells of each lineage (the erythrocyte, segmented neutrophil, monocyte, histiocyte, platelet, mature T- and B-cells, plasma cells, etc.) are not strictly hematopoietic.

Blood

The blood is not necessarily part of the cardiovascular system, nor is it necessarily part of the hematopoietic system. 87612001 | Blood (substance) | is a body fluid, not strictly part of either the hematopoietic or cardiovascular systems.

Regional lymph nodes of lungs

SNOMED CT has lymph node concepts per their anatomical locations, e.g. pulmonary, bronchopulmonary, tracheobronchial, tracheal, and esophageal) and concepts for *node groups* used for clinical staging of lung cancer, i.e. lymph nodes categorized into 14 stations.

Professional societies concerned with the clinical staging of lung cancer have developed at least three different nomenclatures for *stations* of lung-related lymph nodes. Even though the numbering of the stations is very similar, the inter-relationships between the various node groups are complex, particularly in stations 4 and 10, near the carina and hilar regions.

SNOMED CT considers American Joint Committee on Cancer (AJCC) Station 10, hilar lymph node, bronchial lymph node, and bronchopulmonary lymph node as synonyms. The American Thoracic Society (ATS) Station 10R, the right tracheobronchial lymph node is not a subtype of tracheobronchial lymph node because its definition includes nodes covered by both lower paratracheal lymph node, (AJCC Station 4) and by the hilar lymph node (AJCC Station 10). *SNOMED CT* uses tracheobronchial lymph node as a supertype of both inferior tracheobronchial (subcarinal) and superior tracheobronchial (a subset of lower paratracheal).

Musculoskeletal system

Skeletal system, bony skeleton

The *skeletal system* (*systema skeletal in Nomina Anatomica*) includes bones and cartilage. The *bony skeleton* includes bones only. The *vertebral column* is part of the skeletal system, and includes the intervertebral discs (fibrocartilage). Individual vertebrae are part of the bony skeleton.

Skeletal system subdivision

SNOMED CT considers the *skeletal system subdivision* part of the entire bone (system). This may change if there are procedures on cartilaginous skeleton that involve skeletal system subdivisions.

Bone

In ordinary usage, *bone* combines the meanings *bone organ* and *bone tissue*.

The 5 anatomical concepts related to *bone* are:

1. 3138006 |Bone (tissue) structure (body structure)|. Tissue type that makes up bones; a quantity of regular connective tissue consisting of osteocytes and related cells, the intercellular matrix of which is ossified; or any part thereof.
2. 90780006 |Entire bone (organ) (body structure)|. Individual bones, e.g. femur, tibia, ulna, scaphoid, lunate. An organ with cavitated parts; consists primarily of compact (cortical) and cancellous bone surrounding bone marrow cavities; also includes periosteum, endosteum (and, according to FMA, articular cartilage).
3. 118966000 |Skeletal system subdivision (body structure)|. Groups of bones, e.g. spine, skull, bony pelvis.
4. 128530007 |Entire bony skeleton (body structure)|. *Pars ossea systematis skeletalis*, *bone part* of the skeletal system.
5. 113192009 |Skeletal system structure (body structure)|. Entire skeletal system, including bones and cartilage.

Bone (tissue) is part of entire bone (organ); entire bone (organ) is part of skeletal system subdivision (system); skeletal system subdivision (system) is part of entire bony skeleton (body structure); and entire bony skeleton (body structure) is part of skeletal system structure (body structure). We can use Entire bone (system) to define aggregate concepts that involve bones.

Modeling

FSNs for spinal levels should not contain abbreviations.

Correct example,

- Posterior cord syndrome at tenth thoracic spinal cord level, not Posterior cord syndrome of thoracic spinal cord at T10 level.

Non-ossified bone. Bone organs are composed primarily of bone tissue, but there are some non-ossified parts. In particular, periosteum is clearly a part of a bone organ, but is not ossified tissue.

Bone marrow, marrow cavity. Bone marrow is contained within the marrow cavity, but it is not part of the bone organ. The (empty) marrow cavity is part of the bone organ. The bone marrow structure (body structure) is not a subtype of Bone structure (body structure).

Clinically, marrow disorders are not usually considered bone disorders, nor are marrow procedures considered bone procedures.

For example,

- Bone marrow disorders are not musculoskeletal disorders, but bone disorders are musculoskeletal disorders. Bone marrow transplants are not considered types of bone transplant.
- 60168000 |Osteomyelitis (disorder)| is not the same as 44462005 |Osteitis (disorder)|.

Structure of (named bone), bone structure of (named bone)

To differentiate marrow, vessels, nerves, and periosteum from the actual hard tissue of bones, we differentiate structure of tibia from 12611008 |Bone structure of tibia (body structure)|. The bone marrow and other soft tissues of the tibia can then be categorized separately from the hard tissues. Bone marrow diseases are not considered musculoskeletal diseases, so bone marrow structures should not be placed in the bone (tissue) structure hierarchy.

Long bone, short bone

ICD does not use the standard anatomical definition of *long bone*.

For example, Benign neoplasms of long bones are distinguished from benign neoplasms of short bones; the bones of the hand are considered short bones. The anatomical definition of long bone cites the proportional relationship between length and width (length >> width). It is clear that metacarpals, metatarsals, and phalanges are included in the anatomical definition of long bone.

Modeling: phalanx (finger)

The index finger is the *first finger* and *second digit*. Do not use *second finger*.

In order to accommodate the differences between anatomical definitions and classifications, *SNOMED CT* has anatomical groupings that correspond to the ICD groupings. *Scapula*, *humerus*, *radius*, or *ulna* and *long bone of thigh* or *lower leg* are used as the sites for grouper concepts that match ICD definitions and groupings.

Sternum, manubrium, body, xiphoid

The sternum is considered a bone organ. The manubrium, body, and xiphoid are parts of the sternum, classed as zones in the FMA.

Teeth, maxilla, mandible

Even though teeth are supported by the maxillary or mandibular bone, they are not *part of* the 70925003 |Bone structure of maxilla (body structure)| or 91609006 |Bone structure of mandible (body structure)|. Teeth are part of the 4335006 |Upper jaw region structure (body structure)| and 48077000 |Lower jaw region structure (body structure)|.

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*. Some common ones are:

Joint vs. Joint Region	
70258002 Ankle joint structure (body structure)	344001 Ankle region structure (body structure)
74670003 Wrist joint structure (body structure)	8205005 Wrist region structure (body structure)
85537004 Glenohumeral joint structure (body structure)	16982005 Shoulder region structure (body structure)

Shoulder girdle

272691005 |Bone structure of shoulder girdle (body structure)|. This concept is used to define diseases and procedures affecting bones in the shoulder region, i.e. proximal humerus, scapula, and clavicle. It is not a bone, but a bone structure, and is part of the shoulder region.

Intertarsal joint structure

27949001 | Intertarsal joint structure (body structure)|; SYN: Tarsal joint. This structure is part of a group of bones forming the tarsus or tarsal joint (ankle). The [27162001 | Talocalcaneonavicular joint structure \(body structure\)|](#) is the articulation between the talus (one of the seven bones of the ankle joint) and the other bones of the tarsus, and is what is meant by the rarely-used term *talotarsal joint*. The talocalcaneal joint is a synonym for the [127863007 | Subtalar joint structure \(body structure\)|](#). Dislocations of the subtalar joint usually involve the [127864001 | Structure of talonavicular joint \(body structure\)|](#). The subtalar and talonavicular joints constitute the talocalcaneonavicular joint.

Arm, leg and upper, lower extremities

The meanings of the words *arm* and *leg* may be misinterpreted and ambiguous.

- *Arm* may refer to the upper limb, but it may also refer to the upper part of the arm.
- *Leg* may refer to the lower limb, but it may also refer to the lower part of the leg. *Stedman's Medical Terminology* defines lower leg as *the segment of the inferior limb between the knee and the ankle*.
- In common usage, *leg* is a synonym of *lower extremity* and *arm* is a synonym of *upper extremity*.
- The meaning of ICD terms may differ from common usage and *SNOMED CT* concepts.

In *SNOMED CT*, the [53120007 | Upper limb structure \(body structure\)|](#) (SYN, *upper extremity*) includes the hand, but the [40983000 | Upper arm structure \(body structure\)|](#) (SYN, *arm*) does not; the [61685007 | Lower limb structure \(body structure\)|](#) (SYN, *lower extremity*) includes the foot, but the [30021000 | Lower leg structure \(body structure\)|](#) (SYN, *leg*) does not. In order to avoid confusion, FSN's should always specify *lower leg / lower extremity upper arm / upper extremity* and should not rely on *arm* or *leg* alone.

External sources

External sources, such as the *WHO Classifications*, may have conventions for interpreting the meaning of phrases that contain the words *arm* and *leg*. They may be referenced to help determine the meanings of *International Classification of Diseases (ICD)* terms when mapping or completing other actions. ICD terms may differ from common usage and will not necessarily match *SNOMED CT* concepts.

Shoulder and hip regions, upper and lower limbs

The shoulder region is part of the upper limb, and the hip region is part of the lower limb. This follows the general pattern used in the *Foundation Model of Anatomy (FMA)*. The *FMA* defines the upper limb as the free upper limb and the pectoral girdle (of which the shoulder region is part) and the lower limb as the free lower limb and pelvic girdle (of which the hip region is part). *SNOMED CT* has the concept [699617006 | Structure of free lower limb \(body structure\)|](#), i.e. the lower limb not including the pelvic girdle. There is not a concept for the *free upper limb*.

Axilla

The axilla is bound by the upper limb laterally and the thorax medially. It may be viewed as not strictly part of the upper limb or the thorax or it may be views as part of both. [91470000 | Axillary region structure \(body structure\)|](#) is defined in *SNOMED CT* as being both an upper limb structure and a thoracic structure.

Tendon

A muscle may be considered an entire functional unit, including attachments to the skeletal system, or merely the contractile part of this unit. In clinical use, muscle is the contractile part only. The *FMA* definition implies that tendons should be considered part of their corresponding muscles, rather than organs in their own right.

SNOMED CT models tendon structures as subtypes of their muscle structures.

For example, the [61352006 | Structure of achilles tendon \(body structure\)|](#) is a [53451005 | Triceps surae muscle structure \(body structure\)|](#) (gastrocnemius and soleus) muscle structure. The classifier makes [429513001 | Rupture of Achilles tendon \(disorder\)|](#) a disorder of the triceps surae (gastrocnemius and soleus) muscle.

Muscle function

When modeling muscle categories according to their functions, assume they mean the function of the *entire muscle*, unless stated otherwise.

Nervous system

The nervous system has two parts, central and peripheral.

- The central nervous system, sometimes also called the *neuraxis*, consists of the brain and spinal cord. The pyramidal system is a subdivision of the central nervous system; the extrapyramidal system is part of the brain.
- The peripheral nervous system includes all neural structures outside the central nervous system.

The nervous system is also divided as: autonomic, somatic, and enteric.

- The autonomic system is further divided as sympathetic and parasympathetic. The autonomic system is not entirely a part of the peripheral nervous system, but the autonomic nerves are peripheral.

Nerve

The word *nerve* has multiple meanings according to the FMA:

- nerve trunk
- neural organ (trunk plus branches, excluding nuclei, ganglia, and roots)
- neural tree organ, including nuclei, ganglia, roots, etc.

A *neural tree organ* is defined in FMA as *a nonparenchymatous organ which has as its parts an aggregate of neurons (nuclei or ganglia) and their axons which are grouped into fasciculi by connective tissue to form elongated, cable-like structures that are arranged into a tree*. A *nerve*, according to FMA, is defined as *a segment of a neural tree organ which has as its parts a nerve trunk and its branches; together with other nerves of the same tree, it constitutes a neural tree*. The neural tree structure includes:

- Cranial nerve
 - Complex cranial nerve-tract
- Spinal nerve
- Spinal accessory nerve (strictly neither cranial or spinal nerves)
- Peripheral nerve
- Autonomic nerve

Nerve, conventionally has two meanings:

- An anatomically distinct nerve trunk (without branches) that is identified in a dissection (e.g. the structure that student identifies when a pin is placed in the trunk of the vagus nerve, for instance located on the arch of the aorta)
- A larger anatomical entity which supports a related set of functions (e.g. all anatomical components of the vagus nerve that are necessary for it to execute its functions (e.g. when a student is asked which nerve is responsible for slowing the heart the answer, *the vagus nerve*, includes the vagal nucleus, as well as the trunk and branches of the vagus).
- Neural tree designates the second concept in order to distinguish it from the first which is only a part (subdivision of) the vagal neural tree.

A third meaning of nerve, defined by the FMA is: *Segment of neural tree organ which has as its parts a nerve trunk and its branches; together with other nerves of the same tree it constitutes a neural tree*.

For example,

- Chorda tympani, digastric branch of facial nerve, greater petrosal nerve, posterior cutaneous branch of posterior ramus of cervical nerve, superior lateral cutaneous nerve of arm.
- If one severs the facial nerve, the meaning refers to the trunk. But if one has facial nerve palsy, the meaning refers to the entire distribution of the nerve and the functions served by it.

Inactivation

There were several concepts with the phrase *x nerve and its branches*, interpreted as meaning *the entire nerve and its branches*. Therefore, *x nerve and its branches* would be a duplicate of *entire x nerve*, when we interpret *entire x nerve* as being a neural tree organ.

For example,

- *Entire facial nerve* is a neural tree organ, so there is no need for an additional concept called *facial nerve and its branches*.
- *Entire cranial nerve* is a neural tree organ and *structure of cranial nerve* is that organ or any part (or branch) thereof. Branches of the cranial and spinal nerves are segments of the neural tree organs from which they branch.

All concepts named *nerve x and its branches* were inactivated due to their ambiguity. There are *MAYBE A* links to *structure of nerve x*, and *entire nerve x*. Specifying *trunk of a nerve* requires a specific concept.

Supratentorial brain

Cerebrum may refer to the *supratentorial brain*, which is everything except the midbrain, medulla, pons, and cerebellum. In this interpretation, the telencephalon and diencephalon are in the cerebrum. On the other hand, cerebrum may only refer to the parts derived embryologically from the telencephalon, the cerebral hemispheres and the intercerebral commissure (corpus callosum and anterior commissure).

Supratentorial brain may be used for categorizing tumors and for designating the location of swelling that can result in herniation. The telencephalon and diencephalon (including thalamus, geniculate bodies, pineal body, habenulae, and hypothalamus) are definitely supratentorial. The upper part of the midbrain (mesencephalon) is also supratentorial. *SNOMED CT* excludes all midbrain structures from the supratentorial brain.

Respiratory system

Respiratory tract; 321667001 | Respiratory tract structure (body structure). In *SNOMED CT*, *respiratory tract* has the same meaning as the *Nomina Anatomica* term *apparatus respiratorius*, which includes the structures through which air passes from the nares to the alveoli. The *oral cavity* is not included. In common usage, *respiratory system* may have the same meaning as *respiratory tract*; but not in *SNOMED CT*. *Respiratory system* does not mean *the global respiratory system* that might include the CNS components of breathing. *Pleura* are part of the lower respiratory system, but not a part of the lower respiratory tract.

Upper aerodigestive tract; 119253004 | Upper aerodigestive tract structure (body structure). is a phrase that may have several meanings. The *SNOMED CT* concept 361922007 |Entire upper aerodigestive tract (body structure)| has the meaning based on the following reference: *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* (Upper aerodigestive tract cancers, Cancer 1995 Jan 1;75 (1 Suppl): 147-53). This definition matches the tumors included in the *CAP Cancer Checklist* for upper aerodigestive tumors. The esophagus, or at least the cervical esophagus, may be included, but not in *SNOMED CT*.

Upper respiratory tract; 58675001 | Upper respiratory tract structure (body structure). Includes the nasal cavity, paranasal sinuses, nasopharynx, oropharynx, and larynx.

Lower respiratory tract; 82094008 | Lower respiratory tract structure (body structure). Includes the tracheobronchial tree (from the trachea through the terminal bronchioles) and the lungs, including the alveolar respiratory tract (which extends from the respiratory bronchioles to the alveoli).

Lower respiratory system; 400141005 | Lower respiratory system structure (body structure). Includes the lower respiratory tract and the pleura.

Interarytenoid fold or larynx

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). The 102295003 |Structure of hypopharyngeal aspect of interarytenoid fold (body structure)| may be considered part of the hypopharynx, the larynx, or both. A tumor of this site is categorized as a tumor of the hypopharynx, and not the larynx, but the 105585004 |Interarytenoid fold structure (body structure)| is considered part of the larynx.

SNOMED CT does not give a *Part of* relationship between the hypopharyngeal aspect of the interarytenoid fold and the interarytenoid fold. This emphasizes *SNOMED CT* modeling based on the relationship of anatomical entities and disorders and procedures and not simply by reading term names.

Nasal turbinates

SNOMED CT differentiates between the bone underlying the nasal turbinates and the actual turbinates:

Bones underlying the turbinates,

- 118648008 |Inferior nasal turbinate bone structure (body structure)|
- 122491002 |Middle nasal turbinate bone structure (body structure)|
- 122492009 |Superior nasal turbinate bone structure (body structure)|
- 122493004 |Supreme nasal turbinate bone structure (body structure)|

Turbinates, which include bone, overlying mucous membranes, and other tissue,

- 6553002 |Inferior nasal turbinate structure (body structure)|
- 122491002 |Middle nasal turbinate bone structure (body structure)|
- 65289004 |Superior nasal turbinate structure (body structure)|
- 33415007 |Supreme nasal turbinate structure (body structure)|

The 118648008 |Inferior nasal turbinate bone structure (body structure)| is a facial bone and skull bone. And, parts of the ethmoid bone form the middle, superior, and supreme nasal conchae. This means that the bones of the middle, superior, and supreme turbinates are not bone organs.

Ear

The ear includes the external, middle and inner ear. The external ear has two main parts, the *auricle* (also called the *pinna*) and the 84301002 |External auditory canal structure (body structure)|. The external auditory canal has the synonym *external auditory meatus*. The external auditory meatus is not just the external opening of the canal, but rather the canal extending to the ear drum (42859004 |Tympanic membrane structure (body structure)|). The 61671002 |Structure of internal acoustic meatus of temporal bone (body structure)| (SYN, *internal auditory canal*, is not part of the ear. As described in the FSN, it is an opening in the temporal bone, and is primarily a nerve conduit that anatomically parallel to the external auditory canal.

Eye

Choroid

Both *subchoroidal* and *suprachoroidal* refer to the same potential anatomic space between the choroid and the sclera. The term *lamina subchoroidea of choroid* is the same as the *lamina suprachoroidea*.



Suprachoroidal hemorrhage

In the literature, the term *massive suprachoroidal hemorrhage* is replacing *expulsive hemorrhage* and *subchoroidal hemorrhage*.

Retinal vein

There is not a vein actually named *retinal vein*. However, *SNOMED CT* has concepts with the phrase.

For example,

- 85003000 |Structure of retinal vein (body structure)| has the synonym *retinal vein*.
- 280927000 |Entire central vein of the retina (body structure)| has the synonym *entire central retinal vein*.

Orbital region

371398005 |Eye region structure (body structure)| has a synonym of *orbital region structure* which subsumes *bony orbit*, *entire eye*, and *ocular adnexa*.

Unacceptable terms

X disorder at Y level concepts from ICD-11, e.g. *skin laceration of arm at wrist level* (precedent are terms added from ICD-9) will not be added to the SNOMED International Release.

(See also, Appendix, Concept Models: *Anatomical Concept Model*)

2.4.1.3 Morphologic Abnormality Modeling

Section links

[Tumor morphology](#)

[Congenital anomaly](#)

[Degenerative abnormality, degeneration](#)

[Abscess](#)

[Fracture](#)

The morphologic abnormality hierarchy is two levels below the body structure hierarchy, with siblings, apoptosis and structure resulting from tissue repair process:

- *SNOMED CT* concept
 - Body structure (body structure)
 - Body structure, altered from its original anatomical structure (morphologic abnormality)
 - Apoptosis (morphologic abnormality)
 - Morphologically abnormal structure (morphologic abnormality)
 - Structure resulting from tissue repair process (morphologic abnormality)

The concepts in the morphologic abnormality hierarchy represent abnormal body structures.

Tumor morphology

SNOMED CT accepts tumor concepts, as long as they are included in the International Classification of Diseases for Oncology (ICD-O). ICD-O has two coding systems to describe tumors:

- **Topographical.** Anatomical site of origin or the organ system
- **Morphological.** Tumor's cell type or histology and behavior, i.e. malignant vs. benign

Exception

Some ICD-O codes include *Not Otherwise Specified (NOS)*. These concepts are not acceptable in *SNOMED CT*.

For more information

- ICD-O @ <http://codes.iarc.fr/home>.
- SNOMED CT to ICD-O morphology mapping project @ <https://www.snomed.org/snomed-ct/mapping-to-other-terminologies/existing-mappings>

Congenital anomaly

Disorders which involve congenital anomalies are defined with Occurrence (attribute) = Congenital (qualifier value), Associated morphology (attribute) = Morphologic abnormality (qualifier value) and Pathological process (attribute) = Pathological development process (qualifier value).

Therefore, *congenital* does not need to be represented in Associated morphology (attribute) target value. Congenital anomaly morphology concepts usually have non-congenital parents.

For example,

- 609587005 |Congenital cataract (morphologic abnormality)| has the parents, 128306009 |Cataract (morphologic abnormality)| and 16301006 |Congenital opacity (morphologic abnormality)|.

Degenerative abnormality, degeneration

A distinction should be made between 107669003 |Degenerative abnormality (morphologic abnormality)| and 33359002 |Degeneration (morphologic abnormality)|.

- 33359002 |Degeneration (morphologic abnormality)| is a child of 107669003 |Degenerative abnormality (morphologic abnormality)|.
- 107669003 |Degenerative abnormality (morphologic abnormality)| is a grouper concept with members usually characterized by retrogressive pathologic structural changes. Diseases that are degenerative do not necessarily have Associated morphology = 33359002 |Degeneration (morphologic abnormality)|, since the word degenerative sometimes refers to loss of function, rather than structural degeneration.

Examples include degeneration proper, as well as lysis, vascular sclerosis, necrosis, infarct, deposition, dystrophy, pigmentation, atrophy, and depletion.

- Morphologies under degeneration also have retrogressive structural changes, but they are not necessarily any of the above, nor are they necessarily resorption, malacia, obliteration, opacity, plaque, or postmortem change (This seems to be definition by exclusion).
- Necrosis is a degenerative abnormality, but not a degeneration. Necrosis can follow degeneration.
- Atrophy is a degenerative abnormality, but only *atrophic degeneration* is also a degeneration.

Modeling

33359002 |Degeneration (morphologic abnormality)| and 107669003 |Degenerative abnormality (morphologic abnormality)| should rarely, if ever, be used as the value of Associated morphology of a particular disorder; rather, a more specific subtype should be used.

Exception

It might be used as the value of Associated morphology for a broad category of degenerative disorders when the degeneration is always and necessarily structural. It is then inherited by all the subtypes, unless specialized by assigning a subtype of degeneration as the value for Associated morphology.

Abscess

There are two types of abscesses, septic and sterile. Most abscesses are septic, which means that they are the result of an infection. If a concept has a meaning (based on its FSN and text definition) that does not specify whether the

abscess is sterile or septic, then the concept should not be modeled as septic; the concept's logic definition uses the attribute Associated morphology with the value 44132006 |Abscess (morphologic abnormality)|.

Fracture

Although most fractures are traumatic, there are some pathological fractures. In the vast majority of cases, fractures are traumatic. Based on its FSN and text definition, if the word *pathological* is present, use Pathologic fracture (morphologic abnormality).

Example: Modeling Traumatic vs. Pathological Fractures		
Concept	Finding Site	Associated Morphology
21351003 Fracture of phalanx of foot (disorder)	Bone structure of phalanx of foot	Fracture
704168008 Pathological fracture of phalanx of foot (disorder)	Bone structure of phalanx of foot	Pathologic fracture

2.4.1.3.1 Morphologic Abnormalities vs. Findings

Concepts from the Morphologic Abnormality hierarchy should not be used in place of concepts from the Clinical Findings hierarchy, even though they appear to refer to similar *clinical situations*.

For example,

- 4147007 |Mass (morphologic abnormality)| is not a finding, but 300848003 |Mass of body structure (finding)| is a finding

Morphologies are used as the values of the defining attributes of findings and procedures. Findings are used to represent the combination of a morphology and a location.

For example,

- 300923002 |Cyst of scalp (disorder)| represents cystic type of morphology that has the location, scalp

Many morphologies have names that could be misinterpreted as implying a process rather than a structure.

- Inflammation might mean the *structural-morphologic* features of inflammation, such as inflammatory cell infiltrates; or it might mean the *process* that causes the structural changes. Within the morphologic abnormality hierarchy, the *structural* interpretation is intended, not the *process* interpretation.

2.4.2 Clinical Finding/Disorder

Definition	Examples
<ul style="list-style-type: none"> • Clinical finding: normal/abnormal observations, judgments, or assessments of patients • Disorder: always and necessarily an abnormal clinical state 	Clinical finding <ul style="list-style-type: none"> • 167222005 Abnormal urinalysis (finding) Disorder <ul style="list-style-type: none"> • 39579001 Anaphylaxis (disorder)

Clinical findings include both normal and abnormal clinical states. Findings and observations seem to refer to judgments of the observer rather than to the actual state of the body.

Context

The default context for a *Clinical finding* concept is:

- Present (vs. being absent)
- Subject of the record (the patient)
- Current, or may be overridden by a specified time in the past, linked to the concept

The *Clinical finding* hierarchy contains the sub-hierarchy of *Disorder*. Concepts that are descendants of *disease (disorder)* are always and necessarily abnormal clinical states.

This subtype allows diseases to be subtypes of other disorders, as well as subtypes of findings. Concepts with a semantic tag of *disorder*, must have a stated parent of Disease (disorder) and not Clinical finding (finding) .

For example,

- 95617006 |Neonatal cyanosis (disorder)| has the stated parent, Disease (disorder); it is a subtype of 3415004 |Cyanosis (finding)|.

The distinction between a disorder and a finding may be difficult to define. There are, however, distinct characteristics of each.

Disorder vs Finding	
	Characteristics
Disorder	<ul style="list-style-type: none"> • Always and necessarily abnormal • Necessarily have an underlying pathological process • Have temporal persistence (may be under treatment, in remission, or inactive, even though they are still present) • May be present as a propensity for certain abnormal states to occur, even when treatment mitigates or resolves those abnormal states
Finding	<ul style="list-style-type: none"> • May be normal (but not necessarily) • May exist only at a single point in time (e.g. a serum sodium level) • Cannot be temporally separate from the observation (one cannot observe them and say they are absent, nor can they be present when they cannot be observed) • Cannot be defined only in terms of an underlying pathological process that is present, when the observation itself is not present

In some cases the disease process is irrefutable, e.g. meningococcal meningitis. In others an underlying disease process is assumed based on the temporal and causal association of the disorder and its manifestation, e.g. nystagmus (disorder) is different from nystagmus present (finding). Nystagmus present (finding) may be a normal physiological response to head rotation. A person who spins around and has nystagmus present (finding), does not have nystagmus (disorder). Alternatively, a person may have nystagmus (disorder), but not nystagmus present (finding), i.e they do not currently manifest nystagmus. Similarly, hearing loss (disorder) is different from perception of hearing loss (finding), which can be due to a number of temporary causes, such as excessive ear wax.

2.4.2.1 Clinical Finding/Disorder Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 404684003 Clinical finding (finding)	
Domain Constraint	<< 404684003 Clinical finding (finding)
Parent Domain	-
Proximal Primitive Constraint	<< 404684003 Clinical finding (finding)

Proximal Primitive Refinement	-
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Author View of Attributes and Ranges for 404684003 Clinical finding (finding)					
Attribute	Grouped	Cardinality	In Group Cardinality	Range	Constraint
116676008 Associated morphology (attribute)	1	0..*	0New ..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)	
	1	0..*	0..*		
246075003 Causative agent (attribute)	1	0..*	0..1	<< 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 260787004 Physical object (physical object) OR << 78621006 Physical force (physical force)	
246112005 Severity (attribute)	1	0..*	0..1	<< 272141005 Severities (qualifier value)	
246454002 Occurrence (attribute)	1	0..*	0..1	<< 282032007 Periods of life (qualifier value)	
246456000 Episodicity (attribute)	1	0..*	0..1	<< 288526004 Episodicities (qualifier value)	
255234002 After (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)	
263502005 Clinical course (attribute)	1	0..*	0..1	<< 288524001 Courses (qualifier value)	
288556008 Before (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)	
363698007 Finding site (attribute)	1	0..*	0New ..1	<< 442083009 Anatomical or acquired body structure (body structure)	
	1	0..*	0..*		
363705008 Has definitional manifestation (attribute)	1	0..0	0New ..0	<< 404684003 Clinical finding (finding)	
	1	0..*	0..*		
363713009 Has interpretation (attribute)	1	0..*	0..1	<< 260245000 Finding values (qualifier value) OR << 263714004 Colors (qualifier value)	
363714003 Interprets (attribute)	1	0..*	0..1	<< 363787002 Observable entity (observable entity) OR << 108252007 Laboratory procedure (procedure) OR << 386053000 Evaluation procedure (procedure)	
370135005 Pathological process (attribute)	1	0..*	0..1	263680009 Autoimmune (qualifier value) OR << 441862004 Infectious process (qualifier value) OR << 472963003 Hypersensitivity process (qualifier value) OR << 308490002 Pathological developmental process (qualifier value)	
371881003 During (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)	
418775008 Finding method (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)	
419066007 Finding informer (attribute)	1	0..*	0..1	<< 420158005 Performer of method (person) OR << 419358007 Subject of record or other provider of history (person) OR << 444018008 Person with characteristic related to subject of record (person)	

42752001 Due to (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 272379006 Event (event) OR << 71388002 Procedure (procedure)
47429007 Associated with (attribute)	1	0..*	0..*	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure) OR << 272379006 Event (event) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 260787004 Physical object (physical object) OR << 78621006 Physical force (physical force)
719722006 Has realization (attribute)	1	0..*	0..1	<< 719982003 Process (qualifier value)
726633004 Temporally related to (attribute)	1	0..*	0..*	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)

Domain Information for 64572001 Disease (disorder)	
Domain Constraint	<< 64572001 Disease (disorder)
Parent Domain	404684003 Clinical finding (finding)
Proximal Primitive Constraint	<< 64572001 Disease (disorder)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 64572001 Disease (disorder)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
116676008 Associated morphology (attribute)	1	0..*	{New} ..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
	1	0..*	0..*	
246075003 Causative agent (attribute)	1	0..*	0..1	<< 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 260787004 Physical object (physical object) OR << 78621006 Physical force (physical force)
246112005 Severity (attribute)	1	0..*	0..1	<< 272141005 Severities (qualifier value)
246454002 Occurrence (attribute)	1	0..*	0..1	<< 282032007 Periods of life (qualifier value)
246456000 Episodicity (attribute)	1	0..*	0..1	<< 288526004 Episodicities (qualifier value)
255234002 After (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)
263502005 Clinical course (attribute)	1	0..*	0..1	<< 288524001 Courses (qualifier value)
288556008 Before (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)
363698007 Finding site (attribute)	1	0..*	{New} ..1	<< 442083009 Anatomical or acquired body structure (body structure)
	1	0..*	0..*	

363705008 Has definitional manifestation (attribute)	1	0..0	(New) ..0	<< 404684003 Clinical finding (finding)
	1	0..*	0..*	
363713009 Has interpretation (attribute)	1	0..*	0..1	<< 260245000 Finding values (qualifier value) OR << 263714004 Colors (qualifier value)
363714003 Interprets (attribute)	1	0..*	0..1	<< 363787002 Observable entity (observable entity) OR << 108252007 Laboratory procedure (procedure) OR << 386053000 Evaluation procedure (procedure)
370135005 Pathological process (attribute)	1	0..*	0..1	263680009 Autoimmune (qualifier value) OR << 441862004 Infectious process (qualifier value) OR << 472963003 Hypersensitivity process (qualifier value) OR << 308490002 Pathological developmental process (qualifier value)
371881003 During (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)
418775008 Finding method (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)
419066007 Finding informer (attribute)	1	0..*	0..1	<< 420158005 Performer of method (person) OR << 419358007 Subject of record or other provider of history (person) OR << 444018008 Person with characteristic related to subject of record (person)
42752001 Due to (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 272379006 Event (event) OR << 71388002 Procedure (procedure)
47429007 Associated with (attribute)	1	0..*	0..*	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure) OR << 272379006 Event (event) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 260787004 Physical object (physical object) OR << 78621006 Physical force (physical force)
719722006 Has realization (attribute)	1	0..*	0..1	<< 719982003 Process (qualifier value)
726633004 Temporally related to (attribute)	1	0..*	0..*	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)

2.4.2.2 Clinical Finding/Disorder Defining Attributes

The following defining attributes correspond to the *Clinical Finding/Disorder Attributes Summary* table.

Due to

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

For example,

- 402194008 |Cheilitis due to atopic dermatitis (disorder)| IS A Cheilitis (disorder) *Due to* Atopic dermatitis (disorder)

Associated with

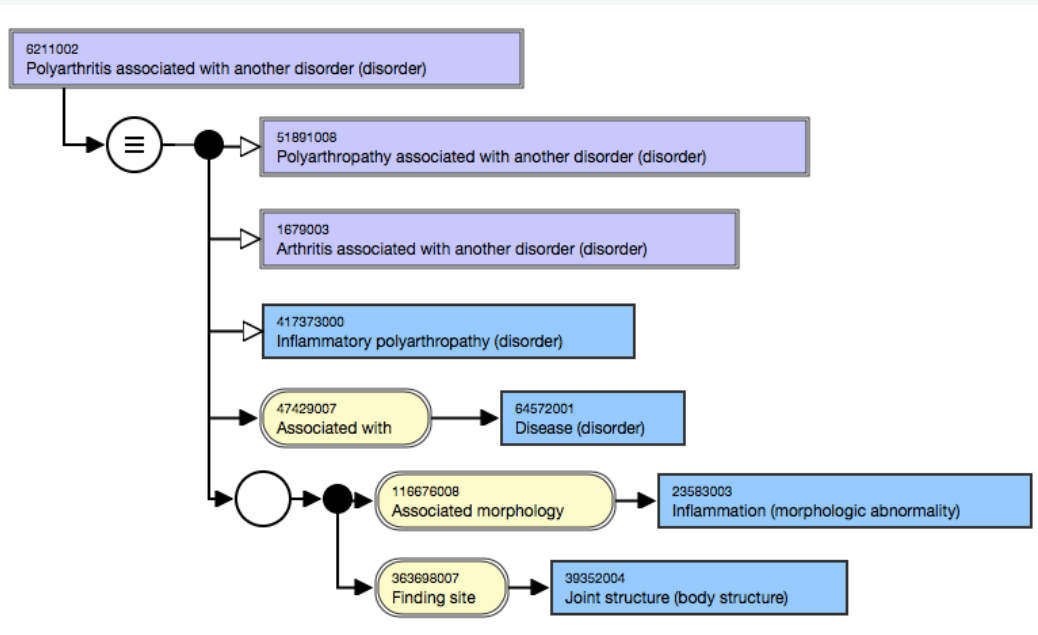
This attribute is used to model an interaction between two concepts beyond simple co-occurrence. *Associated with* represents a clinically relevant association between concepts without either asserting or excluding a causal or sequential relationship between the two.

✓ Modeling

In general, the use of *Associated with* should be avoided due to its ambiguity and inconsistent application. It may be appropriate when creating concepts that group specific associations.

For example,

- 6211002 |Polyarthritis associated with another disorder (disorder)|



Associated morphology

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

(Please see the *Morphologic Abnormalities vs. Findings* page for details).

For example,

- 75694006 |Pancreatitis (disorder)| has the *Associated morphology*, Inflammation (morphologic abnormality)

When selecting a value for this attribute, in general, the concept should not represent a body structure combined with the morphology. There are, however, exceptions, i.e. where a morphology implies the finding site.

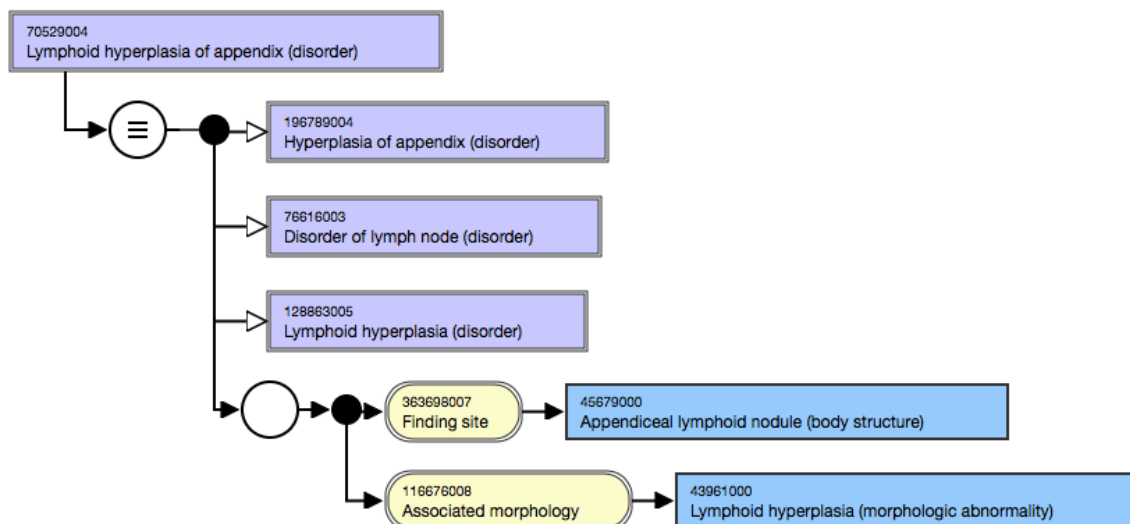
For example,

- 444231005 |Thymoma (disorder)|
- 80400009 |External hyperostosis (morphologic abnormality)|
- 79074005 |Odontoma, no International Classification of Diseases for Oncology subtype (morphologic abnormality)|

Body structure should be captured in the value selected for the Finding site attribute. There are, however, exceptions.

For example,

- 70529004 |Lymphoid hyperplasia of appendix (disorder)| has *Associated morphology*, Lymphoid hyperplasia and the *Finding site*, Appendiceal lymphoid nodule



Causative agent

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

For example,

- 4989003 |Electrical burn of skin (disorder)| has the *Causative agent*, Electricity (physical force)

✓ Modeling

When authoring concepts with the Causative agent values of *fungus* or *bacterium*, use the two concepts that represent formal Linnaean concept classes and their descendants:

- 414561005 |Kingdom Fungi (organism)|
- 409822003 |Superkingdom Bacteria (organism)|

Similar concepts that do not represent formal Linnaean concept classes are being considered for inactivation as part of the Organism and Infectious Disease Model (OIDM) Project:

- 23496000 |Fungus (organism)|
- 41146007 |Bacterium (organism)|

The descendants of these two classes will be reviewed. Applicable concepts that do not have one of the two Kingdoms as ancestors will be edited.

Severity

✔ Modeling

Generally, severity is not used to model concepts precoordinated in the International Release, but it can be used as a qualifier in postcoordination.

This attribute is used to subclass a Clinical finding concept according to its severity. However, this use is *relative*, i.e. it is incorrect to assume that the disease intensity or hazard is the same for all clinical findings to which this attribute is applied.

Symptom intensity should be considered a separate dimension from *disease severity*. The attribute Severity is not applied to 162465004 |Symptom severity (finding)| because:

- *Severe* may be interpreted in different ways, depending on the set of values/value set available. Consider the different meaning of severity in each of the following sets of values:
 - mild / moderate / severe
 - minimal / mild / moderate / severe / very severe
 - mild / mild to moderate / moderate / moderate to severe / severe / life threatening / fatal
- *Severity* is defined relative to the expected degree of intensity or hazard of the Clinical finding that is being qualified. For example, the common cold has a baseline intensity or hazard that is much less than a more serious disease like lupus erythematosus or pneumonia; thus, a severe cold might be considered less intense or less hazardous than mild pneumonia.
- Some disorders that are life-threatening do not ordinarily have a severity assigned to them. Cancer, for example, is not usually described as mild, moderate or severe, but rather by stage or grade.

Consequently, the Severity attribute cannot be used for all Clinical findings that may be serious or life-threatening. Nevertheless, it is still useful to subclass certain concepts and to differentiate between severities of a single disorder.

Occurrence

This attribute refers to the specific period of life during which a condition first presents. However, conditions may persist beyond the period of life when they first present.

For example,

- 192611004 |Childhood phobic anxiety disorder (disorder)| has the *Occurrence* Childhood (qualifier value)

✔ Modeling

Multiple values of *Occurrence* for a single *concept* are not desirable. They will be addressed in a future release.

Episodicity

This attribute is used to represent *episodes of care* provided by a physician or other healthcare provider, not episodes of disease experienced by the patient.

For example,

- Asthma with Episodicity = first episode represents the first time the patient presents to their healthcare provider with asthma.

✓ Modeling

Episodicity is not used to model any concepts precoordinated in the *International Release*, but it can be used as a qualifier in postcoordination.

After

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

For example,

- 123948009 |Post-viral disorder (disorder)| occurs *After* a Viral disease (disorder)

Clinical course

This attribute is used to represent both the *course* and *onset* of a disease or condition.

Many conditions with acute (sudden) onsets also have acute (short-term) courses. However, few conditions with chronic (long-term) durations require rapid vs. gradual onset sub-typing. Thus, there is no clear need for separating the rapidity of onset from the duration of a disease. This attribute, that combines onset and course, has been more reproducible and useful than two attributes that attempt to separate the meanings.

For example,

- 74973004 |Chronic fibrosing pancreatitis (disorder)| has a *Clinical course* of Chronic (qualifier value)

⚠ The word - acute

The word *acute* has more than one meaning, and the meanings are often overlapping or unclear. It may imply rapid onset, short duration, or high severity; in some circumstances it might be used to mean all of these. For morphological concepts, *acute* may also imply the kind of morphology associated with the speed of onset.

For example,

- 4532008 |Acute inflammation (morphologic abnormality)| does not necessarily have Clinical course Sudden onset and/or short duration (qualifier value), but rather implies polymorphonuclear infiltration (84499006 |Chronic inflammation (morphologic abnormality)| implies mononuclear cell infiltration, not necessarily a chronic course, although inflammation with a chronic course is highly correlated with a lymphocytic infiltration)

Before

This attribute is used to model pre-procedure complications (e.g, preoperative complication). It represents temporal associations between procedures and related disorders.


Finding site

This attribute specifies the body site affected by a condition.

For example,

- 90708001 |Kidney disease (disorder)| has *Finding site*, Kidney structure (body structure)

Has definitional manifestation

 This attribute is no longer approved. It does appear in legacy concepts.

Has interpretation

This attribute refers to and designates the judgment aspect being evaluated or interpreted (e.g. presence, absence, degree, normality, abnormality, etc.). It is grouped with the *Interprets* attribute.

For example,

- 398151007 |Decreased muscle tone (finding)| has *Interprets* muscle tone (observable entity) with *Has interpretation* Decreased (qualifier value)

Interprets

This attribute refers to the entity being evaluated or interpreted, when an evaluation, interpretation, or judgment is intrinsic to the meaning of a concept. It is usually grouped with the *Has interpretation* attribute.

For example,

- 102660008 |Abnormal glucose level (finding)| has *Interprets* Glucose measurement (procedure) with *Has interpretation* Outside reference range (qualifier value)

Modeling

For concepts in the *Measurement finding* subhierarchy, the value for *Interprets* should be an *Evaluation procedure* or a *Laboratory procedure* not *Observable entity*.

Pathological process

This attribute provides information about the underlying pathological process of a disorder, but only when the results of that process are not structural and cannot be represented by the *Associated morphology* attribute.

Infectious process (qualifier value) and its *subtype* Parasitic process (qualifier value) are included in the range for *Pathological process*. These are used in modeling the Infectious disease (disorder) subhierarchy.

For example,

- 17322007 |Disease caused by parasite (disorder)| has the *Pathological process* Parasitic process (qualifier value)

Pathological process must not be used for values that could overlap with *Associated morphology*

For example,

- Inflammatory processes result in inflammation (by definition), but these disorders should be defined by their morphology, i.e. 708039003 |Inflammatory lesion (morphologic abnormality)|

Pathological process

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

Disorders which involve congenital anomalies are defined with Occurrence (attribute) = Congenital (qualifier value), Associated morphology (attribute) = Morphologic abnormality (qualifier value) and Pathological process (attribute) = Pathological development process (qualifier value).

Congenital X morphology concepts are not to be used unless there is no non-congenital supertype.

During

This attribute is used to model concepts in which a clinical finding occurs *during* another clinical finding (combined disorder) or procedure. Neither asserting nor excluding a causal relationship, it instead emphasizes a sequence of event.

For example,

- 10901000087102 |Hypotension during surgery (disorder)| has the value Surgical procedure (procedure) for During (attribute)

Finding method

This attribute specifies the means by which a clinical finding was determined. It includes findings that were determined by examination of the patient. *Finding method* is frequently used with *Finding informer*.

For example,

- 713071004 |Alcohol misuser in household (finding)| has the *Finding method* History taking (procedure)

Finding informer

This attribute specifies the person or other entity from which the clinical finding information was obtained. It is not about the particular individual, but about the *category or type* of informer. It is used to differentiate patient-reported symptoms from provider-determined signs. This attribute is frequently used in conjunction with *Finding method*.

For example,

- 272027003 |Complaining of a headache (finding)| has the *Finding informer* Subject of record or other provider of history (person)

Has realization

This attribute is used to specify the process or activity that is the consequence of realization of the function.

✓ Modeling: Allergy to X

Allergy to X is modeled with *Has realization*, Allergic process (qualifier value) and *Causative agent*, Substance (substance).

Temporally related to

This attribute specifies a period of time occurring before, during, and after a clinical entity. It is a grouper concept only.

2.4.2.3 Clinical Finding/Disorder Naming Conventions

Clinical finding

When possible, the fully specified name (FSN) for a *Clinical finding* should name the *morphologic abnormality* before naming the site.

For example,

- 399525009 |Inflammation of ampulla of Vater (disorder)|, *Inflammation* is the morphologic abnormality and *ampulla of Vater* is the site

Disorder

In the disorder hierarchy, the following naming conventions apply:

- The word *disorder* should be singular, e.g. disorder of nose, not disorders of nose.

! Exceptions

Plurals may be used:

- As synonyms for grouper concepts, e.g. *disorders* or *diseases*
- In bilateral concepts, e.g. disorder of bilateral eyes, disorder of both eyes (see also *Lateralized Disorder Naming Conventions*)

- When the concept is a general grouping of disorders of a body system, body site, or other broad category, the word *disorder* is preferred over the word *disease* for the FSN, e.g. disorder of reproductive system, not disease of reproductive system. This does not apply at the *leaf* level,

For example,

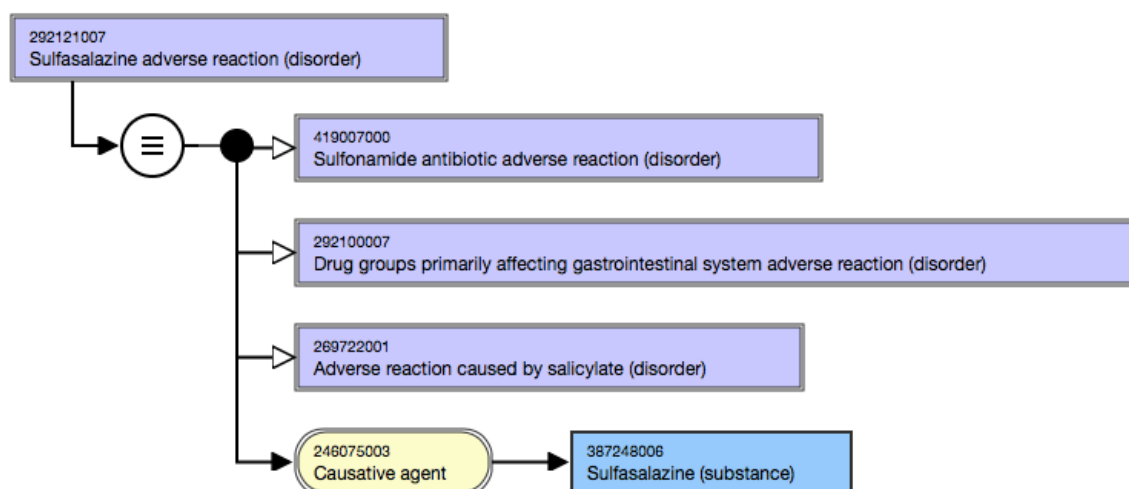
- 417683006 |Sickle cell-hemoglobin C disease without crisis (disorder)|
- Strings should avoid the article *the*, e.g. disorder of lower respiratory system, not disorder of *the* lower respiratory system.

Adverse reaction caused by a substance

Use the International Nonproprietary Name (INN).

For example, 292121007 |Sulfasalazine adverse reaction (disorder)|

- FSN: Sulfasalazine adverse reaction (disorder)
- PT: Sulfasalazine adverse reaction



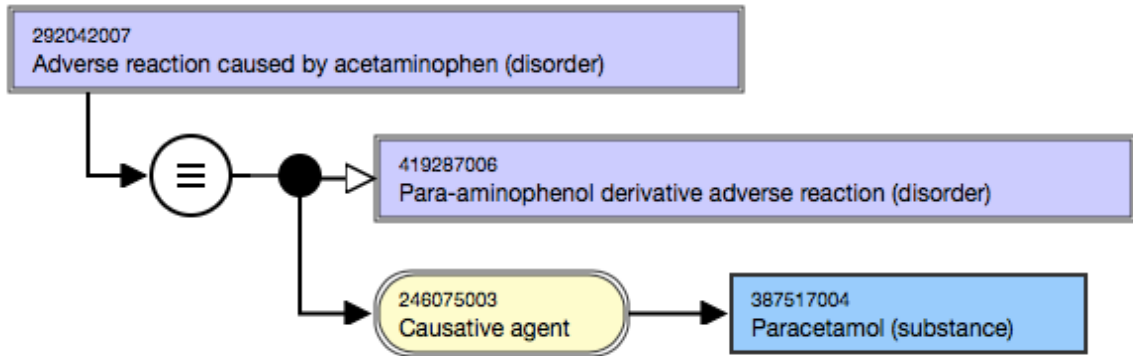
Where BAN (British Approved Name) and/or USAN (United States Adopted Name) differs from the INN, then synonyms should be added using the BAN or USAN.

For example, 292042007 |Adverse reaction caused by acetaminophen (disorder)|

- FSN/PT: Adverse reaction caused by acetaminophen (disorder)
- PT: Adverse reaction caused by acetaminophen
- SYN: Adverse reaction caused by paracetamol
- SYN: Adverse reaction to paracetamol

Single-ingredient substance modeling

The following illustrates proximal primitive modeling for single-ingredient substance concepts.



Adverse reaction caused by multiple substances

Use the International Nonproprietary name (INN), listing substances in alphabetical order.

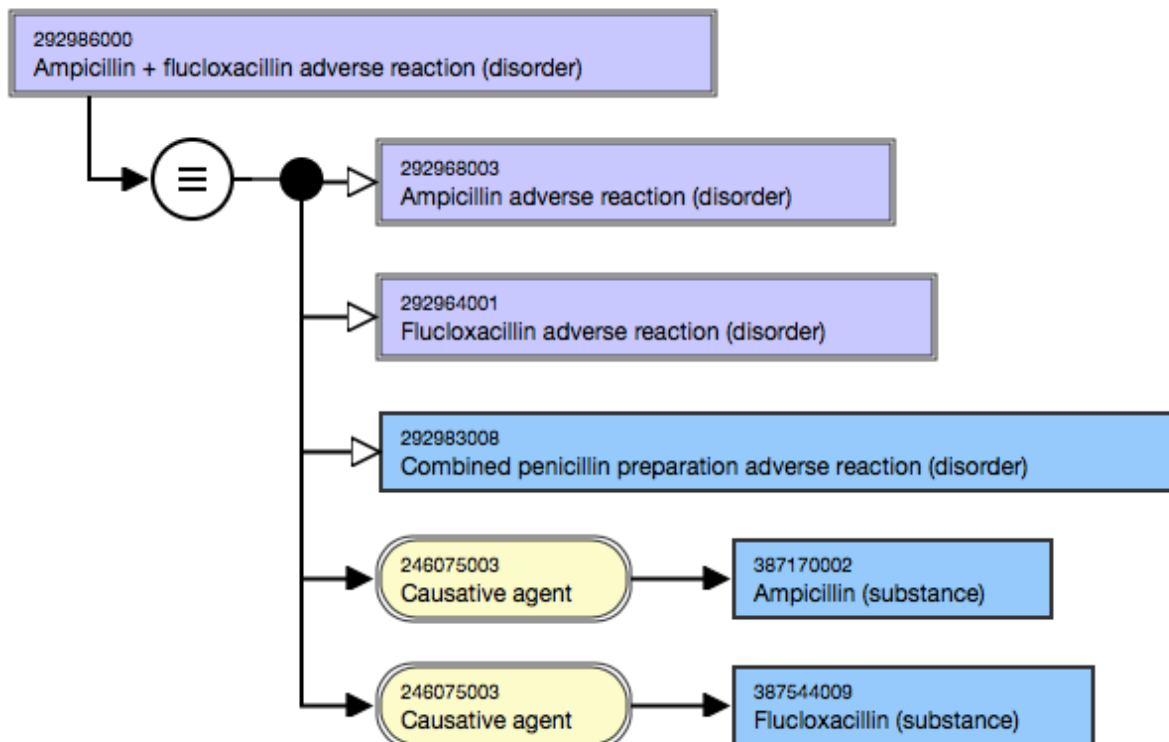
For example, 292986000 |Ampicillin + flucloxacillin adverse reaction (disorder)|

- FSN: Ampicillin + flucloxacillin adverse reaction (disorder)
- PT: Ampicillin + flucloxacillin adverse reaction

As with single-ingredient substances, when the BAN (British Approved Name) and/or USAN (United States Adopted Name) differs from the INN, then synonyms should be added then synonyms should be added using the BAN or USAN.

Multiple-ingredient substance modeling

The following illustrates proximal primitive modeling for multiple ingredient substance concepts.



 **Information**

The modeling approach for multiple-ingredient concepts is a temporary solution. It incorrectly asserts an adverse reaction to each, rather than to one, agent. The use of concepts from the Pharmaceutical/biologic product hierarchy is being considered as a final solution but further work is required to determine if this would be a viable solution.

Adverse reaction caused by an organism

- Use the scientific name for the organism in the FSN, e.g. Adverse reaction caused by *Artemisia vulgaris* pollen (disorder)
- Use the common name in the preferred term, e.g. Adverse reaction caused by mugwort
- The synonym should match the FSN, e.g. Adverse reaction caused by *Artemisia vulgaris* pollen

Hypersensitivity disorders

Allergic and nonallergic hypersensitivity (pseudoallergic) diseases

FSN pattern: Allergic disease X (caused by Y) (disorder)

For example,

- Allergic rhinitis (disorder)
- Allergic conjunctivitis (disorder)
- Allergic rhinitis caused by grass pollen (disorder)
- Allergic rhinitis caused by house dust mite (disorder)

PT pattern: Allergic disease X (caused by Y)

For example,

- Allergic rhinitis
- Allergic conjunctivitis
- Allergic rhinitis caused by grass pollen
- Allergic rhinitis caused by house dust mite

Allergic and nonallergic hypersensitivity (pseudoallergic) dispositions

 **Drug allergies**

Allergic and nonallergic hypersensitivity (pseudoallergic) dispositions include drug allergies.

Description type	Patterns and examples
FSN	Patterns: <ul style="list-style-type: none"> • Allergy to X (finding) • Allergy to X and Y (finding) <ul style="list-style-type: none"> • X and Y = INN or the scientific name of the organism • X and Y in alphabetical order for concepts representing multiple substances For example, <ul style="list-style-type: none"> • Allergy to abacavir (finding) • Allergy to acetaminophen (finding) • Allergy to <i>Artemisia vulgaris</i> pollen (finding) • Allergy to sulfamethoxazole and trimethoprim (finding)

Description type	Patterns and examples
PT	Patterns: <ul style="list-style-type: none"> • Allergy to X • Allergy to X and Y <ul style="list-style-type: none"> • X and Y = INN or the common name of the organism • X and Y in alphabetical order for concepts representing multiple substances For example, <ul style="list-style-type: none"> • Allergy to abacavir • Allergy to acetaminophen • Allergy to mugwort pollen • Allergy to sulfamethoxazole and trimethoprim
SYN	Pattern: <ul style="list-style-type: none"> • Allergy to Z <ul style="list-style-type: none"> • Z = BAN or USAN, when the BAN (British Approved Name) and/or USAN (United States Adopted Name) differs from the INN • A synonym with the scientific name of the organism For example, <ul style="list-style-type: none"> • Allergy to paracetamol • Allergy to Artemisia vulgaris

Allergic and nonallergic hypersensitivity (pseudoallergic) reactions

FSN patterns: Allergic reaction (caused by X) (disorder); Anaphylactic reaction (caused by X); Anaphylactoid reaction (caused by X)

For example,

- Allergic reaction caused by dye (disorder)
- Allergic reaction caused by pollen (disorder)

PT pattern: Allergic reaction caused by X

For example,

- Allergic reaction caused by dye
- Allergic reaction caused by pollen

Intolerance to substance

FSN pattern: Intolerance to X (finding)

PT pattern: Intolerance to X

2.4.2.3.1 Lateralized Disorder Naming Conventions



For more information

See the IHTSDO Authoring Projects; Anatomy Projects webpage [5. Laterality](#)

See also [8. Naming convention for anatomy \(draft\)](#) for information on naming concepts referring to digits

All lateralized anatomy concepts should be sufficiently defined. Bilateral disorders or procedures should be modeled using two relationship groups, one for each lateralized anatomy concept. Bilateral concepts for anatomy are not allowed.

Right, left disorder concepts

Descriptions

- FSN: X disorder of right eye (disorder)
- PT: X disorder of right eye

For example, 336541000119107 |Acute anterior uveitis of right eye (disorder)|

- FSN: Acute anterior uveitis of right eye (disorder)
- PT: Acute anterior uveitis of right eye

Bilateral disorder concepts

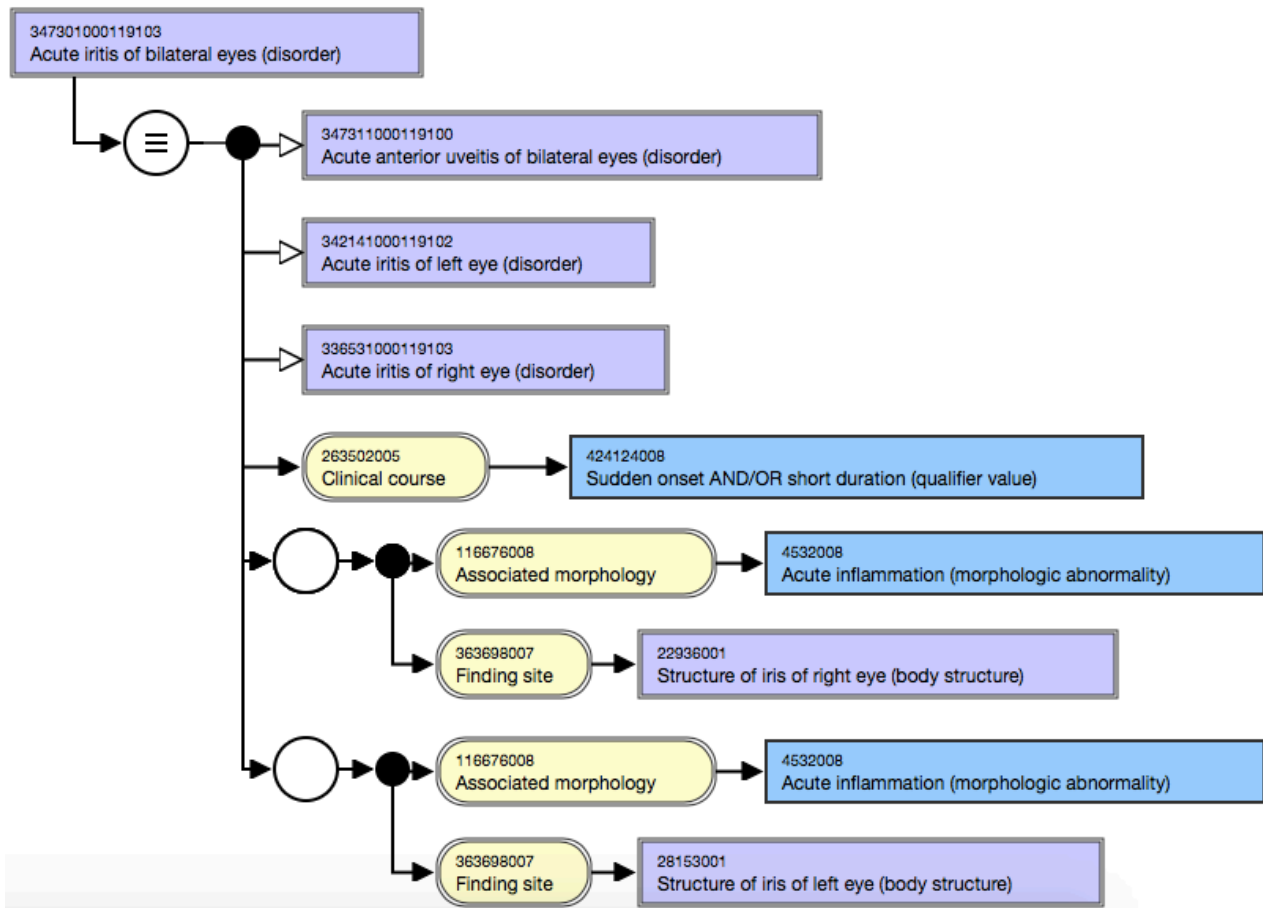
Descriptions

- FSN: X disorder of bilateral eyes (disorder)
- PT: Bilateral X disorder
- SYN: X disorder of bilateral eyes
- SYN: X disorder of both eyes

For example, 347301000119103 |Acute iritis of bilateral eyes (disorder)|

- FSN: Acute iritis of bilateral eyes (disorder)
- PT: Bilateral acute iritis
- SYN: Acute iritis of bilateral eyes
- SYN: Acute iritis of both eyes

Modeling of bilateral disorders



When the morphology implies the finding site, it is unnecessary to name it in the FSN.

For example, 342141000119102 |Acute iritis of left eye (disorder)|

- FSN: Acute iritis of left eye (disorder)
- PT: Acute iritis of left eye

Unacceptable example,

- FSN: Acute iritis of iris of left eye (disorder)

When the morphology is a subpart of a region, then add the term *region* to the FSN:

For example, 342131000119106 |Acute lacrimal canaliculitis of left eye region (disorder)|

- FSN: Acute lacrimal canaliculitis of left eye region (disorder)
- PT: Acute lacrimal canaliculitis of left eye region

Bilateral example, 347291000119104 |Acute lacrimal canaliculitis of bilateral eye regions (disorder)|

- FSN: Acute lacrimal canaliculitis of bilateral eye regions (disorder)
- PT: Bilateral acute lacrimal canaliculitis
- SYN: Acute lacrimal canaliculitis of bilateral eye regions
- SYN: Acute lacrimal canaliculitis of both eye regions

2.4.2.4 Disorder Modeling

A disorder is always and necessarily an *abnormal clinical state*. Disorders are modeled as follows:

2.4.2.4.1 Specific Disorder Modeling

Topic links (by disorder type)

[Ischemic disorder](#)

[Ischemic heart disease](#)

[Arrhythmia](#)

[Lesion](#)

[Trauma, injury](#)

[Friction injury, abrasion](#)

[Laceration, incised wound](#)

[Rupture](#)

[Traumatic disorders](#)

[Tumor vs. neoplasm](#)

[Primary vs secondary neoplastic disorders](#)

[Neoplasia](#)

[Neoplasm vs. hamartoma](#)

[Nevus](#)

[Infectious disease, inflammatory disorder](#)

[Hypersensitivity disorders](#)

[Congenital](#)

[Congenital vs. acquired](#)

[Hereditary](#)

[Familial](#)

Developmental

Genetic, development, congenital, and physical

Malformation, deformation, anomaly

Hematologic, lymphatic

Hematologic disorders, lymphoid and myeloid neoplasms

Coagulation, hemostasis, thrombosis

Hernias

Osteoarthritis

Multisystem disorders

Mental health disorders

Ischemic disorder

Ischemic disorders are defined by a morphology of ischemic structural change. This need not be permanent, but it is assumed that all ischemia results in some structural alterations at the molecular level.

Ischemic heart disease

Ischemic heart disease includes myocardial infarction, myocardial ischemia (without infarction), angina, and other disorders of the heart that have ischemic structural change (reversible or non-reversible) as a *defining characteristic*.

Coronary arteriosclerosis can, of course, be present without causing ischemia, so coronary arteriosclerosis is not a *subtype* of ischemic heart disease.

Likewise, there are causes of myocardial ischemia and infarction other than coronary arteriosclerosis, so ischemic heart disease is not a *subtype* of coronary arteriosclerosis.

Arrhythmia

Cardiologists noted confusion in the placement of *Conduction disorder of the heart (disorder)* as a broad grouping that subsumed arrhythmias and heart blocks. In common usage *arrhythmia* refers to a broad set of conditions that include conduction disorders, under which are heart blocks. The concept Cardiac arrhythmia (disorder) is a parent of Conduction disorder of the heart (disorder), and the active referent of the inactive concepts named *dysrhythmia* or *arrhythmia*.

For example,

- Arrhythmias, like 72654001 |Supraventricular arrhythmia (disorder)|, are under 698247007 |Cardiac arrhythmia (disorder)|

Conduction disorders include heart block, AV block, bundle branch block, conduction delay, and conduction defect, like 418341009 |Atrioventricular conduction disorder (disorder)|. Other arrhythmias were moved from under 44808001 |Conduction disorder of the heart (disorder)| and placed under 698247007 |Cardiac arrhythmia (disorder)|.

Lesion

The word *lesion* can be used to refer to both structural and functional abnormalities. If a disorder (or procedure) refers to a lesion in a way that makes it clear that it is a generic term for a structural abnormality, then the correct modeling approach is to use 116676008 |Associated morphology (attribute)| or 49755003 |Morphologically abnormal structure (morphologic abnormality)| (For procedures, use 405816004 |Procedure morphology (attribute)|).

Functional lesions should not be modeled using values from the Morphologically abnormal structure hierarchy.

Trauma, injury

The word *trauma* has multiple meanings. The first is physical damage to the body (versus emotional trauma). We assume *trauma* means physical damage unless accompanied by words that make clear it is emotional.

417163006 |Traumatic AND/OR non-traumatic injury (disorder)|

Injury is not synonymous with trauma since injuries, caused by stroke, drowning, or toxins, for example, are non-traumatic. Thus the concept, 417163006 |Traumatic AND/OR non-traumatic injury (disorder)|.

Traumatic injury (disorder)

417746004 |Traumatic injury (disorder)| is defined as any disorder with a morphology of 19130008 |Traumatic abnormality (morphologic abnormality)|.

Friction injury, abrasion

An injury due to *friction* can be represented using 400152004 |Friction injury (morphologic abnormality)|, in which case it will not classify as a kind of wound.

For example,

- 47222000 |Friction injury of tooth (disorder)|
- 400068007 |Mechanical irritation (morphologic abnormality)|

However, most disorders that are named *abrasion* imply that skin or other tissue has been abraded (scraped or worn away). Thus, they are also considered wounds and will correctly classify as wounds after assigning the correct morphology, 400061001 |Abrasion (morphologic abnormality)|.

For example,

- 211039006 |Abrasion, chest wall (disorder)|

Laceration, incised wound

The word *laceration* has two meanings, which can be summarized as *torn* vs *cut*. In common clinical usage *laceration* means *incised wound*. For example, a common reason for emergency department visits is an accidental cut of a finger with a kitchen knife. These are routinely called *lacerations*. On the other hand, most dictionaries define *laceration* as a wound with ragged edges, as a result of tearing. Obstetrical lacerations have this meaning. When structures are torn or ruptured, the edges are usually irregular.

There are two morphologies with a synonym of *laceration*: *incised wound* (above) and *traumatic rupture* (below). Modelers must choose which of these two meanings is intended, when the word *laceration* or *lacerated* is part of a concept description in the injury hierarchy.

Rupture

Ruptures can occur either as a result of injury or spontaneously. The word *rupture*, when applied to muscles and tendons, implies a traumatic injury (e.g. 239731008 |Rupture of lateral collateral ligament of knee (disorder)|). *Rupture*, when applied to an internal organ, may be either traumatic or spontaneous (e.g. 4240001 |Rupture of aorta (disorder)|, 88294009 |Rupture of ovary (disorder)|, etc).

Rupture has the *subtype* morphologies, 415747007 |Traumatic rupture (morphologic abnormality)| and 125672000 |Nontraumatic rupture (morphologic abnormality)|. It is important to make this distinction, at a minimum, in order to support queries related to the effects of trauma. Modelers choose:

- 415747007 |Traumatic rupture (morphologic abnormality)| as the value of associated morphology for concepts involving anatomical sites, such as muscles and tendons, where trauma is involved (in the absence of a specific lesion).

For example,

- 209765005 |Rupture of tendon of thumb (disorder)|

- 125671007 |Rupture (morphologic abnormality)| as the value of associated morphology for concepts involving anatomical sites, such as internal organs, where rupture may be traumatic or spontaneous.

For example,

- 46126003 |Rupture of artery (disorder)|

- 125672000 |Nontraumatic rupture (morphologic abnormality)|, when it is stated as such.

For example,

- 268002004 |Non-traumatic tendon rupture (disorder)|

Rupture may be inferred, when the rupture is of a lesion, which ordinarily leads to spontaneous rupture in the absence of trauma.

For example,

- 286967008 |Acute perforated appendicitis (disorder)|

Traumatic disorders

If an *injury/traumatic disorder* does not have a morphology which is a sub-class of 19130008 |Traumatic abnormality (morphologic abnormality)|, then an additional relationship group is added to express this relationship. The relationship is only required for traumatic injury concepts.

These disorders often have an FSN prefixed by *injury* or explicitly prefixed by *traumatic*.

Examples of FSNs,

- Injury of brachial plexus trunk (disorder)
- Traumatic dislocation of sixth and seventh cervical vertebra (disorder)

Most traumatic concepts have the relationship groups, *Finding site* and *Associated morphology*.

For example, 721347007 |Fracture of third cervical vertebra (disorder)| has

- Finding site (attribute) = Bone structure of C3 (body structure)
- Associated morphology (attribute) = Fracture (morphologic abnormality)

Usually, as in the above example, the morphology is a sub-class of 119130008 |Traumatic abnormality (morphologic abnormality)| and thus auto-classifies appropriately. However, some morphologies are not currently sub-classes of Traumatic abnormality, and a traumatic variant does not exist. These morphologies will not auto-classify as an injury.

For example, 722628000 |Traumatic hemorrhage of subdural space of infratentorial region (disorder)|

- Associated morphology (attribute) = Hemorrhage (morphologic abnormality) and
- Finding site (attribute) = Structure of subdural space of infratentorial region (body structure)

In these cases an additional relationship group is added.

For example,

- Finding site (attribute) = Structure of subdural space of infratentorial region (body structure) and
- Associated morphology (attribute) = Traumatic abnormality (morphologic abnormality)

Tumor vs. neoplasm

The word *tumor* has two primary meanings, a mass, regardless of whether it is neoplastic or not, or a neoplastic mass. Neoplasm is preferred since it is less ambiguous than tumor.

For example,

- 92385005 |Benign neoplasm of small intestine (disorder)|

Primary vs secondary neoplastic disorders

SNOMED CT follows ICD-O and ICD-10, where secondary malignant neoplasm of (*site X*) is uniformly interpreted to mean that metastasis has occurred *to site X*. The alternative interpretation, *from site X*, is not intended.

For concepts that describe metastasis *from* a malignant tumor, SNOMED CT explicitly uses the word *from*.

For example,

- 315006004 |Metastasis from malignant tumor of lung (disorder)|

In SNOMED CT, metastases are modeled with two relationship groups, each with an appropriate morphology and site.

For example,

- 712849003 |Primary malignant neoplasm of prostate metastatic to bone (disorder)|:
 - ISA (attribute): Disease (disorder)
 - Finding site (attribute): Bone structure (body structure) and Associated morphology (attribute): Neoplasm, metastatic (morphologic abnormality)
 - Associated morphology (attribute): Malignant neoplasm, primary (morphologic abnormality) and Finding site (attribute): Prostatic structure (body structure)

Neoplasia

When modeling neoplasia:

- Where the definition is *primary*, the associated morphology: Malignant neoplasm, primary (morphologic abnormality) is used.
- Where the definition is *primary* or *secondary*, the morphology: Malignant neoplasia of primary, secondary or uncertain origin (morphologic abnormality) is used.
- Where the concept expresses a specific morphology the FSN always contains the word *primary*.

For example,

- 9541000119105 |Primary adenocarcinoma of gallbladder (disorder)|
 - Finding site (attribute): Gallbladder structure (body structure)
 - Associated morphology (attribute): Adenocarcinoma (morphologic abnormality)

Neoplasm vs. hamartoma

A neoplasm is defined as a growth of tissue no longer under normal control. A hamartoma is defined as a benign, self-limiting growth of disorganized mature cells normally found in the region, representing faulty development.

SNOMED CT has disorder (and morphologic abnormality) concepts and subtypes representing neoplasia, hamartomas, and tumors.

The SNOMED CT concept 399981008 |Neoplasm and/or hamartoma (disorder)| has six subtypes:

1. angiomatosis
2. hamartoma
3. hemangioma
4. lymphangioma
5. melanocytic nevus
6. neoplastic disease

The SNOMED CT concept 400177003 |Neoplasm and/or hamartoma (morphologic abnormality)| also has six subtypes:

1. angiomatosis
2. blood vessel tumor
3. hamartoma
4. lymphatic vessel tumor
5. melanocytic nevus
6. neoplasm

Nevus

The word *nevus* has many different meanings. The differences are generally based on answers to the following questions:

- Is it necessarily on the skin? Or can it be located in mucosal sites or other sites?
- Is it necessarily visible? Or can it be in internal locations such as gastric mucosa, etc?
- Is it necessarily present at birth? Or can it occur later in life?
- Is it necessarily dark and made of melanocytes? Or can it be non-pigmented, or made of other types of cells?
- Is it necessarily made of tissue that is normally present at the site? Or can it be ectopic?
- Does it exclude benign neoplasms?

Some common meanings of nevus based on some combinations of answers to the questions are as follows:

- A birthmark, that is, any visible spot on the skin or oral mucosa present since birth, regardless of tissue of origin, excluding benign neoplasms.
- Any benign cluster of melanocytes, regardless of location, and regardless of pigmentation, whether present since birth or appearing later.
- Any cutaneous hamartoma. This excludes non-cutaneous sites, and excludes neoplasms and ectopic tissue, such as choristomas.

As a result of this wide variation in meaning, any *SNOMED CT* FSN containing the word *nevus* may be ambiguous. For example, the term *vascular nevus*, may mean:

- Congenital blood vessel tumor in the skin
- Congenital blood vessel hamartoma or neoplasm that is visible somewhere (not only the skin, but also the mucosa, whether visible externally or not)
- Congenital blood or lymphatic vessel tumor in the skin
- Congenital blood or lymphatic vessel hamartoma or neoplasm that is visible somewhere
- Any of the above but not necessarily congenital

A better FSN for vascular nevus (morphologic abnormality) would be vascular hamartoma (morphologic abnormality). Likewise, a better FSN for congenital vascular nevus (disorder) would be congenital vascular hamartoma (disorder).

In those cases where common clinical usage of a term containing nevus is unambiguous, there is no need to inactivate the description or the concept.

Infectious disease, inflammatory disorder

The concepts, infectious disease (disorder) and inflammatory disorder (disorder) are *siblings*, i.e. not all infectious diseases are inflammatory.

Infectious disease and its subtypes have a Causative agent relationship to the appropriate organism.

For example,

- The causative agent for 232399005 |Acute herpes simplex pharyngitis (disorder)| is Human herpes simplex virus (organism)

Inflammatory disorder has an Associated morphology relationship to 409774005 |Inflammatory morphology (morphologic abnormality)| or one of its *subtypes*.

For example,

- The associated morphology for 81077008 |Acute rheumatic arthritis (disorder)| is 4532008 |Acute inflammation (morphologic abnormality)|

Post-infectious disorders

Post-infectious disorders are not subtypes of infectious disorders. The *After* attribute is used for linking post-infectious disorders with their associated infections.

Hypersensitivity disorders

- 473010000 |Hypersensitivity condition (disorder)| is a primitive concept. It subsumes 473011001 |Allergic condition (disorder)| and 609405001 |Pseudoallergic condition (disorder)|.

- 473010000 |Hypersensitivity condition (disorder)| is a direct descendant of 404684003 |Clinical finding (finding)|.
- 473011001 |Allergic condition (disorder)| and 609405001 |Pseudoallergic condition (disorder)| are both primitive concepts. Each has three descendants representing:
 - Diseases/disorders: abnormal structures
 - Processes: allergic and nonallergic hypersensitivity (pseudoallergic) reactions
 - Dispositions: propensities to develop allergic and nonallergic hypersensitivity (pseudoallergic) reactions; they do not have pathophysiologic manifestations prior to allergic and nonallergic hypersensitivity (pseudoallergic) processes, i.e. reactions

Diseases/disorders and reactions, but not dispositions, are defined by underlying pathological processes.

General Concept Inclusion

An 473011001 |Allergic condition (disorder)| may be represented using general concept inclusions (GCI):

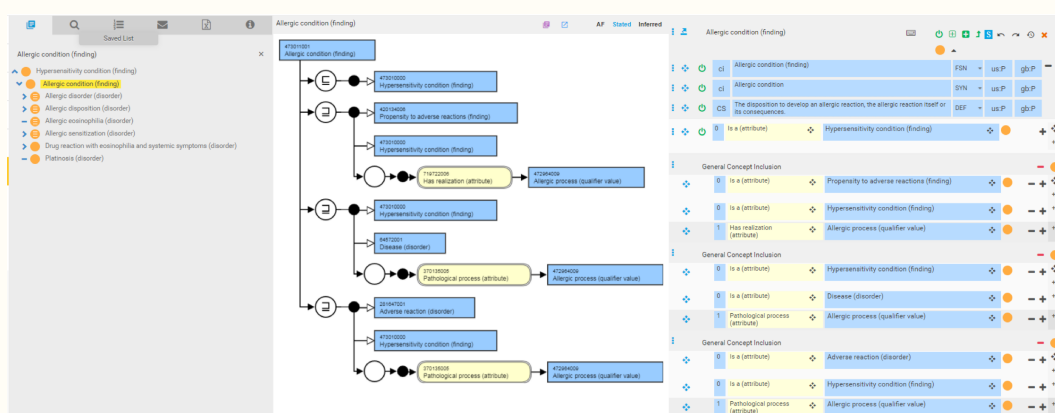


Figure 2.4.2.4.1-1: General Concept Inclusions (GCI)

Pathological process (qualifier value) hierarchy

In order to fully describe the full range of hypersensitivity responses, there are qualifier values in the Pathological process (qualifier value) hierarchy. (See also *Qualifier Value* page).

Disorder of immune function

Modeling 414029004 |Disorder of immune function (disorder)| with 769247005 |Abnormal immune process (qualifier value)| allows allergic and autoimmune disorders to correctly classify as *disorders of immune function*.

Allergic and nonallergic hypersensitivity (pseudoallergic) disease

Allergic and nonallergic hypersensitivity (pseudoallergic) diseases represent manifestations of pathologic processes that result in abnormal structures. Modeling an allergic and nonallergic hypersensitivity (pseudoallergic) disease includes the following relationship groups:

- 116676008 |Associated morphology (attribute)| and 363698007 |Finding site (attribute)| representing the abnormal structure
- Pathological process: 472963003 |Hypersensitivity process (qualifier value)|, or one of its descendants
- 246075003 |Causative agent (attribute)|: substance (if specified)

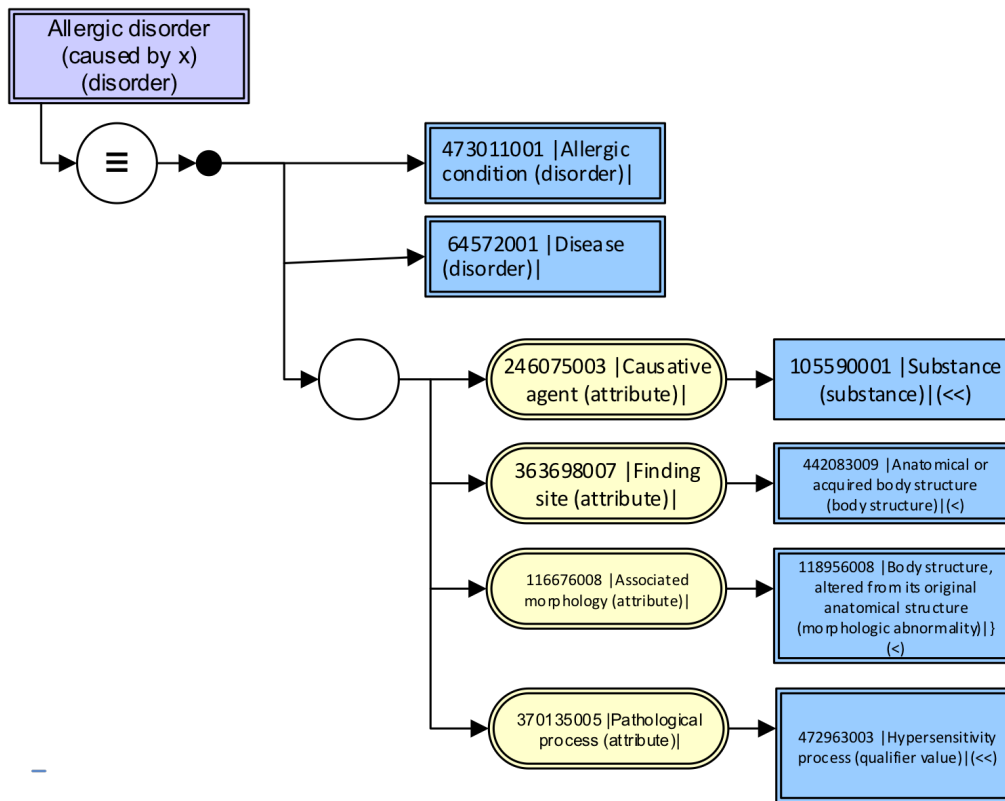


Figure 2.4.2.4.1-2: Allergic and nonallergic hypersensitivity (pseudoallergic) disease model

For example,

Relationship	Cardinality	Concept 1	Concept 2
is a (attribute)	0	Allergic rhinitis (disorder)	Allergic condition (finding)
is a (attribute)	0	Allergic rhinitis (disorder)	Disease (disorder)
is a (attribute)	1	Associated morphology (attribute)	Inflammation (morphologic abnormality)
is a (attribute)	1	Pathological process (attribute)	Immunoglobulin E mediated allergic process (qualifier value)
is a (attribute)	1	Finding site (attribute)	Structure of mucous membrane of nose (body structure)

Allergic and nonallergic hypersensitivity (pseudoallergic) disposition

Allergic and nonallergic hypersensitivity (pseudoallergic) dispositions are propensities to develop allergic and nonallergic hypersensitivity (pseudoallergic) reactions; they do not have pathophysiologic manifestations prior to reactions. They are considered clinical findings, not disorders. This further distinguishes them from allergic and nonallergic hypersensitivity (pseudoallergic) reactions.

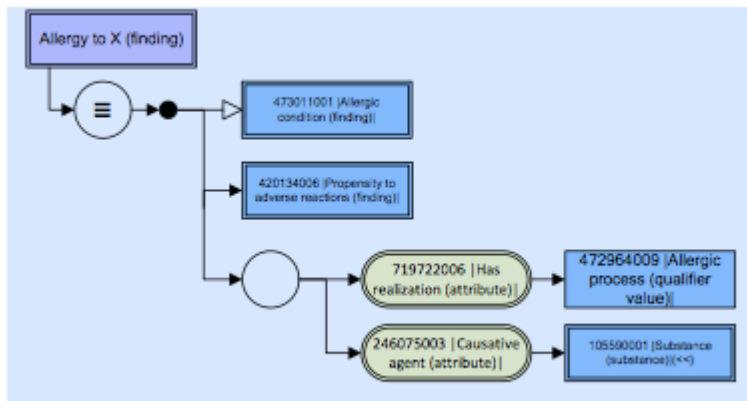


Figure 2.4.2.4.1-3: Allergic and nonallergic hypersensitivity (pseudoallergic) disposition model

For example,



Figure 2.4.2.4.1-4: Allergic disposition (finding) modeling

Allergic and nonallergic hypersensitivity (pseudoallergic) reaction

Allergic and nonallergic hypersensitivity (pseudoallergic) reactions are adverse reactions and allergic conditions. Like diseases/disorders, they are defined by underlying pathological processes.

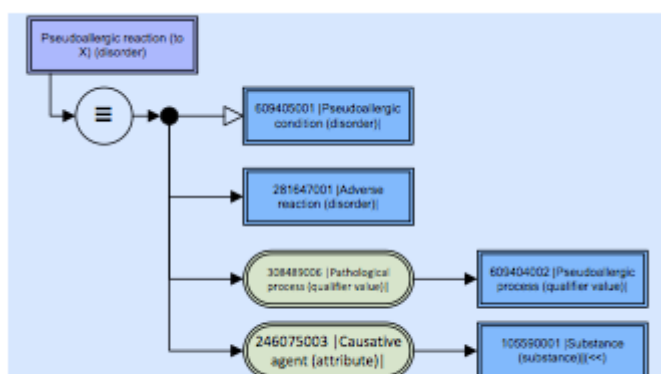
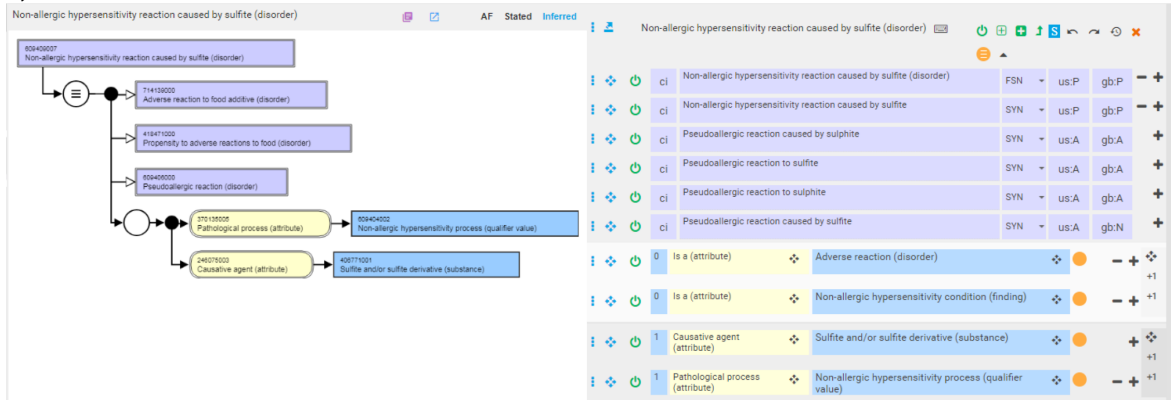


Figure 2.4.2.4.1-5: Allergic and nonallergic hypersensitivity (pseudoallergic) reaction model

For example,

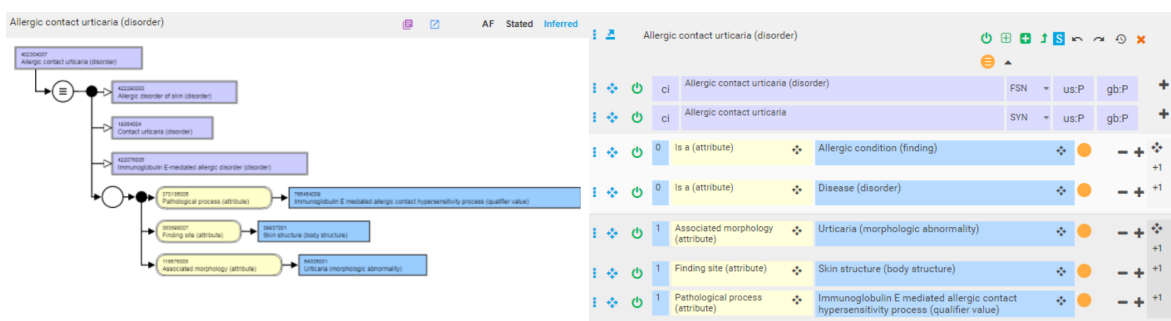


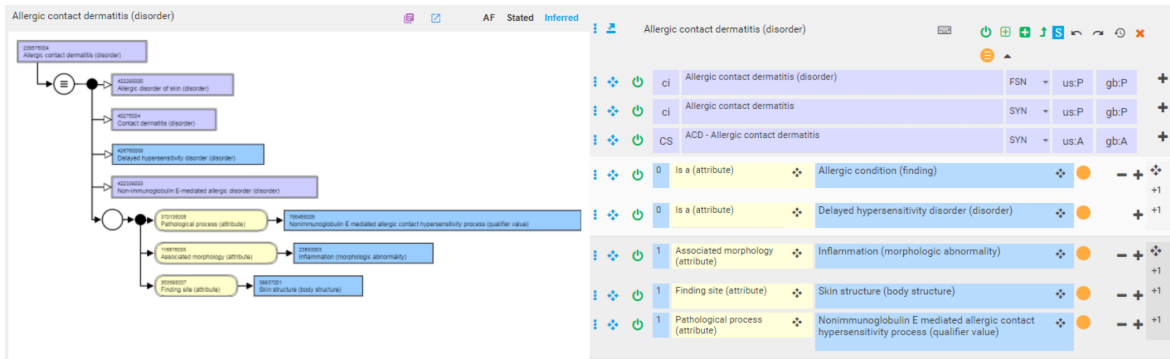
Contact hypersensitivity

Contact hypersensitivity occurs when the skin, or a mucous membrane, comes in contact with a substance. The resulting response may be immune mediated (allergic) or nonimmune (irritant). Allergic responses may be immunoglobulin E mediated, as in 402304007 [Allergic contact urticaria \(disorder\)](#), or nonimmunoglobulin E mediated, as in 238575004 [Allergic contact dermatitis \(disorder\)](#). Contact hypersensitivity concepts are modeled as 473010000 [Hypersensitivity condition \(disorder\)](#), using the pathological processes illustrated below:

- ✓ ● Hypersensitivity process (qualifier value)
- ● Allergic process (qualifier value)
- ✓ ● Contact hypersensitivity process (qualifier value)
- ✓ ● Allergic contact hypersensitivity process (qualifier value)
- ● Immunoglobulin E mediated allergic contact hypersensitivity process (qualifier value)
- ● Nonimmunoglobulin E mediated allergic contact hypersensitivity process (qualifier value)

For example,





Intolerance to substance

An *intolerance* is the propensity to develop an adverse reaction to a substance. The adverse reaction may be associated with various pathological processes, but specifically excludes hypersensitivity reactions.

It may be difficult to define the pathological process and to associate the substance with the propensity to develop a reaction. Consequently, 47429007 |Associated with (attribute)| is used to model intolerance to substances.

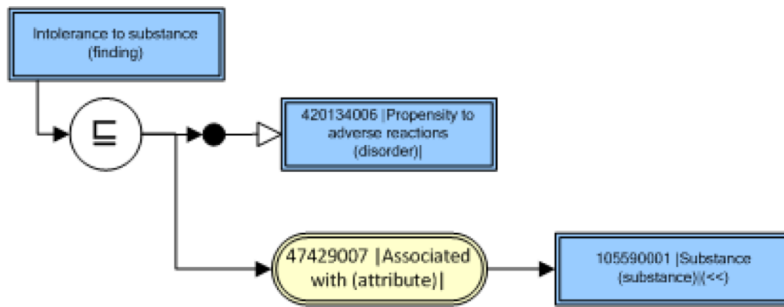
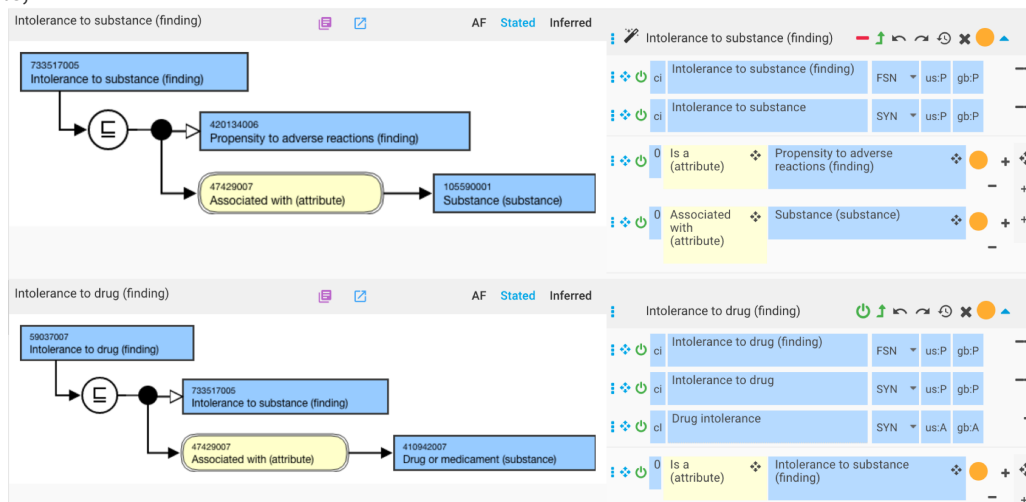


Figure 2.4.2.4.1-6: Intolerance to substance (finding) model

For example,



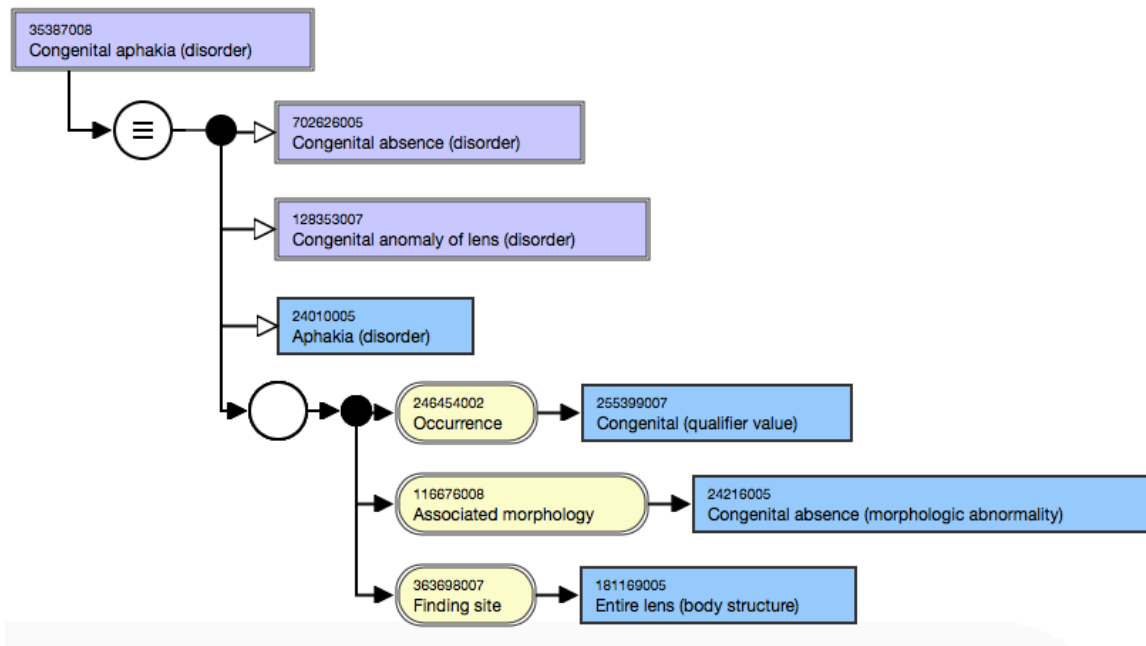
Congenital

The word *congenital* may be applied to genetic disorders. However, the term *genetic* is preferred for those disorders. A 66091009 |Congenital disease (disorder)|, i.e present at birth, should have a stated relationship Occurrence = congenital (qualifier value).

The following guidelines also apply:

- Disorders with the word *congenital* in their FSNs should be classified under 66091009 |Congenital disease (disorder)|.
- Do not make a direct stated assertion that the parent is 66091009 |Congenital disease (disorder)|; instead allow the classifier to infer this relationship.
- Occurrence should be in the same relationship group as Associated morphology and Finding site because the morphology is located at the site and the occurrence applies to the combined morphology-site pair.

For example, 35387008 |Congenital aphakia (disorder)| has the relationship group, Occurrence = Congenital (qualifier value), Associated morphology = Congenital absence (morphologic abnormality), and Finding site = Entire lens (body structure)



- Associated morphology relationships should not have values from subtypes of Congenital anomaly (morphologic abnormality).

✔ Previously, when modeling congenital disorders, Associated morphology = congenital X (morphologic abnormality) was used. Congenital morphologies are being inactivated, so the new pattern should be:

- Associated morphology = X (morphologic abnormality)
- Occurrence = congenital (qualify value)

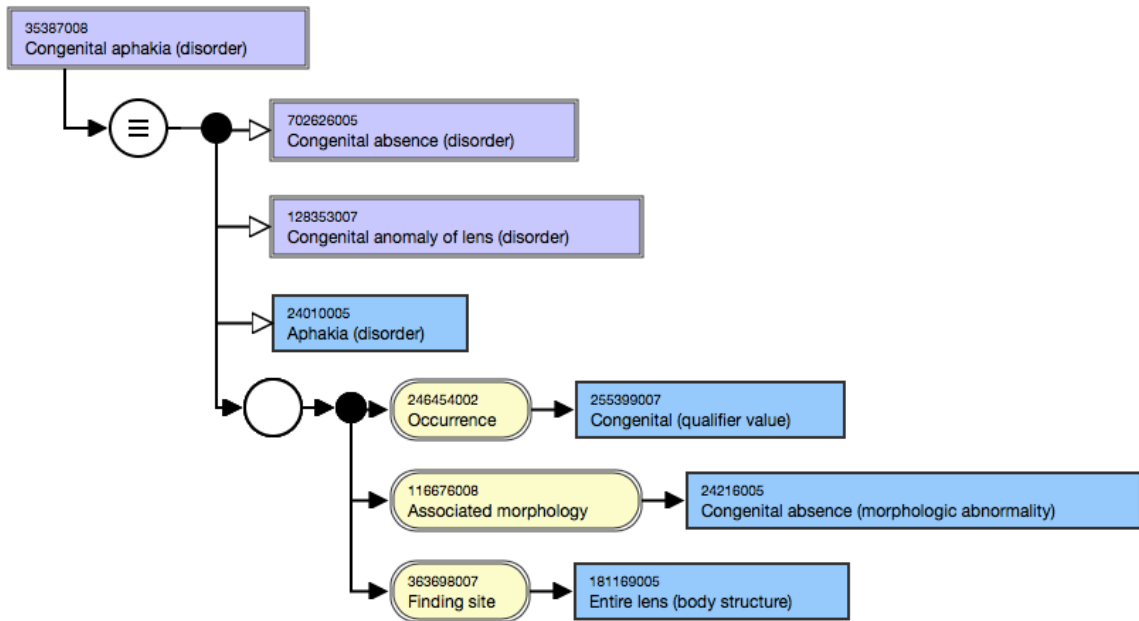
- For general congenital anomaly disorder grouper concepts, such as Congenital anomaly of cardiovascular system (disorder), the preferred value for Associated morphology (attribute) is Developmental anomaly (morphologic abnormality).
- Where existing Congenital morphologic abnormality concepts are used as values for Associated morphology (attribute), replace with the non-congenital morphologic supertype.

Congenital vs. acquired

Disorders, in general, may be either *congenital* or *acquired*.

Congenital disorders are modeled using Occurrence = 255399007 | Congenital (qualifier value) |. If the FSN does not include *congenital*, it should not be modeled as *congenital*. The precise meaning of the FSN should be followed (e.g. many hereditary disorders have *congenital appearances*).

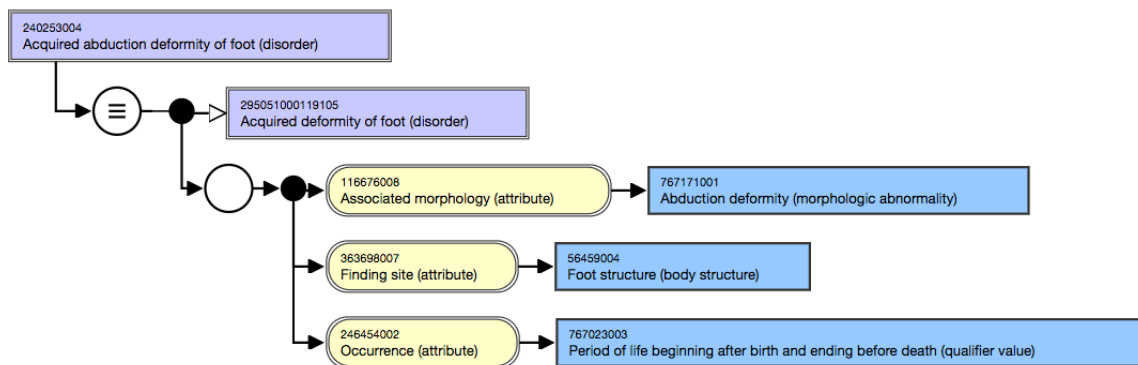
For example, 35387008 |Congenital aphakia (disorder)| is modeled with Occurrence = Congenital (qualifier value)



Acquired disorders are those which originate and manifest after birth. The disorders are associated with a period of life, as opposed to a specific process or structure. All diseases (disorders) that occur after birth are considered *acquired*.

There is a *Period of life* concept, 767023003 | Period of life beginning after birth and ending before death (qualifier value) |. All concepts that explicitly state *acquired* in their FSNs or in a synonym should be modeled with Occurrence = 767023003 | Period of life beginning after birth and ending before death (qualifier value) |; that is if an Occurrence relationship does not already exist, i.e. there is not already another period of life that is a value for Occurrence, which would infer the parent. This allows many primitive concepts to be sufficiently defined.

For example, 240253004 |Acquired abduction deformity of foot (disorder)|



Neonatal period

According to the American Medical Association, the periods of life in the *postnatal period* include all periods after birth including the neonatal or immediate postpartum period. It may be challenging to differentiate a congenital disorder from a neonatal disorder. A condition may be present at birth, i.e. congenital, however clinical manifestations may take longer to appear, i.e. during the neonatal period (e.g. 14333004 |Alloimmune neonatal neutropenia (disorder)|).

Modeling: Acquired disorders

When revising acquired disorders, remove any acquired morphologies and replace with general parent morphologies, e.g. replace 127560004 |Acquired deformity (morphologic abnormality)| with 6081001 |Deformity (morphologic abnormality)|. And, add the attribute Occurrence = 767023003 | Period of life beginning after birth and ending before death (qualifier value) |. One of its children may also be used if the FSN states the period of life, such as *Childhood* or *Adulthood*.

Hereditary

It may be a challenge to classify a condition as a hereditary disease. *Hereditary* requires case-by-case definition; it cannot be applied to broad categories. Nevertheless, the names by which many diseases are known include the term, and it is permitted, as long as it does not introduce ambiguity.

Familial

The term *familial* may also be ambiguous when used for broad categories. It may mean that the disorder is found in higher proportions in the immediate or extended family compared to other groups. Or, it may mean there is a possibility of a disease being inherited. It may be used, however it may require clarification of meaning from the requestor. It should not be used as a synonym for *genetic*.

Developmental

Developmental is a useful label for disorders that affect developing structures or functions that may occur during pre- or postnatally. They may be present at birth or develop later.

Genetic, developmental, congenital, and physical

The following figure shows the structure of genetic, developmental, and congenital categories, along with non-genetic, non-developmental, and postnatal categories. A dimension, called *extrinsic physical force*, is included to distinguish *deformations* from *malformations*. The sections of the diagram represent categories formed from the combination of the dimensions, each which represents the answer to one of the following questions:

- Is it genetic or not?
- Is it developmental or not?
- Is it present at birth or not?
- Is it due to an extrinsic physical force or not?

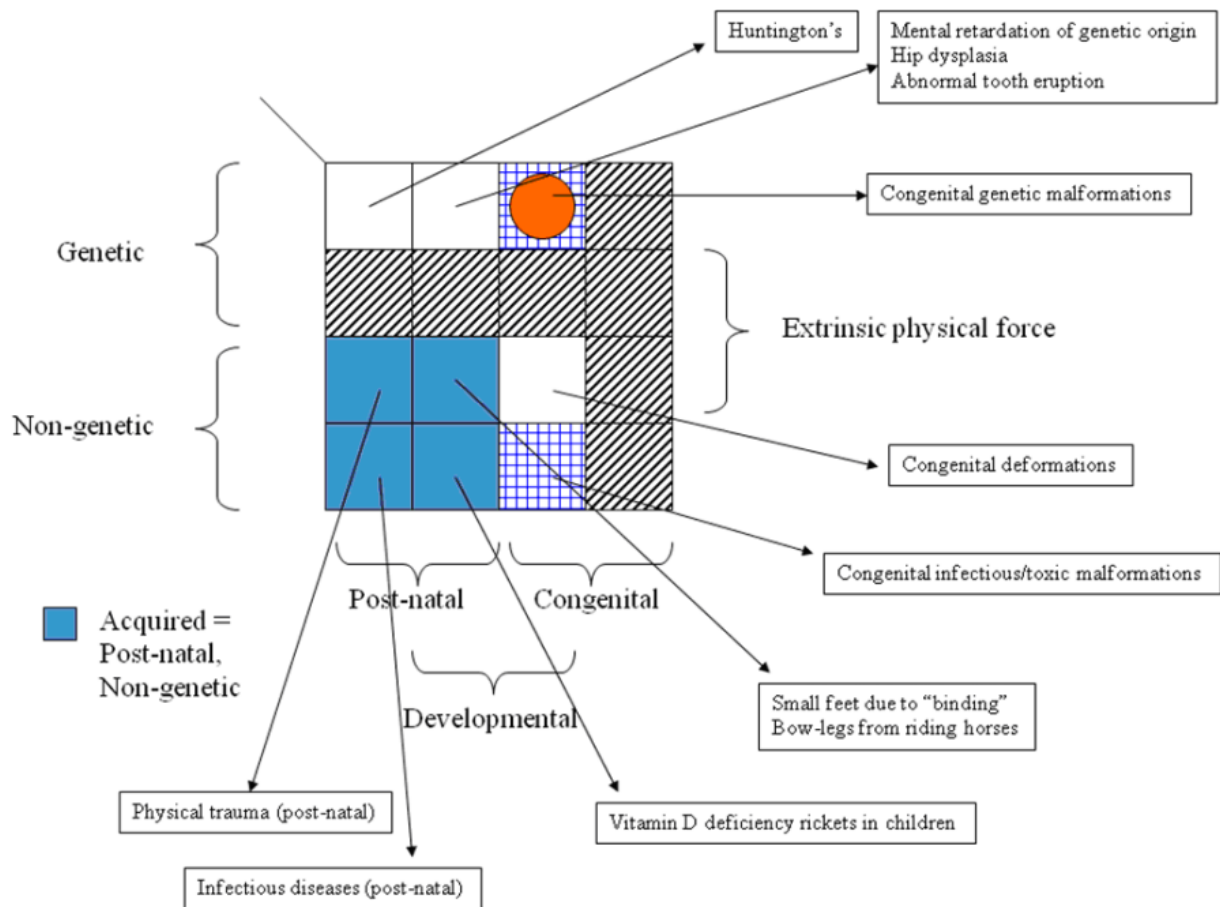


Figure 2.4.2.4.1-7: The relationships of genetic, congenital, developmental, and acquired disorders

Explanation of Figure 1

- The sections with diagonal hashed lines represent combination categories that do not occur. For example, there are no genetic disorders that are due to an extrinsic physical force. Likewise, there are no congenital disorders that are considered non-developmental.
- The sections with blue crossing lines represent congenital malformations; they may be either genetic or non-genetic. For example, congenital infectious malformations
- The red circle represents congenital genetic malformations.
- The blue sections represent *acquired*, i.e. disorders that are non-genetic and not present at birth. For example, Vitamin D deficiency (rickets) in children is a non-genetic, non-congenital, developmental malformation.
- The white sections represent genetic congenital or genetic postnatal disorders. For example, Huntington's disease is a genetic disease that is neither congenital nor developmental. The gene defect is present at birth, but the disease does not manifest until adulthood.
- Arrows leading from the sections point to examples of disorders for the category.

Malformation, deformation, anomaly

A *deformation* is a structural abnormality that is due to an extrinsic physical force. *Malformations* are structural abnormalities that result from intrinsically disordered development. The word *anomaly* is, by itself, ambiguous. It may mean: any abnormality including non-structural ones; malformation; both malformation and deformation. Concepts with the word *anomaly* must be evaluated for ambiguity.

For example,

- *Congenital anomaly of <x structure>* is definitely structural, but is not the same as *congenital malformation* (structural abnormality due to intrinsically disordered development present at birth). Therefore, it can be regarded as having the more general meaning of *structural abnormality present at birth*.

Hematologic, lymphatic

There is more than one meaning of *hematologic*. A definition based on hematological system *structure* includes hematopoietic and lymphoid structures (including bone marrow, spleen, thymus, lymph nodes, etc), as well as the cellular components of blood. *Hematologic neoplasms* clearly fit this definition.

A definition based on *clinical usage by hematologists* is broader. Disorders of hemostasis and thrombosis are often managed by hematologists, but these do not have a common structural overlap with the lymphoid and hematopoietic systems (with the exception of platelets and megakaryocytes). For clarity, *hematologic disorder* is a navigational concept that is used to define a *reference set* that includes disorders of blood and blood forming organs, as well as disorders of hemostasis and thrombosis, depending on what is intended.

Hematologic disorders, lymphoid and myeloid neoplasms

Hematologic disorders may refer to disorders of: hematopoietic cell origin; blood forming organs (bone marrow, lymph nodes, spleen, thymus, and other lymph tissues); cellular components of blood; or function of hemostatic and thrombotic systems.

Diseases of the blood forming organs (bone marrow, lymph nodes, etc.) can be defined by any one or a combination of the following:

- The morphology (neoplastic diseases, at a minimum, include those morphologies covered by neoplasms in the International Classification of Diseases for Oncology, ICD-O).

For example,

- 118599009 |Hodgkin's disease (disorder)| has Hodgkin lymphoma - category (morphologic abnormality)
- The body site involved (especially specific lymph node groups or skin sites).

For example,

- 400122007 |Primary cutaneous T-cell lymphoma (disorder)| has Finding site, skin structure (body structure)

For some disorders, like T-cell lymphomas, and plasma cell and immunosecretory disorders, it is important to distinguish those defined by morphology, site, or manifestation.

- T-cell lymphomas can be subcategorized according to the primary site, a lymph node, the skin, or other extranodal site. This means that a *site* of lymphoid structure cannot be the defining characteristic of the parent concept *T-cell lymphoma*. Its defining attribute should be morphology alone.
- Plasma cell and immunosecretory disorders (e.g. monoclonal gammopathy, heavy chain disease, Waldenstrom's macroglobulinemia) are defined by their manifestations, i.e. the type of monoclonal protein they secrete. Others (e.g. myeloma, plasmacytoma) are defined by their morphology, regardless of whether or not they are secretory.

- Immunosecretory disorders may have a morphology of *plasma cell neoplasm*, even though no mass has been identified and the monoclonal protein may be the only evidence that there is a clonal neoplasm.

In general, lymphoid and myeloid neoplasms can be modeled with their morphologies, but without a site. Leukemias and myelodysplastic syndromes are modeled with Finding Site, bone marrow structure (body structure).

Coagulation, hemostasis, thrombosis

There is more than one meaning of *coagulation*. A broad meaning, to stop bleeding, is better described as *hemostasis*. A more narrow definition, limited to the formation of the fibrin clot, might exclude certain components of hemostasis (e.g the ability to stop hemorrhage through the actions of blood vessels, collagen, endothelial cells, and platelets, in the absence of clotting). Individuals with *congenital fibrinogen deficiency* cannot form fibrin clots, yet their bodies are able to stop bleeding. Therefore, *coagulation disorders* are kinds of *hemostatic disorders*.

Hernias

Hernia concepts may or may not name the two structures involved. If two structures are specified, each may be described by different morphologies.

For example,

- 40775003 |Intestinal hernia (disorder)|,

Relationship group 1:

- Associated morphology, herniated structure
- Finding site, Intestinal structure

Relationship group 2:

- Associated morphology, hernial opening
- Finding site, abdominal structure

Relationship group 1 names the herniated structure while relationship group 2, names the opening through which the hernia passes.

If the concept is non-specific about the herniated structure, one or the other of these relationship groups is omitted.

For example,

- 128545000 |Hernia of abdominal wall (disorder)| specifies the hernial opening but not the herniated structure.

Relationship group 1:

- Associated morphology, hernial opening
- Finding site, abdominal structure

Osteoarthritis

396275006 |Osteoarthritis (disorder)| is regarded as a degenerative disease, despite the *-itis* in its name. Because of this, 396275006 |Osteoarthritis (disorder)| is not a *subtype* of arthritis in the disorder hierarchy but instead, the more general, 399269003 |Arthropathy (disorder)|. Arthritis is inflammatory by definition, but osteoarthritis has a subclass in the medical literature called non-inflammatory osteoarthritis. In fact, according to many authoritative sources, osteoarthritis is usually regarded as a non-inflammatory disease, and therefore it is not strictly a *subtype* of arthritis.

Structuring the hierarchy this way does not imply that there are no cases of osteoarthritis with inflammation, nor does it rule out inflammation as an etiologic or contributory factor. It is well established that inflammation often occurs in osteoarthritis, and treatment with anti-inflammatory agents has been more

effective than pure analgesics in many cases. Despite growing evidence of the role of inflammatory cytokines in osteoarthritis, it is not always necessarily an inflammatory disorder of the joint.

Multisystem disorders

Multisystem disorders are often rare conditions. There may be limited information about such disorders, so they should be carefully modeled.

When determining parent concepts:

- A multisystem parent concept should be included.
- Genetic or inherited disorders should be modeled in the same way as other genetic and inherited disorders.
- The manifestations of the disorder must always necessarily be true before assigning the relevant parents.
- Attributes must also always necessarily be true.

For example,

- In 702410002 |Iris coloboma with ptosis, hypertelorism, and mental retardation (disorder)|, the coloboma of the iris is not always present. This would not be explicitly modeled in the relationships.
- Some multisystem disorders can be named by their manifestations. The FSN should be descriptive, rather than just a list of names.

For example,

- 717909004 |Bilateral microtia with deafness and cleft palate syndrome (disorder)|
- A multisystem disorder with an eponymous syndrome name, should be included as a synonym only.

Mental health disorders

Dependence-related concepts which express the current existence of abuse are acceptable.

For example,

- 191816009 |Drug dependence (disorder)|

Dependence related concepts which express the pattern as either continuous or episodic are not acceptable.

Unacceptable patterns,

- X with single episode
- X with multiple episodes
- Current episode of X
- First episode of X
- X with continuous pattern

Unacceptable legacy concepts,

- Drug abuse, continuous (disorder)
- Episodic drug abuse (disorder)

Concepts describing *full* or *partial remission* are acceptable, but not the phase of the remission. The patterns are:

- X in full remission
- X in partial remission

For example,

- 46244001 |Recurrent major depression in full remission (disorder)|
- 5703000 |Bipolar disorder in partial remission (disorder)|

Unacceptable examples,

- X in early full remission

- X in sustained full remission
- X in sustained partial remission

Conditions with associated symptoms should be expressed and modeled like combined disorders. *Co-occurrent* and *Due to*, and *Due to situations* are acceptable; but not simple *Co-occurrent*.

For example,

- 724665004 |Perceptual disturbances co-occurrent and due to sedative withdrawal (disorder)|

Concepts containing X without Y are considered on a case-by-case basis.

For example,

- 724735003 |Oppositional defiant disorder without chronic irritability-anger (disorder)|

Unacceptable example,

- Bipolar type II disorder with current episode moderately depressive without psychotic symptoms

Death

Death is an event, not a disorder. *Concepts* like *relatives died*, *death of companion* are life event findings, 365574009 |Finding of life event (finding)|, which is a social and personal history finding.

Sudden Cardiac Death

Sudden cardiac death is a term used in clinical practice. It refers to an arrhythmia that results in sudden loss of cardiac function which, if not quickly reversed, will lead to *actual* death. The FSN Sudden cardiac death (disorder) is modeled as a subtype of 127337006 |Acute heart disease (disorder)|. It should not be classified as *death*. Individuals with sudden cardiac death have not necessarily been declared *dead* and are frequently revived. It is regarded as a *subtype* of *cardiac dysrhythmia*.

2.4.2.4.2 Disorder Combination Modeling

Many disorders occur in combination. Current guidance on modeling and constructing FSNs for disorder combinations simplifies available options to achieve consistency. *SNOMED CT* provides clinically significant disorder combinations so users can document temporal and/or causal relationships between them. In order to do so, one of the following associations is used:

- Simple co-occurrence
- Causation 1 (where the causal disorder is no longer necessarily present)
- Causation 2 (where the causal disorder is necessarily still present)
- Temporal sequencing (without necessary implication of causation)

Information

For more information, see documentation on the IHTSDO website @ <http://www.snomed.org/snomed-ct/learn-more>.

Truth Table

When considering disorder combinations two questions can be asked:

1. Is there a causal relationship?
2. What is the temporal relationship?

The following truth table provides the possible combinations/answers. It allows authors to assign the combination disorder to one category, to which the modeling and FSN construction (below) can be applied. The stricter rules for

FSN construction do not prevent the addition of more familiar connectives in other descriptions (e.g. *with, associated with*).

Disorder Combination Truth Table			
		Is there necessarily a causal relationship?	
		Yes	No
What is the temporal relationship?	Co-occurrence	Causation 2 Modeling pattern: x co-occurrent and due to y	Simple co-occurrence Modeling pattern: x co-occurrent with y
	Partial overlap	Causation 1 Modeling pattern: x due to y	<i>Overlaps with</i> [§]
	No overlap	Temporal sequencing (without necessary implication of causation - after)	
		<i>Due to and after</i> *	<i>After</i> * Modeling pattern: x following y

* = Theoretical *due to and after/after* distinction; § = Theoretical *overlaps with* role. Both approaches require further work.

X Co-occurrent with Y: Simple Co-occurrence	
Default modeling pattern	Default FSN and PT
Assign each participating disorder as a supertype (or ensure that each participating disorder is present in the ancestor tree following classification)	FSN: <i>X co-occurrent with Y</i> PT: X and Y
Examples:	
41931000119102 Sinusitis co-occurrent with nasal polyps (disorder)	
714203003 Acute bronchitis co-occurrent with bronchiectasis (disorder)	
Legacy examples (not to be repeated):	
Psoriasis-eczema overlap condition (disorder)	
Hay fever with asthma (disorder)	

 **Pattern**

The requestor submission FSN may be used as preferred term if it does not comply with the above recommended pattern.

X Due to Y; Causation 1 (causal disorder is no longer necessarily present)	
Default modeling pattern	Default FSN construction

X Due to Y; Causation 1 (causal disorder is no longer necessarily present)

Assign the resultant caused disorder as a supertype (or ensure that the caused disorder is present in the ancestor tree following classification).

Assign the causal disorder as the target of a *due to* relationship.

This applies where the causal factor is a disorder.

Where X occurs due to another disorder or an event Y (which is no longer necessarily present), construct an FSN of the form:

X due to Y

Examples:

190645001 |Adult osteomalacia due to malabsorption (disorder)|

52937008 |Infertility due to infection (finding)|

Legacy examples (not to be repeated):

Neutropenia associated with acquired immunodeficiency syndrome (disorder)

Dilated cardiomyopathy secondary to granuloma (disorder)

X Co-occurrent and Due to Y: Causation 2 (causal disorder is necessarily present)

Default modeling pattern

Assign each participating disorder as a supertype (or ensure that each participating disorder is present in the ancestor tree following classification).

Assign the causal disorder as the target of a *due to* relationship.

Default FSN and PT

Where X occurs due to another disorder or an event Y (which is necessarily still present), construct

FSN: X co-occurrent and due to Y

PT: Y with X

Examples:

1086291000119109 |Abscess of jejunum co-occurrent and due to diverticulitis (disorder)|

367781000119101 |Oligozoospermia co-occurrent and due to obstruction of efferent duct (disorder)|

Legacy examples (not to be repeated):

Choking due to airways obstruction (finding)

Coma associated with diabetes mellitus (disorder)

✓ Modeling

To verify the validity of the causal relationship of the FSN, examine the name while ignoring the words *co-occurrent* and *and*. Check that the directionality of the *due to* is correct.

For example,

- 367171000119100 |Hematuria co-occurrent and due to cystitis (disorder)| - Correct directionality
- Scleroderma co-occurrent and due to glomerulonephritis - Incorrect directionality

Implementation

- If co-occurrence has to be documented at the time of an encounter, the causal disorder could be separately recorded.
- When searching a database for all cases of a particular condition, include all instances of the condition (and descendants), plus all instances where the *due to* attribute has been used in to express the condition as the causal disorder.

X Following Y: Temporal Sequencing (without necessary implication of causation)

As indicated in the truth table (above), the reason for selecting this option is to capture and emphasize the *non-overlap* of the conditions (the preceding modeling concept is not included in the life-phase being described).

Explicit causation may be captured by either the use of a new *due to and after* role, or by the use of both *due to* and *after* (not yet implemented).

Default modeling pattern	Default FSN construction
Assign the X disorder (as a supertype (or ensure that the caused disorder is present in the ancestor tree following classification) Assign the Y disorder (or procedure) as the target of an <i>after</i> relationship The <i>following</i> modeling pattern also applies to allergy dispositions which occur following sensitization.	Where X occurs after Y (and it is not specified that X is due to Y, although causality is frequently implied), construct an FSN of the form: <i>X following Y</i>

Examples:

402490007 |Calcinosis following localized fat necrosis (disorder)|

391103005 |Adverse event following complementary therapy (disorder)|

Legacy examples (not to be repeated):

Herpes zoster retinitis (disorder)

Vertigo as late effect of stroke (disorder)

Disorder combination modeling

- It covers only combinations of two disorders. Frequently, combinations include more (including syndromes).
- It does not cover absent components or *negation*.
- It does not cover cases where combination concepts are demonstrably class-, category-derived (This limitation accepts that some content may be so obviously based on a class or category that it would be undesirable to reinterpret its semantics).
- The modeling approach may be difficult to apply in all cases of combined disorders; domain-specific templates should be developed to ensure modeling consistency and accuracy.

General heuristics

For all resultant conditions that represent manifestations of a *multisystem disorder*, model as *co-occurrent and due to*.

For example,

- 319841000119107 |Rheumatoid lung disease with rheumatoid arthritis (disorder)| = Rheumatoid lung disease co-occurrent and due to rheumatoid arthritis

For all causative conditions that are systemic and non-curable, model as *co-occurrent and due to*.

For example,

- 21921000119103 |Dementia co-occurrent and due to Pick's disease (disorder)| = Dementia co-occurrent and due to Pick's disease

For all combined disorders where a cause is either a disorder or a material agent (e.g. gallstones, alcohol), model as *caused by material agent*, if direct cause.

For example,

- 445507008 |Inflammation of pancreas caused by alcohol (disorder)|

For all combined disorders where a cause is either a disorder or a material agent (e.g. gallstones, alcohol), model as *due to* disorder if indirect cause.

For example,

- 87810006 |Megaloblastic anemia caused by alcoholism (disorder)|

Use simple co-occurrence sparingly for two conditions that are related by a common predisposition or that represent an overlap syndrome.

For example,

- 125021000119107 |Intermittent asthma co-occurrent with allergic rhinitis (disorder)| = no change

Use simple co-occurrence sparingly for two conditions that are necessarily co-occurrent, but for which a causative chain is not definitive (after thorough review of the current literature).



Covert co-occurrence

There are many concepts that reflect *covert co-occurrence*, such as infections with a specific morphology of a body site (e.g. bacterial conjunctivitis). Bacterial conjunctivitis might be construed as conjunctivitis co-occurrent with a bacterial infection.

Notes about causative agent

Many X caused by Y phenomena can be represented by the use of the causative agent. This approach is used when where the causal factor is a material entity and the means of exposure/introduction are not significant (if significant, the causal factor will be an event).

Caused By Substance or Physical Force			
Default modeling pattern	Default FSN construction	Example	Legacy examples (not to be repeated)
Assign the caused disorder as a supertype (or ensure that the caused disorder is present in the ancestor tree following classification) Assign the causal factor as the target of a Causative agent relationship	Where X occurs due to exposure to a substance or physical force Y, construct an FSN of the form X caused by Y	291000119100 Contact dermatitis caused by chemical (disorder)	Laser-induced burn (disorder)

Infectious Complications	
Use <i>causative agent</i> role if the complication is the direct result of the presence of the infectious agent. Otherwise use <i>co-occurrent and due to</i> or <i>after</i> infection.	
103611000119102 Cirrhosis of liver due to hepatitis B (disorder)	Due to: 66071002 Viral hepatitis type B (disorder)

Infectious Complications	
195888009 Proteus pneumonia (disorder)	Caused by: 50517009 Genus Proteus (organism)
123949001 Post-streptococcal reactive arthritis (disorder)	After: 302809008 Streptococcus pyogenes infection (disorder)



For more information

SNOMED International website @ <http://www.snomed.org/snomed-ct/learn-more>.

(See also, Appendix, Concept Models: *Disorder Combinations*)

2.4.2.4.2.1 Heuristics for Co-occurrent Genomic Disorders

Germline chromosomal abnormality *co-occurrent* and *causing* disorder: 41040004 |Complete trisomy 21 syndrome (disorder)|

If the phenotype is always caused by a specific genotype, there is no need to include the cause in the FSN or clarify with a *Due to* relationship.

Germline nucleotide sequence variant *co-occurrent* and *causing* disorder: 190905008 |Cystic fibrosis (disorder)|

Modeling for germline mutations causing conditions, such as cystic fibrosis, should have *co-occurrent* mutations, *Occurrence* = congenital, and *Due to* the mutation finding.

For example,

- Cystic fibrosis *co-occurrent* and *due to* G542X mutation

Somatic NSV (NCBI structural variant) *co-occurrent* and *poly-etiological*: BRAF V600E positive melanoma

Somatic mutations leading to cancer, such as *malignant melanoma with BRAF V600E mutation*, should have *dual supertypes*, including the malignant disorder and the somatic mutation and *Due to* the associated somatic mutation finding.

For example,

- Melanoma *co-occurrent* and *due to* BRAF V600E mutation

Somatic IHC (immunohistochemical) finding *co-occurrent* but not etiologic: Estrogen-receptor status in breast cancer

Somatic mutations which do not have a causative role in the development of a malignancy should be modeled as *Co-occurrent* with two supertype concepts, but should not be modeled as *due to* the mutation.

For example,

- Breast cancer *co-occurrent* with positive estrogen-receptor assay

2.4.2.4.3 Complication and Sequela Modeling

Complication and sequela attributes

Modeling complications and sequelae is new to *SNOMED CT*. Complications and sequelae are modeled using the Causal and Temporal attributes under the *Associated with* attribute hierarchy:

- Associated with (attribute)
 - Causative agent (attribute)
 - Due to (attribute)
 - Temporally related to (attribute)
 - During (attribute)

- After (attribute)

A *complication* is a disorder caused by another disorder, procedure, or event which is not a natural progression or expected outcome of its cause; temporally may be During and After the causative disorder, procedure, or event.

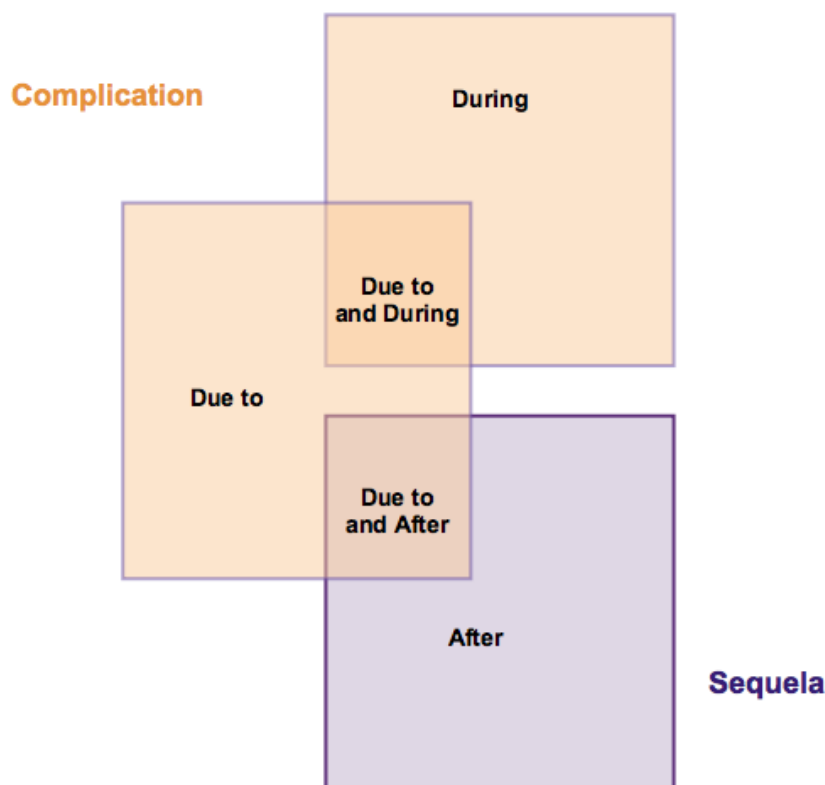
! Exception

- A complication can occur preoperatively; i.e it is a disorder that complicates the procedure, rather than a complication of that procedure. A preoperative complication exists prior to surgery, adversely affecting the surgery or resulting in an intraoperative or postoperative complication.

Many, but not all, sequelae are also complications (again, the resultant disorder is not a natural progression or expected outcome of the preceding disorder, procedure, or event).

A *sequela* is a disorder which is a natural progression or not an unexpected outcome that follows another disorder, procedure, or event. When there is a causal relationship with the preceding disorder, procedure, or event, a sequela may also be a complication.

Complication and sequela relationships



Modeling

If a request is received for inclusion of a concept containing *complication* or *sequela* and it is unclear whether the relationship is causal and/or temporal, request additional information from the submitter.

A concept should always be modeled primarily according to its relationship to a procedure when the nature of these relationships are clear.

- Causation: *Due to*
- Temporal relationship, i.e *Temporally related to: During, After*

For those occasions for which it is clear that an ensuing disorder starts during a procedure but persists after the procedure has been completed, both During and After attributes may be used in the model.

The words *complication* and *sequela* may or may not be part of an FSN.

✓ Modeling

- This modeling facilitates auto-classification. However, in *SNOMED CT* both 116223007 |[Complication \(disorder\)](#)| and 362977000 |[Sequela \(disorder\)](#)| are primitive, which means the relationship to these two concepts has to be explicitly modeled with an IS_A relationship.
- The semantic pattern *Complication of* implies *Due to*.

For example,

- 410019002 |[Complication of vaccination \(disorder\)](#)|
- When a concept has a relationship of Co-occurrent and Due to between two disorders, it will only have an IS A relationship to *Complication*, not to *Sequela*.

Complication and Sequela Allowable Relationships

Attribute	IS A Sequela	IS A Complication
Due to	Possible/Allowable	Necessarily true
During	Not allowable	Possible/allowable
After	Necessarily true	Possible/allowable

⚠ Late effects

ICD uses the phrase *late effects*, which is equivalent to sequela. Thus it should be modeled with After (and Due to if there is a causal relationship) and with an IS A relationship to 362977000 |[Sequela \(disorder\)](#)|.

Types of complications and sequelae

The three types are as follows:

- Only the cause is specified
- Only a temporal relationship is specified
- Both a cause and a temporal relationship to the cause are specified

Types of Complications and Sequelae

Complications				
Type	Disorder / Disorder	Disorder / Procedure	Modeling	Notes
Cause only	11307961000119106 Pathological fracture of pelvis due to neoplastic disease (disorder)	<ul style="list-style-type: none"> • 26944003 Acute megaloblastic anemia due to dialysis (disorder) 	<i>Due to</i> X due to Y Create an IS A relationship to 116223007 Complication (disorder)	<i>Due to</i> can be used to assert causality, at any point in a causal chain, between a condition or procedure and another resultant condition, when there is no explicit temporal relationship
Temporal only	NA	Exception		

		<ul style="list-style-type: none"> Pre-procedure/preoperative anxiety (Not yet modeled in <i>SNOMED CT</i>) Preoperative hyponatremia (Not yet modeled in <i>SNOMED CT</i>) 	<i>Before</i> X before Y	Use to model pre-procedure complications (e.g. preoperative complication), without causal relationships Model with <i>Before</i> , but without assigning a parent of Complication or a causal relationship
	These concepts are modeled with the Combined disorder guidelines using the Co-occurrence pattern	<ul style="list-style-type: none"> 713419002 Intraoperative cardiorespiratory arrest (disorder) 	<i>During</i> X during Y	Use to model a disorder that occurs during a procedure (e.g. intraoperative complication), but without a causal relationship Only use when understood in the FSN (e.g. intraoperative complication or X complication during Y)
Causal + Temporal	These concepts are modeled with the Combined disorder guidelines using the Co-occurrence pattern	<ul style="list-style-type: none"> 36561000119109 Rupture of posterior lens capsule as intraoperative complication (disorder) 196040003 Aspiration pneumonitis due to anesthesia during labor and delivery (disorder) 	<i>Due to and During</i> X due to and during Y	Use to model a disorder that occurs during a procedure (e.g. intraoperative complication), with a causal relationship Both a cause and a temporal relationship to the cause are specified <i>A Due to and During</i> relationship, makes the concept analogous to the use of the <i>After</i> relationship
	<ul style="list-style-type: none"> 236427002 Post-traumatic acute tubular necrosis (disorder) x 733180006 Arthropathy caused by virus due to and following virus infection (disorder) 	<ul style="list-style-type: none"> 724868000 Necrosis of skin due to and following injection of filler (disorder) 762459007 Disorder due to and following breast reduction (disorder) 	<i>Due to and After</i> X due to and following Y	Use to model a disorder that occurs after a disorder or procedure (e.g. postoperative complication), with a causal relationship Both a cause and a temporal relationship to the cause are specified
Sequelae				
Type	Disorder / Disorder	Disorder / Procedure	Modeling	Notes
Temporal only	NA	<ul style="list-style-type: none"> 422411000 Surgical scar (disorder) 711057003 Phantom pain following amputation of lower limb (disorder) 	<i>After</i> X following Y Create an IS_A relationship to 362977000 Sequela (disorder)	Use to model a disorder that occurs after a procedure Does not assert or exclude a causal relationship; instead it emphasizes a sequence of events (e.g. every post-viral disorder occurs after a viral disease) A disorder that follows a procedure is a sequela, unless the disorder and procedure are arbitrarily associated

Causal + Tempo ral	<ul style="list-style-type: none"> • 23311000119105 Acute myocardial infarction due to right coronary artery occlusion (disorder) • 230691006 Cerebrovascular accident due to occlusion of cerebral artery (disorder) 	<ul style="list-style-type: none"> • 73781000 Late radiation dermatitis (disorder) • 762459007 Disorder due to and following breast reduction (disorder) 	<i>Due to and After</i> X due to and following Y	Use to model a disorder that occurs after a disorder or procedure (e.g. postoperative complication), with a causal relationship Both a cause and a temporal relationship to the cause are specified
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Determining the causal relationship

Most combined disorders have a direct or indirect causal relationship. Concepts containing the words *following*, *after*, *post*, or *sequela* in the FSN, and/or are modeled using the *after* attribute, should be considered to be *sequela* and usually *complications* as well.

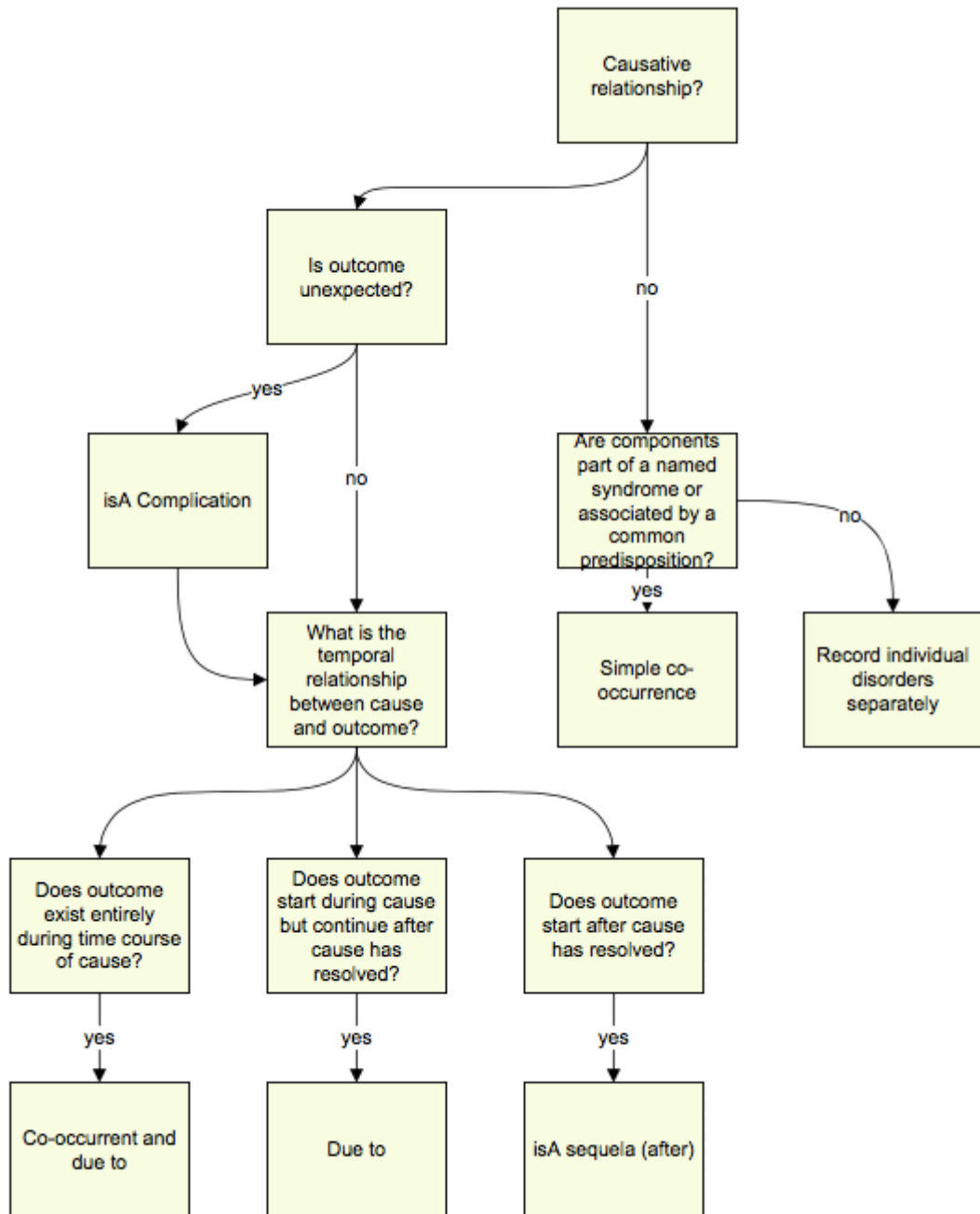


Figure 2.4.2.4.3-1: Causal relationship flowchart

2.4.3 Environment and Geographical Location*

Definition	Examples
<ul style="list-style-type: none"> Environment: types of environments Location: named locations such as countries, states, or regions 	<ul style="list-style-type: none"> 398156002 Medical or surgical floor (environment) 223565009 Nigeria (geographic location)

2.4.4 Event*

Definition	Examples
Occurrences impacting health or health care; not procedures or interventions	<ul style="list-style-type: none"> 242039002 Abuse of partner (event) 405621004 Tracheal intubation event (event)


2.4.4.1 Event Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 272379006 Event (event)	
Domain Constraint	<< 272379006 Event (event)
Parent Domain	-
Proximal Primitive Constraint	<< 272379006 Event (event)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 272379006 Event (event)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
246075003 Causative agent (attribute)	1	0..*	0..1	<< 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 260787004 Physical object (physical object) OR << 78621006 Physical force (physical force)
246454002 Occurrence (attribute)	1	0..*	0..1	<< 282032007 Periods of life (qualifier value)
255234002 After (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)
288556008 Before (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)
371881003 During (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)
42752001 Due to (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 272379006 Event (event) OR << 71388002 Procedure (procedure)

47429007 Associated with (attribute)	1	0..*	0..*	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure) OR << 272379006 Event (event) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 260787004 Physical object (physical object) OR << 78621006 Physical force (physical force)
726633004 Temporally related to (attribute)	1	0..*	0..*	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)

 Additional authoring guidelines for the use of attributes in the Event [hierarchy](#) have yet to be established.

2.4.5 Observable Entity

Definition	Examples
Information about a quality/property to be observed and how it will be observed	<ul style="list-style-type: none"> 416540001 Calcium deposit observable (observable entity) 263731006 Coughing (observable entity)

Use of Observable Entities

Observables entities may be used to:

- Code elements on a checklist or assign values to elements.
For example, *color of nail* is an observable entity. *Gray nails* is a finding.
- Code headers on a template
For example, the observable entity, *gender*, may be used to code a section of a template titled *gender*. The user would choose *male* or *female*. *Female gender* would then constitute a finding.

Types of Observable Entities

There are four general types of observable entities for use in health care. Each has different representation requirements and patterns, i.e. the set of attributes will vary.

- Quality.** A characteristic, feature, or property that is inherent in someone or something.
 - Examples, mass of a person, temperature of internal organs, concentration of sodium in plasma, angle of a joint
- Disposition.** A characteristic or feature that is not always realized in full.
 - Example, antibiotic susceptibility of a certain population
- Function.** The ability of a person, some part of a person, or a thing to perform activities or realize processes.
 - Example, ability to walk
- Process.** A process or outcome of a process
 - Examples, secretion rate, heart rate, respiratory rate

2.4.5.1 Observable Entity Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 363787002 |Observable entity (observable entity)|

Domain Constraint	<< 363787002 Observable entity (observable entity)
Parent Domain	-
Proximal Primitive Constraint	<< 363787002 Observable entity (observable entity)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 363787002 Observable entity (observable entity) 				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
246093002 Component (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
246501002 Technique (attribute)	1	0..*	0..1	<< 272394005 Technique (qualifier value)
246514001 Units (attribute)	1	0..1	0..1	< 767524001 Unit of measure (qualifier value)
370130000 Property (attribute)	1	0..1	0..1	<< 118598001 Property of measurement (qualifier value)
370132008 Scale type (attribute)	1	0..1	0..1	<< 30766002 Quantitative OR << 26716007 Qualitative OR << 117363000 Ordinal value OR << 117365007 Ordinal or quantitative value OR << 117362005 Nominal value OR << 117364006 Narrative value OR << 117444000 Text value
370134009 Time aspect (attribute)	1	0..1	0..1	<< 7389001 Time frame (qualifier value)
405815000 Procedure device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
424226004 Using device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
704319004 Inheres in (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact) OR << 125676002 Person (person)
704320005 Towards (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
704321009 Characterizes (attribute)	1	0..*	0..1	<< 719982003 Process (qualifier value) OR << 71388002 Procedure (procedure)

704322002 Process agent (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 105590001 Substance
704323007 Process duration (attribute)	1	0..1	0..1	<< 7389001 Time frame (qualifier value)
704324001 Process output (attribute)	1	0..*	0..1	<< 105590001 Substance (substance) OR << 719982003 Process (qualifier value)
704325000 Relative to (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
704326004 Precondition (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 703763000 Precondition value (qualifier value) OR << 71388002 Procedure (procedure)
704327008 Direct site (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
718497002 Inherent location (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
719715003 Relative to part of (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
719722006 Has realization (attribute)	1	0..*	0..1	<< 719982003 Process (qualifier value)



This table has been reviewed for implementation in the Observable entity hierarchy. Application of this model in the Evaluation Procedure hierarchy is tentative.

2.4.5.2 Observable Entity Defining Attributes

The following defining attributes correspond to the *Observable Entity Attributes Summary* table.

Component

This attribute is used to specify the numerator of a relational property types, e.g. ratio, concentration.

For example,

- Arbitrary concentration of Varicella-Zoster virus (observable entity) has the *Component* Human herpesvirus 3

Technique

This attribute is used to specify the systematic method of a procedure used to accomplish a specific activity.

For example,

- Presence of Brucella abortus antibody in serum by latex agglutination (observable entity) has the *Technique* latex agglutination test technique

Units

This attribute is used to specify the units used in assigning a value to an observation.

For example,

- Basophils per 100 leukocytes (observable entity) has the *Units* percentage

Property

This attribute is used to specify the type of inherent quality or process to be observed. Its values are abstract types of quality (length, odor, concentration) or abstract types of process features (rate, speed).

For example,

- Blood glucose mass concentration (observable entity) has the *Property* mass concentration

Scale Type

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

For example,

- 443911005 |Ordinal level of hemoglobin A1c (observable entity)| has a *Scale type* of ordinal

Time Aspect

This attribute is used to specify the timing of an observation.

For example,

- Substance concentration of acetone in urine (observable entity) has the *Time Aspect* Single point in time

Procedure device

This attribute is used to model devices associated with a procedure. This attribute is used to define high-level, general concepts that aggregate procedures according to the device involved.

Using device

This attribute is used to specify the instrument or equipment utilized to execute an action. Using device is appropriate when the device is actually used to carry out the action that is the focus of the procedure.

For example,

- 415921007 |Temperature of forehead using skin strip thermometer (observable entity)| has *Using Device* skin strip thermometer

Inheres in

This attribute specifies the independent continuant in which the quality exists and on which the dependent quality (of this observable) depends.

For example,

- Volume of 24-hour urine sample (observable entity) has *Inheres in* 24 hour urine sample

Towards

This attribute is used to specify a disposition, what the disposition is towards, i.e. a specific triggering agent, or more generally, participant in the realization of the disposition.

For example,

- Moxalactam susceptibility MLC (observable entity) has *Towards* moxalactam

Characterizes

This attribute specifies the process which the property describes, and on which the property (of this observable) depends. The process can be very general (e.g. *excretion*).

For example,

- Mass concentration ratio of silver to creatinine in 24-hour urine (observable entity) has *Characterizes* excretion process.

Process agent

This attribute is used to specify the continuant (e.g. body structure or organism) that is causally active in the process on which the property depends. It may refine the meaning of the process named as the value of *characterizes*, or it may simply repeat the meaning that is already there. The *process agent* can be left unspecified.

For example,

- Substance rate of secretion of somatotropin by pituitary following clonidine per os (observable entity) has the *Process Agent* pituitary gland.



Process agent and has agent

Process agent appears to have the same meaning as *Has agent* in the Open Biological and Biomedical Ontology (OBO) Relations Ontology.

Process duration

This attribute specifies the duration of the process characterized by the observable property type.

For example,

- Mass rate of excretion of cortisone in 24 hour urine (observable entity) has the *Process Duration* of 24 hours

Process output

This attribute is used to specify the substance or process produced by the process characterized by the observable property type.

For example,

- Substance rate of excretion of pregnanediol in micromoles per day (observable entity) has a *Process Output* of pregnanediol

Relative to

This attribute is used to specify the denominator of a relational property type, e.g. a ratio or proportion.

For example,

- Urine alpha aminobutyrate to creatinine ratio (observable entity) has *Relative To* creatinine
- Neutrophils per 100 leukocytes in blood (observable entity) has *Relative To* population of all leukocytes in portion of fluid

Precondition

This attribute is used to specify body state, timing, challenges, or other situations that must be true of the entity to be observed.

For example,

- Plasma creatinine concentration 7 days post challenge (observable entity) has a *Precondition* of 7 days post challenge
- 163033001 |Lying blood pressure (observable entity)| has a *Precondition* of recumbent body position

Direct site

This attribute is used to specify the entity on which the observation is directly made. It may also be used when the observation is indirect, i.e. when a direct observation cannot be done.

For example,

- 415974002 |Core body temperature measured at tympanic membrane (observable entity)| has the *Direct Site* of tympanic membrane structure

Inherent location

This attribute is used to specify a body site or other location of the independent continuant in which the property exists.

For example,

- DNA taxon of Mycobacterium from bronchial secretions (observable entity) has *Inherent location* bronchus

Relative to part of

This attribute is used to specify the denominator of a relative relational property, such as a ratio of ratios.

For example,

- Relative substance concentration of cerebrospinal fluid IgM to plasma IgM (observable entity) has *Relative To Part Of* plasma

Has realization

This attribute is used to specify the process or activity that is the consequence of realization of the function.

For example,

- 282097004 |Ability to walk (observable entity)| *Has Realization* of walking

2.4.5.3 Observable Entity Modeling



Observable entities

- When they have not been given a value, observable entities behave like procedures with respect to the *concept model* for context.
- When they have been given a value, observable entities behave like clinical findings with respect to the *concept model* for context.

2.4.5.3.1 Test Observable Entity Naming Conventions

Naming conventions for the fully specified name (FSN) for observable entities and for naming evaluation procedures or observable entities that are submitted with names from the IFCC-IUPAC NPU systems are as follows:

General naming pattern: Property, Component, Specimen

- **First: Property**
 - Property (the property type of the observable) is named first, when possible.
 - Modifier: Scale Method.
 - Scale Method refines the Property, and, therefore, precedes the action in the naming order. (Scale Method, Property)
 - Naming pattern: (Scale Method, Property), Component, Specimen
- **Second: Component**
 - Property is named first, followed by the entity that is the value of Component, when possible.
- **Third: Specimen**
 - Modifier: Timing. Timing provides information about the specimen and precedes it in the naming order. (Timing, Specimen)

For example,

- 416125006 |Concentration of hemoglobin in erythrocyte (observable entity)|

Modeling: Screening measurements

Measurements done by screening should be specified with *by screening method* added at the end of the description.

2.4.5.3.2 Observable Entity and Evaluation Procedures

The observable entity and evaluation procedure hierarchies have some of the same attributes. There is not necessarily a one-to-one correspondence between the two hierarchies. Not every evaluation procedure will have a corresponding observable entity, and neither will every observable entity have a corresponding evaluation procedure. It is anticipated that some evaluation procedure concepts will become observable entity concepts.

Evaluation procedures

The evaluation procedure hierarchy is currently classified under *Procedure by method*, with many immediate children.

- Procedure by method (procedure)
 - Evaluation procedure (procedure); some children include:
 - Imaging (procedure)
 - Measurement procedure (procedure)
 - Physical examination assessment (procedure)

Evaluation procedures can be defined by Method = evaluation - action (qualifier value).

Subtypes of Evaluation-action (qualifier value) include:

- Examination - action (qualifier value)
- Imaging - action (qualifier value)
- Measurement - action (qualifier value)
- Monitoring - action (qualifier value)
- Spectroscopy - action (qualifier value)

New concepts

150 physiological measurement observable entity concepts including body temperature, respiratory rate, heart rate, and blood pressure are available and have been modeled.

Inactivated

Vital sign (observable entity) is inactivated.

2.4.5.3.3 Observable Entity and Microbiology Test Results

When microbiology laboratory results are encoded, it is important to be aware of the context provided by the observation, i.e. the test performed and, therefore, the implied meaning of the result value, i.e. the organism.

For example, the combination of *Logical Observation Identifiers Names and Codes (LOINC)* for the lab test and *SNOMED CT* for the organism, provides a unique and specific meaning:

- LOINC provides microbiology reporting codes with attributes including the *property* through the use of *PRID* (presence or identity) and the *scale* through the use of *NOM* (nominal or categorical response that does not have a natural ordering) as the result value (typically the name of organism).
- Use of organism concepts in combination with such LOINC codes implies that a specific organism is seen, detected, identified, isolated, or present.

Organism

On its own, an organism concept can only indicate the definition of that organism. Its detection or presence can only be implied when it is paired with other information that may come from the electronic health application and/or from the LOINC observation.

Organism X or organism Y

Use organism X or organism Y when a laboratory report indicates a single isolate is assumed, but the lab is unable (for any reason) to differentiate the result instance.

For example,

- 703015006 |Human coxsackievirus or human echovirus (finding)|

Organism X, not organism Y

Use organism X, not organism Y when a laboratory report indicates a class of organisms described by the exclusion of specific Linnaean or non-Linnaean classes. These concepts are found in the organism hierarchy (to avoid limitless combinations). They are a primitive super class, in between the species or species subtype.

For example,

- 115407004 |Haemophilus influenzae, not b (organism)|

Genus X, not species Y and not species Z

Use Genus X, not species Y and not species Z when a laboratory report indicates a species of Genus X and confirms that it is not species Y, nor species Z. E.g. Bacillus species, not Bacillus anthracis and not Bacillus cereus (organism).


Use this naming convention only with Genus, species, and subspecies levels of the hierarchy.

Untypable organisms

Laboratory reports and journal articles may include an organism that could not be serotyped, e.g. *E. coli*, *untypable*. The requests for such concepts are declined due to ambiguity. Instead, use the closest taxonomic level in the hierarchy.

Presumptive values

Laboratory findings may be reported with a status of preliminary, presumptive, provisional, or etc. These typically cover reportable or notifiable lab values. The status of a report is different from the result; it is part of the electronic health application model/message. The requests for such concepts are declined as they are ambiguous and subject to limitless combinations.

 Existing concepts with presumptive values are undergoing review for inactivation.

Mixed Organism

Some laboratories report findings indicating a mixed population of bacteria from several classes, e.g. *mixed anaerobic Gram negative bacilli*. The request for such a concept is added as a *clinical finding*. The actual organism is unknown, however there is a result, although more general.

Reporting Negative and Positive Results

Laboratories perform and report on specific tests to identify the absence, as well as the presence, of a particular pathogenic organism. Laboratories typically report negative result values, such as *X not seen*, *X not detected*, *X not isolated*, and *no X seen (or identified or isolated)* and positive results as *X seen*, *X detected*, and *X isolated*. The following tables includes the acceptable modeling for negative and positive results.

Microbiology Tests: Negative and Positive Values	
Lab test	Value
General culture (scale = nominal)	<i>No X isolated</i> (finding) <i>X</i> (organism)
Specific culture	<i>Not isolated</i> (qualifier value) <i>Isolated</i> (qualifier value)
General microscopic testing (Scale = Nominal)	<i>No X seen</i> (finding) <i>X</i> (organism)
Specific microscopic testing	<i>Not seen</i> (qualifier value) <i>Present</i> (qualifier value)
Serologic, DNA or other organism specific test	<i>Not detected</i> (qualifier value) <i>Detected</i> (qualifier value) Rationale: Almost all of these tests are organism-specific

Microbiology Tests: Examples of Negative and Positive Values		
Test Category	Lab observation (lab test) LOINC	Result values (lab result) SNOMED CT

Microbiology Tests: Examples of Negative and Positive Values		
General culture	11475-1 - Microorganism <i>X</i> Culture (where <i>X</i> represents no specific system/specimen is part of the concept)	Valid value 168204005 Salmonella not isolated (finding) 27268008 Genus Salmonella (organism) Invalid value Not isolated Isolated
Organism-specific culture	48741-3 Bordetella pertussis; Nasopharynx; Culture	Valid value 264887000 Not isolated (qualifier value) 46651001 Isolated (qualifier value) Invalid value Bordetella pertussis not isolated Bordetella pertussis isolated
	10635-1 - Acanthamoeba Eye Culture	Valid value 264887000 Not isolated (qualifier value) 46651001 Isolated (qualifier value) Invalid value No Acanthamoeba isolated Acanthamoeba isolated
Specific microscopic testing	14369-3 - Yeast Cervix QI Wet Prep	Valid value 47492008 Not seen (qualifier value) 52101004 Present (qualifier value) Invalid value No yeast seen Yeast seen
Serologic and DNA testing	35727-7 - Chlamydia species DNA; Urethra; PCR/NAAT	Valid value 260415000 Not detected (qualifier value) 260373001 Detected (qualifier value) Invalid value No Chlamydia detected Chlamydia detected

2.4.5.3.4 Relationship between Observable Entities and NPU codes

Nomenclature, Properties, and Units (NPU) is a coding system and terminology for identification and communication of examination results from clinical laboratories. Please see their website for more information: <http://www.npu-terminology.org/>.

Logically there is a relationship between NPU and *SNOMED CT* observable entities. A pilot project examined overlaps and possible alignment; further work may be done. However, there is no formally maintained *SNOMED CT* documentation on this alignment.

2.4.5.3.5 Representing LOINC Terms with the SNOMED CT Observable Entity Model

Logical Observation Identifiers Names and Codes (LOINC) terms are defined using the Observable Entity model in *SNOMED CT* as produced in the LOINC - SNOMED CT Cooperation Project releases.

The project release documentation contains information about how LOINC terms and parts are aligned with *SNOMED CT* concepts using the model.



For more information

[SNOMED CT July 2017 LOINC - SNOMED CT Cooperative package Production release - RF2 Release notes](#)

2.4.6 Organism*

Definition	Examples
Organisms of significance to human medicine	<ul style="list-style-type: none"> 3265006 Genus Candida (organism) 710877000 Beta lactam resistant bacteria (organism)



Organism concepts

Organism concepts are used:

- In modeling cause of disease
- To document the cause of reportable or notifiable diseases
- In evidence-based infectious disease protocols, e.g. in clinical decision-support systems

Qualifiers in organism names



Intrinsic qualifiers

If a qualifier is an intrinsic part of an organism, it belongs in the organism hierarchy and is modeled accordingly (when finalized by the Organism Project Group). *Intrinsic* should be interpreted as a characteristic that is inherent in the organism (e.g. Gram-positive), as opposed to a context-dependent characteristic (e.g. some uses of *intracellular*).

When modeling organisms with qualifiers, the qualifier should be placed in front of the organism name.

Morphology qualifiers

For example, a non-Linnaean class of bacteria described by morphology

- 8745002 |Gram-positive bacterium (organism)|

Physiology qualifiers

For example, a non-Linnaean class of bacteria described by physiology

- 417454003 |Non-motile Salmonella (organism)|

Resistance / susceptibility qualifiers

For example, A non-Linnaean class of bacteria described by antimicrobial susceptibility

- 712662001 |Carbapenem resistant Enterobacteriaceae (organism)|

✓ Modeling with qualifiers

Use the antimicrobial agent, not the enzyme.

For example,

- Carbapenem resistant enterobacteriaceae, not carbapememase producing enterobacteriaceae

Organisms with resistance-type qualifiers, i.e where the qualifiers refer to the resistance phenotype and the organisms are defined by the mechanism underlying the resistance phenotype, appear in the literature and are sometimes used interchangeably. However, in creating new concepts, these terms should be distinguished as they are separate concepts.

For example,

- *Carbapenem resistant enterobacteriaceae* and *carbapenemase-producing enterobacteriaceae* share a significant overlap, but the former refers to the resistance phenotype, regardless of the mechanism of resistance. The presence of gene and carbapememase production, as a resistance mechanism, usually results in clinically relevant levels of carbapenem resistance. However, it is possible to have only reduced susceptibility.

Validity

The number of qualifiers that might be valid (e.g. aerobic microaerophilic, motile curved gram-negative bacteria) is:

- Determined on a case-by-case basis
- Highly dependent on fitting in with the model limitations (as determined by the *Organism Project Group*)
- Based on *Bergey's Manual of Systematic Bacteriology* as the primary reference

When requesting a new qualifier, an acceptable reference must be provided. Concepts with valid qualifiers are added to the International Release and assigned a parent.

Organism groupings

Only authoritative taxonomic groupings are added to the *SNOMED CT* International Release.

- When requesting new organism concepts, authoritative references must be provided.
- Acceptance is determined on a case-by-case basis by authors.
- These concepts may evolve over time as the names evolve.

Complex or Group

The terms *complex* and *group* are often used in scientific papers. Laboratories may use these terms in their local descriptions. However, the terms used in scientific papers may not be from authoritative taxonomic groupings. Instead they may be terms used to group sets of organisms for ease of publication (Authoritative taxonomic grouping terms, however, are usually used).

As the sophistication of microbiology laboratories increases, the organisms in some groups may change or even become obsolete (This has occurred with some of the Centers for Disease Control and Prevention - CDC groups).

Existing *complex* or *group* concepts, with grouper concepts separate from the genus, but with the same meaning as the genus, will be inactivated in the *SNOMED CT* International Release.

Descriptions with *group* or *complex* as synonyms of the genus, will be deprecated from the *SNOMED CT* International Release (The genus concept should be used for these concepts).

Biotype, Serotype, Serogroup

- Requests for new concepts are evaluated on a case-by-case basis.
- It is important to understand the meaning from the requestor and determine how it can be modeled.
- These concepts may evolve over time as the names evolve.

Multidrug-resistant, extensively drug-resistant, pan drug-resistant bacteria

DRAFT UNDER REVIEW: CONTENT TO BE FINALIZED

SNOMED International adopted the recommendations of a joint initiative of the European Centre for Disease Prevention and Control (ECDC) and the CDC for the characterization of the different patterns of resistance found in healthcare-associated, antimicrobial resistant bacteria. A panel of international experts convened and drafted a proposal which provides clear consensus definitions. Please refer to the following article for details: Magiorakos, A. Srinivasan, A. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. *Clinical Microbiol Infect* 2012; 18: 268-281.

2.4.6.1 Organism Naming Conventions

Fully Specified Name

The fully specified name (FSN) of organism concept has classes that are officially recognized Linnaean taxonomic classes (other than species), and include a designation of *rank*. They include, but are not limited to Phylum, Order, Suborder, Class, Family, Genus, and subspecies.

Properly constructed FSN descriptions have single word terms indicating the taxonomic rank + the recognized name of that rank + hierarchy designator.

For example,

- 106544002 |Family Enterobacteriaceae (organism)|

 The naming convention is not applied to concepts that only refer to a rank.

For example,

- 113727004 |Vancomycin resistant enterococcus (organism)| is correct. It refers to a subclass of the genus, Enterococcus species that are resistant.

Incorrect example,

- *Vancomycin resistant Genus Enterococcus* is incorrect. It refers to the rank only, Genus Enterococcus.

Organism subspecies descriptions

FSN descriptions of organism subspecies should use the word *subspecies* and not an abbreviation of same.

For example,

- 440815004 |Staphylococcus succinus subspecies casei (organism)|

Organism class variants

FSNs of organism classes that are variants (of their superclass) may include the terms *variant*, *biovar*, *serovar*, and *pathovar*.

For example,

- 698206009 |Brucella suis biovar 4 (organism)|

Other abbreviations (*var*, *var.*, *sv*, *sv.*, *bv*, *bv.*, *pv*, *pv.*) should not be used in the FSN.

Allowable abbreviations

Descriptions with abbreviations as part of their official names, should include one synonym that is the official name with the appropriate abbreviation.

For example,

- A synonym for 398620001 |Salmonella enterica subsp. indica (organism)| is Salmonella enterica subsp. indica

Official names of subspecies in the *Superkingdom bacteria* include the abbreviation *subsp.* The list of synonyms for subspecies should include one description that is the official name of the class.

For example,

- 416266002 |Aeromonas salmonicida subsp. pectinolytica (organism)|

Binomial format

The binomial format for an organism species includes capitalizing the genus name and beginning the species name with a lower case letter.

For example,

- 24224000 |Brucella abortus (organism)|

Salmonella serotype nomenclature

Salmonella serotypes have a quadrinomial format of Genus species subspecies Serotype where the serotype name is capitalized.

For example,

- A synonym for 114683003 |Salmonella Doel (organism)| is Salmonella enterica subsp. enterica ser. Doel

Additional descriptions, without the species and subspecies names, are in common usage for *Salmonella* serotypes.

For example,

- 656008 |[Salmonella Os \(organism\)](#)|

In *SNOMED CT*, the serotype name in the description should be capitalized.

Salmonella Serotypes

Salmonella serotypes, without the species and subspecies names, should not be confused with binomial species names of other organisms.

Streptococcus pneumoniae

Streptococcus pneumoniae is a human pathogen whose virulence is based on its protective polysaccharide capsule. Study of the polysaccharide capsule has identified multiple serogroups and serotypes. Serotypes are defined by the chemical structure and immunologic properties of their polysaccharide; each serogroup contains one or more serotypes that elicit the same antibody response.

There are two serotype naming systems, one in the U.S. and one in Denmark. The Danish system is nearly universally accepted and preferred. For details, please refer to See Geno K A, Gilbert G L, Song J Y, Skovsted I C, Klugman K P, Jones C, Konradsen H B, Nahm M H. Pneumococcal capsules and their types: past, present, and future. *Clinical Microbiology Reviews* 2015; 28(3):871-899. [PMID: 26085553]).

Streptococcus pneumoniae concepts

A review of *Streptococcus pneumoniae* serotypes in *SNOMED CT* showed lack of specificity, as well as inconsistency, in the naming of *Streptococcus pneumoniae* serotypes. Guidelines for creating concepts containing *Streptococcus pneumoniae* serotypes were formulated. They are as follows:

FSN and preferred term (PT) descriptions should follow the Danish naming system. When an American synonym exists, it should be added. A synonym (SYN) that matches the FSN, but does not contain the naming system can also be added.

For example,

- 698149000 |[Streptococcus pneumoniae serotype 48 \(organism\)](#)| is renamed as follows:
 - FSN: *Streptococcus pneumoniae* Danish serotype 48 (organism)
 - PT: *Streptococcus pneumoniae* Danish serotype 48
 - SYN: *Streptococcus pneumoniae* American serotype 82
 - SYN: *Streptococcus pneumoniae* serotype 48

The guidelines for creating new concepts containing *Streptococcus pneumoniae* serotypes also apply to concepts in other *SNOMED CT* hierarchies, such substances and procedures.

For example,

- 120683007 |[Streptococcus pneumoniae serotype 7F antibody \(substance\)](#)| is renamed as follows:
 - FSN: Antibody to *Streptococcus pneumoniae* Danish serotype 7F (substance)
 - PT: *Streptococcus pneumoniae* Danish serotype 7F Ab
 - SYN: Antibody to *Streptococcus pneumoniae* Danish serotype 7F
 - SYN: Anti-*Streptococcus pneumoniae* Danish serotype 7F antibody
 - SYN: *Streptococcus pneumoniae* Danish serotype 7F antibody
 - SYN: Antibody to *Streptococcus pneumoniae* American serotype 51

Legacy Streptococcus pneumoniae concepts

- FSNs that adhered to one of the naming systems were kept, but changes were made to the descriptions, based on the above guidelines. Any resulting duplicates were deprecated.

- FSNs that did not adhere to one of the naming system were inactivated as ambiguous. They were replaced with newly created concepts, based on the above guidelines.
- Missing serotype concepts were added.

US/GB spelling variants for taxonomic concepts

Taxonomic resources (e.g. Integrated Taxonomic Information System or ITIS, List of Prokaryotic names with Standing in Nomenclature or LPSN) use the official scientific name for organisms. Similarly, in *SNOMED CT*, the official scientific name should be used in FSNs and PTs. If the preferred spelling in a country or region is not the official scientific name, the preferred name should be added in the language RefSet extension.

Use of X species

In the context of the Linnaean organism hierarchy, there is no difference between *Salmonella species* and simply *Salmonella*, the genus. Terms with *X species*, such as Salmonella species, are routinely used in laboratory reporting. They may provide additional information, other than the place of the organism in the Linnaean hierarchy. However, the intended connotation may vary from lab to lab and from organism to organism. Since the organism concept represents a class of organisms, it cannot also represent what was, was not, or what will be done to identify the organism. Neither can it represent other information about the result. If there is additional information to report, it should be in a separate statement or comment (e.g. *further species identification pending or sent to reference laboratory for further identification or further identification to be done if clinically indicated*).

Microorganism name changes

Microorganism taxonomic names may change, often due to scientific advances. This may result in:

1. Finding an organism in a particular taxonomic group (e.g. Genus) that is unrelated, on a molecular basis, to other members of the group.
2. Reassessing the taxonomic group originally established, based on phenotypic characteristics.
3. Proposing to reassign the organism to a different existing or new taxonomic group.

If the name of an organism changes, *SNOMED CT*'s goal is to use the current name (**for the organism concept and all other concepts such as findings, procedures, and disorders that reference the organism name**), while preserving the old name/s. This is done on a case-by-case basis. Requests for name changes are based on the following use cases:

- The name of one organism changes: change the FSN for affected concepts, but not the concept ID, and retain the old name as a synonym:
 - The original FSN description and its description ID are made *inactive* (OLD description FSN)
 - A new FSN and description ID are created and made *active* (New description FSN)
 - A new synonym and description ID are created and made *active* (New description)
- A single species is reclassified as multiple species: inactivate the original concept as *ambiguous*, create new required concepts, and set a *may be* relationship between the old concept and the new ones.
- Multiple species are reclassified as one: create a new concept and inactivate the existing ones with a *replaced by* relationship to the new one.

Organism life stages

Concepts in the organism hierarchy represent *fully realized* organisms. An organism's *life cycle stage* is a characteristic of a given taxon. It represents different stages of life e.g. egg, larva, and adult.

SNOMED CT allows for the representation of an organism in a specific life cycle stage.

For example, ,

- 337915000 |Homo sapiens (organism)| are organisms. Homo sapiens include humans, in general, as well as children. Childhood is a *life cycle stage*, however it is not an organism.

- Eggs of the nematode, 42625000 |Strongyloides stercoralis (organism)| are organisms. They are living and can change to other life stages appropriate to the species. However, the *egg stage* of Strongyloides stercoralis is not an organism.

Diagnostic test results may identify a particular life stage of an organism.

For example, the results of a 83033005 |Fecal analysis (procedure)| may identify the presence of 609326000 |Larva of Strongyloides stercoralis (organism)| and 699572004 |Egg of Strongyloides stercoralis (organism)|.

Organism concepts

Concepts in the organism hierarchy should not represent organism *structures* (e.g. fungal hyphae) or *stages* in the life cycle of the organism (e.g. larval stage of a nematode parasite).

Naming patterns

FSN pattern: (Life cycle stage) of (Taxon including rank, if required) (organism)

For example,

- 609043009 |Adult of phylum Nemata (organism)|
- 699572004 |Egg of Strongyloides stercoralis (organism)|

The name of the rank is included with the first letter lower case, except at the species and subspecies levels, where the Linnaean binomial and trinomial are specified.

PT pattern: (Taxon including rank, if required) (organism)

For example,

- Adult of phylum Nemata (organism)
- Egg of Strongyloides stercoralis (organism)

Cestode larvae

A number of *cestode larvae* use Linnaean binomial names that are completely different from adult (or egg) names.

For example,

- 47399003 |Larva of Taenia saginata (organism)|, a human tapeworm, is usually called *Cysticercus bovis*.

PT pattern: Linnaean binomial of larva OR (Taxon, including rank, if required) (organism)

For example,

- Larva of Taenia saginata (organism)
- Larva of Taenia solium (organism)
- Larva of class Cestoda (organism)

Although rare, a subtype of cestode larva may appear to be a Linnaean trinomial name. This, then, is the PT.

For example,

- Plerocercoid larva of Diphyllbothrium latum (organism)

Synonyms

An organism, or organism stage, may be in *adjectival* form (e.g. Ascarid egg) or referred to by common name (e.g. adult nematode). These terms may be included as additional synonyms, especially when included as part of a request).

Resources for organism naming

SNOMED International utilizes various resources when reviewing changes to the organism hierarchy. They include:

Bacteria

- List of Prokaryotic names with Standing in Nomenclature (LPSN)
- International Committee on Systematics of Prokaryotes (ICSP)
- International Journal of Systematic and Evolutionary Microbiology
- DSMZ-Prokaryotic Nomenclature Up-to-date

Fungi

- MycoBank Database
- Index Fungorum

Viruses

- International Committee on Taxonomy of Viruses (ICTV)

Parasites

- National Center for Biotechnology Information (NCBI) Taxonomy (Although not an authoritative source, provides useful links to other sources; used by Unified Medical Language System (UMLS) as a QA source)

General

- Integrated Taxonomic Information System (ITIS) (Covers a limited number of organisms)

2.4.7 Pharmaceutical/Biologic Product

Definition	Examples
A top-level hierarchy to clearly distinguish drug products (products) from their chemical constituents (substances)	<ul style="list-style-type: none"> • 85591001 Product containing timolol (medicinal product) • 713746008 Product containing amikacin in parenteral dosage form (medicinal product form) • 317222006 Product containing only cimetidine 200 mg/1 each oral tablet (clinical drug)

Proprietary

Proprietary is a regulatory state and not appropriate for inclusion in the International Release.

The Pharmaceutical / biologic product hierarchy is separate from the Substance hierarchy. It contains concepts that represent multiple levels of granularity including:

Medicinal Product (MP). An abstract representation of the intended *active ingredient* for a drug product. It implies that the drug product non-exclusively contains the intended active ingredient specified in the FSN, but may also contain other intended active ingredients.

Medicinal Product Form (MPF). An abstract representation of the *active ingredient and dose form* for a drug product. It implies that the drug product non-exclusively contains the active ingredient specified in the FSN, but may also contain other active ingredients.

Clinical Drug (CD). An abstract representation of the intended *active ingredient, (basis of strength substance (BoSS), strength, and manufactured dose form* of a drug product. It implies that the drug product non-exclusively contains the intended active ingredient and BoSS specified in the FSN, but may also contain other active ingredients.

Pharmaceutical / biologic product hierarchy

There are frequent iterations of the editorial guidelines for the Pharmaceutical / biologic product hierarchy with the opportunity for review and comment. Announcements, that include links to the current iteration and deadlines for submission of comments, can be found on the project Confluence site, Drug Model Working Group - Directory.

2.4.7.1 Pharmaceutical/Biologic Product Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 373873005 Pharmaceutical / biologic product (product)	
Domain Constraint	<< 373873005 Pharmaceutical / biologic product (product)
Parent Domain	-
Proximal Primitive Constraint	<< 373873005 Pharmaceutical / biologic product (product)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 373873005 Pharmaceutical / biologic product (product)					
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint	
127489000 Has active ingredient (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)	
411116001 Has manufactured dose form (attribute)	0	0..1	0..0	<< 736542009 Pharmaceutical dose form (dose form)	[Opt]
732943007 Has basis of strength substance (attribute)	1	0..*	0..1	< 105590001 Substance (substance)	
732944001 Has presentation strength numerator value (attribute)	1	0..*	0..1	< 260299005 Number (qualifier value)	
732945000 Has presentation strength numerator unit (attribute)	1	0..*	0..1	< 767524001 Unit of measure (qualifier value)	
732946004 Has presentation strength denominator value (attribute)	1	0..*	0..1	< 260299005 Number (qualifier value)	
732947008 Has presentation strength denominator unit (attribute)	1	0..*	0..1	< 767524001 Unit of measure (qualifier value)	
733722007 Has concentration strength denominator unit (attribute)	1	0..*	0..1	< 767524001 Unit of measure (qualifier value)	
733723002 Has concentration strength denominator value (attribute)	1	0..*	0..1	< 260299005 Number (qualifier value)	
733724008 Has concentration strength numerator value (attribute)	1	0..*	0..1	< 260299005 Number (qualifier value)	
733725009 Has concentration strength numerator unit (attribute)	1	0..*	0..1	< 767524001 Unit of measure (qualifier value)	
762949000 Has precise active ingredient (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)	
762951001 Has ingredient (attribute)	-				
763032000 Has unit of presentation (attribute)	0	0..1	0..0	<< 732935002 Unit of presentation (unit of presentation)	

766939001 Plays role (attribute)	0	0..*	0..0	<< 766940004 Role (role)
766952006 Count of base of active ingredient (attribute)	0	0..1	0..0	< 260299005 Number (qualifier value)
766953001 Count of active ingredient (attribute)	0	0..1	0..0	< 260299005 Number (qualifier value)
766954007 Count of base and modification pair (attribute)	0	0..1	0..0	< 260299005 Number (qualifier value)

2.4.7.2 Pharmaceutical/Biologic Product Defining Attributes

Editorial guidelines draft

Editorial guidelines are in development for the Pharmaceutical/Biologic Product hierarchy. Each hierarchy is comprised of multiple smaller hierarchies, e.g. the Medicinal product hierarchy.

The current Pharmaceutical/Biologic Product editorial guidelines draft is located on the Drug Model Working Group's Confluence space, section *Review versions and issue logs of Editorial Guides and Core documentation* at: <https://confluence.ihtsdotools.org/display/IAP/Drug+Model+Working+Group+-+Directory>

The following defining attributes correspond to the *Pharmaceutical or Biologic Product Attributes Summary* table. They are part of the guideline development, thus the information is incomplete.

Has active ingredient

This attribute indicates the relevant part or whole of the substance that is intended to have a therapeutic action on or within the body (It excludes esters, salts, or other non-covalent derivatives, but may include secondary modifications).

Has manufactured dose form

This attribute specifies the manufactured dose form of a product.

Has basis of strength substance (BoSS)

This attribute represents an ingredient, that is the part of the active ingredient, upon which the strength of a given product is based.

Has presentation strength numerator value

This attribute specifies the numerator value of a product strength.

Has presentation strength numerator unit

This attribute specifies the numerator unit of a product strength.

Has presentation strength denominator value

This attribute specifies the denominator value of a product strength.

Has presentation strength denominator unit

This attribute specifies the denominator unit of a product strength.

Has concentration strength denominator unit

This attribute specifies the denominator unit of a product concentration strength (amount of the BoSS per unit of presentation, i.e. volume, mass).

Has concentration strength denominator value

This attribute specifies the denominator value of a product concentration strength (amount of the BoSS per unit of presentation, i.e. volume, mass).

Has concentrations strength numerator value

This attribute specifies the numerator value of a product concentration strength (amount of the BoSS per unit of presentation, i.e. volume, mass).

Has concentration strength numerator unit

This attribute specifies the numerator unit of a product concentration strength (amount of the BoSS per unit presentation, i.e. volume, mass).

Has precise active ingredient

This attribute indicates the most specific description of a substance present in the manufactured dose form, before any dilution or transformation. It includes modifiers, such as salts, esters, polymers, and/or solvates.

Has ingredient

Has unit of presentation

Plays role

Count of base active ingredient

Count of active ingredient

Count of base and modification pair

2.4.8 Physical Force*

Definition	Examples
Forces applied to the body that may cause injury	<ul style="list-style-type: none"> 87588000 High altitude (physical force) 263762005 Friction (physical force)

Physical Force

The concepts in the *Physical force* hierarchy primarily represent physical forces that may play a role in injuries.

2.4.9 Physical Object*

Definition	Examples
Physical devices relevant to health care, or to injuries/accidents	<ul style="list-style-type: none"> 469785004 Heel protector (physical object) 40388003 Implant, device (physical object)

Physical Object

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

2.4.10 Procedure

Definition	Examples
<ul style="list-style-type: none"> Procedure: activities performed in the provision of health care (includes medical history-taking, physical examination, diagnostic and therapeutic interventions, training and education, and counseling) Regime/therapy (subtype of procedure): set of procedures focused on a single purpose on one patient over time (e.g. repeated administration of drug in a small dose for an indefinite period of time) 	<ul style="list-style-type: none"> 54321008 Cardiac flow imaging (procedure) 386513007 Anesthesia management (regime/therapy)

Procedure concepts

Procedure concepts represent activities performed in the provision of health care. This *hierarchy* represents a broad variety of activities, including but not limited to:

- Invasive procedures, e.g. 77018005 |Excision of lesion of intracranial artery (procedure)|
- Administration of medicines, e.g. 39343008 |Pertussis vaccination (procedure)|
- Imaging procedures, e.g. 47079000 |Ultrasonography of breast (procedure)|
- Education procedures, e.g. 183063000 |Low salt diet education (procedure)|
- Administrative procedures, e.g. 305212007 |Medical records transfer (procedure)|

2.4.10.1 Procedure Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM). In addition, Evaluation, Surgical, and Administration of Substance via Specific Route procedures each have unique defining attributes.

Domain Information for 71388002 Procedure (procedure)	
Domain Constraint	<< 71388002 Procedure (procedure)
Parent Domain	-
Proximal Primitive Constraint	<< 71388002 Procedure (procedure)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 71388002 Procedure (procedure)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
246513007 Revision status (attribute)	1	0..*	0..1	<< 261424001 Primary operation (qualifier value) OR << 255231005 Revision - value (qualifier value) OR << 257958009 Part of multistage procedure (qualifier value)
260507000 Access (attribute)	1	0..*	0..1	<< 309795001 Surgical access values (qualifier value)
260686004 Method (attribute)	1	0..*	0..1	<< 129264002 Action (qualifier value)
260870009 Priority (attribute)	1	0..*	0..1	<< 272125009 Priorities (qualifier value)
363699004 Direct device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)

363700003 Direct morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363701004 Direct substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance) OR << 373873005 Pharmaceutical / biologic product (product)
363702006 Has focus (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)
363703001 Has intent (attribute)	1	0..*	0..1	<< 363675004 Intents (nature of procedure values) (qualifier value)
363704007 Procedure site (attribute)	1	0..*	0..*	<< 442083009 Anatomical or acquired body structure (body structure)
363709002 Indirect morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363710007 Indirect device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
370131001 Recipient category (attribute)	1	0..*	0..1	<< 125676002 Person (person) OR << 35359004 Family (social concept) OR << 133928008 Community (social concept) OR << 105455006 Donor for medical or surgical procedure (person) OR << 389109008 Group (social concept)
405813007 Procedure site - Direct (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405814001 Procedure site - Indirect (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405815000 Procedure device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
405816004 Procedure morphology (attribute)	1	0..*	0..*	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
424226004 Using device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
424244007 Using energy (attribute)	1	0..*	0..1	<< 78621006 Physical force (physical force)
424361007 Using substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)
425391005 Using access device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)

Domain Information for 386053000 Evaluation procedure (procedure)	
Domain Constraint	<< 386053000 Evaluation procedure (procedure)
Parent Domain	71388002 Procedure (procedure)
Proximal Primitive Constraint	<< 71388002 Procedure (procedure)
Proximal Primitive Refinement	[[1..*]] 260686004 Method = [+id(<< 129265001 Evaluation - action)]]

Author View of Attributes and Ranges for 386053000 Evaluation procedure (procedure)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
116686009 Has specimen (attribute)	1	0..*	0..1	<< 123038009 Specimen (specimen)

246093002	Component (attribute)	1	0..*	0..1	<< 123037004 Body structure (body structure) OR << 410607006 Organism (organism) OR << 105590001 Substance (substance) OR << 123038009 Specimen (specimen) OR << 260787004 Physical object (physical object) OR << 373873005 Pharmaceutical / biologic product (product) OR << 419891008 Record artifact (record artifact)
246513007	Revision status (attribute)	1	0..*	0..1	<< 261424001 Primary operation (qualifier value) OR << 255231005 Revision - value (qualifier value) OR << 257958009 Part of multistage procedure (qualifier value)
260507000	Access (attribute)	1	0..*	0..1	<< 309795001 Surgical access values (qualifier value)
260686004	Method (attribute)	1	0..*	0..1	<< 129264002 Action (qualifier value)
260870009	Priority (attribute)	1	0..*	0..1	<< 272125009 Priorities (qualifier value)
363699004	Direct device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
363700003	Direct morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363701004	Direct substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance) OR << 373873005 Pharmaceutical / biologic product (product)
363702006	Has focus (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)
363703001	Has intent (attribute)	1	0..*	0..1	<< 363675004 Intents (nature of procedure values) (qualifier value)
363704007	Procedure site (attribute)	1	0..*	0..*	<< 442083009 Anatomical or acquired body structure (body structure)
363709002	Indirect morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363710007	Indirect device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
370129005	Measurement method (attribute)	1	0..*	0..1	<< 127789004 Laboratory procedure categorized by method (procedure)
370130000	Property (attribute)	1	0..1	0..1	<< 118598001 Property of measurement (qualifier value)
370131001	Recipient category (attribute)	1	0..*	0..1	<< 125676002 Person (person) OR << 35359004 Family (social concept) OR << 133928008 Community (social concept) OR << 105455006 Donor for medical or surgical procedure (person) OR << 389109008 Group (social concept)
370132008	Scale type (attribute)	1	0..1	0..1	<< 30766002 Quantitative OR << 26716007 Qualitative OR << 117363000 Ordinal value OR << 117365007 Ordinal or quantitative value OR << 117362005 Nominal value OR << 117364006 Narrative value OR << 117444000 Text value
370134009	Time aspect (attribute)	1	0..1	0..1	<< 7389001 Time frame (qualifier value)
405813007	Procedure site - Direct (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405814001	Procedure site - Indirect (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405815000	Procedure device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)

405816004 Procedure morphology (attribute)	1	0..*	0..*	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
424226004 Using device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
424244007 Using energy (attribute)	1	0..*	0..1	<< 78621006 Physical force (physical force)
424361007 Using substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)
425391005 Using access device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)

Domain Information for 387713003 Surgical procedure (procedure)	
Domain Constraint	<< 387713003 Surgical procedure (procedure)
Parent Domain	71388002 Procedure (procedure)
Proximal Primitive Constraint	<< 71388002 Procedure (procedure)
Proximal Primitive Refinement	[[1..*]] 260686004 Method = [[+id(<< 129284003 Surgical action (qualifier value))]]

Author View of Attributes and Ranges for 387713003 Surgical procedure (procedure)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
246513007 Revision status (attribute)	1	0..*	0..1	<< 261424001 Primary operation (qualifier value) OR << 255231005 Revision - value (qualifier value) OR << 257958009 Part of multistage procedure (qualifier value)
260507000 Access (attribute)	1	0..*	0..1	<< 309795001 Surgical access values (qualifier value)
260686004 Method (attribute)	1	0..*	0..1	<< 129264002 Action (qualifier value)
260870009 Priority (attribute)	1	0..*	0..1	<< 272125009 Priorities (qualifier value)
363699004 Direct device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
363700003 Direct morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363701004 Direct substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance) OR << 373873005 Pharmaceutical / biologic product (product)
363702006 Has focus (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)
363703001 Has intent (attribute)	1	0..*	0..1	<< 363675004 Intents (nature of procedure values) (qualifier value)
363704007 Procedure site (attribute)	1	0..*	0..*	<< 442083009 Anatomical or acquired body structure (body structure)
363709002 Indirect morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363710007 Indirect device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)

370131001 Recipient category (attribute)	1	0..*	0..1	<< 125676002 Person (person) OR << 35359004 Family (social concept) OR << 133928008 Community (social concept) OR << 105455006 Donor for medical or surgical procedure (person) OR << 389109008 Group (social concept)
405813007 Procedure site - Direct (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405814001 Procedure site - Indirect (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405815000 Procedure device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
405816004 Procedure morphology (attribute)	1	0..*	0..*	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
424226004 Using device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
424244007 Using energy (attribute)	1	0..*	0..1	<< 78621006 Physical force (physical force)
424361007 Using substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)
424876005 Surgical approach (attribute)	1	0..*	0..1	<< 103379005 Procedural approach (qualifier value)
425391005 Using access device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)

Domain Information for 433590000 Administration of substance via specific route (procedure)	
Domain Constraint	<< 433590000 Administration of substance via specific route (procedure)
Parent Domain	71388002 Procedure (procedure)
Proximal Primitive Constraint	<< 433590000 Administration of substance via specific route (procedure)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 433590000 Administration of substance via specific route (procedure)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
246513007 Revision status (attribute)	1	0..*	0..1	<< 261424001 Primary operation (qualifier value) OR << 255231005 Revision - value (qualifier value) OR << 257958009 Part of multistage procedure (qualifier value)
260507000 Access (attribute)	1	0..*	0..1	<< 309795001 Surgical access values (qualifier value)
260686004 Method (attribute)	1	0..*	0..1	<< 129264002 Action (qualifier value)
260870009 Priority (attribute)	1	0..*	0..1	<< 272125009 Priorities (qualifier value)
363699004 Direct device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
363700003 Direct morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363701004 Direct substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance) OR << 373873005 Pharmaceutical / biologic product (product)
363702006 Has focus (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 71388002 Procedure (procedure)

363703001 Has intent (attribute)	1	0..*	0..1	<< 363675004 Intents (nature of procedure values) (qualifier value)
363704007 Procedure site (attribute)	1	0..*	0..*	<< 442083009 Anatomical or acquired body structure (body structure)
363709002 Indirect morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
363710007 Indirect device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)
370131001 Recipient category (attribute)	1	0..*	0..1	<< 125676002 Person (person) OR << 35359004 Family (social concept) OR << 133928008 Community (social concept) OR << 105455006 Donor for medical or surgical procedure (person) OR << 389109008 Group (social concept)
405813007 Procedure site - Direct (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405814001 Procedure site - Indirect (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)
405815000 Procedure device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
405816004 Procedure morphology (attribute)	1	0..*	0..*	<< 49755003 Morphologically abnormal structure (morphologic abnormality)
410675002 Route of administration (attribute)	1	0..*	0..1	<< 284009009 Route of administration value (qualifier value)
424226004 Using device (attribute)	1	0..*	0..*	<< 49062001 Device (physical object)
424244007 Using energy (attribute)	1	0..*	0..1	<< 78621006 Physical force (physical force)
424361007 Using substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)
425391005 Using access device (attribute)	1	0..*	0..1	<< 49062001 Device (physical object)

2.4.10.2 Procedure Modeling

Procedure attribute hierarchies

SNOMED CT has attribute hierarchies for Procedure Site, Procedure Device, and Procedure Morphology. Each has two sub-attributes to represent the *direct* and *indirect objects*. *Procedure Device* also has more specific attributes, *Using Device* and *Using Access Device*.

Author View of Ranges for 363704007 |Procedure site (attribute)|

Range Constraint

<< 442083009 |Anatomical or acquired body structure (body structure)|

Author View of Ranges for 405815000 |Procedure device (attribute)|

Range Constraint

<< 49062001 |Device (physical object)|

Author View of Ranges for 405816004 |Procedure morphology (attribute)|

Range Constraint

<< 49755003 |Morphologically abnormal structure (morphologic abnormality)|

Method attribute

Procedures that have a *Method* attribute can be described using an *action verb* that corresponds to the method. The direct object/s of the action verb should be represented using one or more of the four direct object attributes, depending on whether the direct object on which the method acts is a:

- Anatomical structure: Procedure site - Direct
- Morphologic abnormality: Direct Morphology
- Device: Direct Device
- Substance: Direct Substance

If the body structure, device, or substance of the direct object is indeterminate, do not use the direct-object attributes.

Reason for procedure

The reason a procedure is ordered should not be precoordinated with the procedure, i.e. it should not constrain the reporting of results. The reason that a procedure is ordered, however, may influence the interpretation of the results, but not the way the procedure is performed.

Unacceptable example,

- Computed tomography angiography of chest with contrast for evaluation of pulmonary embolus (procedure)

Study

Procedures with the word *study* are unacceptable. They are ambiguous, as they imply context beyond the execution of the procedure.

Primary vs secondary procedures

The meaning of *primary* and *secondary*, when describing a procedure, is open to interpretation. Consequently, the concepts will be inactivated.

The interpretation of primary may be:

- Not ever done before at this site
- The first of multiple procedures, with two sub-meanings:
 - The first of planned multiple procedures, whether the plan is carried out or not
 - The first of multiple procedures that were not planned or foreseen, i.e. it is only the first of multiple procedures in retrospect

Examples of unacceptable descriptions,

- Primary anterior decompression of cervical spinal cord (procedure)
- Primary anterior excision of cervical intervertebral disc (procedure)
- Primary arthrodesis of interphalangeal joint of toe (procedure)
- Primary anterolateral excision of thoracic intervertebral disc (procedure)

2.4.10.2.1 Procedure Defining Attributes

The following defining attributes correspond to the *Procedure Attributes Summary* table from the HRCM.

Revision status

Revision Status refers to another procedure performed on the same site for the same condition. A procedure without a revision status is considered to be performed for the first time. A revision procedure can be modeled with a Revision status (attribute) of *revision - value (qualifier value)*.

For example,

- 128323000 |Revision of implant (procedure)| has Revision status, revision - value (qualifier value)

Access

Access describes the route used to access the site of a procedure. It distinguishes open, closed, and percutaneous procedures.

For example,

- 174572001 |Open removal of bile duct stent (procedure)|, has Open approach - access (qualifier value)

Method

Method represents the action being performed to accomplish the procedure. It does not include the surgical approach, e.g. translumbar, or equipment, e.g. sutures, or physical force, e.g. laser energy (see *Surgical Procedures Defining Attribute* page).

The Method is the anchor of each relationship group that defines a procedure. For two methods, there are two different relationship groups. Each relationship group is like a *sub-procedure* that defines the overall procedure. Each method has direct and indirect objects that are specified by the site, morphology, device, substance, or energy attributes that are grouped with it.

For example,

- 10255001 |Incision of ureter (procedure)| has Method, Incision - action (qualifier value)

When modeling procedures where the Method is *Removal - action* (qualifier value) or one of its subtypes, e.g. Excision, Surgical biopsy, etc., for *removal of*:

- Structures and Tissue lesions (e.g. cysts, tumors, etc. are considered removal of the site) use *Procedure site - Direct*
- Devices, calculi, thrombi, foreign bodies, and other non-tissue entities from the structure use *Procedure site - Indirect*

For example,

- 43748006 |Removal of urinary bladder catheter (procedure)| has Method, Removal - action (qualifier value) and Procedure site - Indirect, Bladder and outflow structure (body structure)

Method attribute

Attributes should be grouped with the Method attribute to which they apply. In the absence of a Method attribute, related attributes should be grouped together.

Exception,

- Recipient Category (see below). A single procedure concept should not be precoordinated when more than one Recipient Category is involved. Such complex statements should have two or more procedure concepts that are placed into an appropriately structured electronic health application.

Priority

Priority refers to the priority or importance assigned to a procedure.

For example,

- 708932005 |Emergency hemodialysis (procedure)| has Priority, Emergency (qualifier value)
- 177141003 |Elective cesarean section (procedure)| has Priority, Elective (qualifier value)

Direct device

Direct Device represents the device on which the method directly acts.

For example,

- 431698006 |Adjustment of gastric banding using fluoroscopic guidance (procedure)| has Direct device, Surgical band (physical object)

Direct morphology

Direct Morphology describes the morphologically abnormal structure that is the direct object of the Method action.

For example,

- 31512000 |Shaving of benign lesion with chemical cauterization (procedure)| has the Direct morphology, Lesion (morphologic abnormality)

Direct substance

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

For example,

- 428845007 |Intramedullary fixation with cementing of bone (procedure)| has Direct substance, Bone cement (substance)

Pharmaceutical / biologic product

Pharmaceutical / biologic product (product) and its descendants are not used as values for Direct Substance in the International Release.

Has focus

Has Focus specifies the Clinical finding or Procedure which is the focus of a procedure.

For example,

- 385941006 |Wound care assessment (procedure)| Has focus, Wound care (regime/therapy)

Has intent

Has Intent specifies the intent or purpose of a procedure.

For example,

- 108249004 |Audiologic AND/OR audiometric test including vestibular function (procedure)| has Intent, Diagnostic intent (qualifier value)

Procedure site

Procedure Site describes the body site acted on or affected by a procedure.

Relatively few concepts are modeled using Procedure Site. It is used to model the site for high-level *grouping-type* procedure concepts. It is most likely used for concepts that do not require a Method (action) attribute. It is not necessarily required in order for the classifier to work properly.

Procedure Site subsumes the more specific attributes, Procedure site - Direct (site directly acted upon) and Procedure site - Indirect (site indirectly acted upon). The more specific attributes should be used, if possible (see Procedure Site - Direct and Procedure Site - Indirect below)

For example, 118839001 |Procedure on colon (procedure)| has Procedure site, Colon structure (body structure)

Procedure site

Procedures are not necessarily categorized by site.

Indirect morphology

Indirect Morphology describes the morphology that is acted upon, but is not the direct object of the Method action. This means the procedure acts directly on something else, e.g. a device, substance, or anatomical structure.

For example,

- 404205006 |Removal of mesh from wound (procedure)| has Indirect morphology, Wound (morphologic abnormality)

Indirect device

Indirect Device represents action on something that is located in or on a device, but is not directly on the device itself. This attribute is infrequently needed. When modeling, carefully consider its use.

For example,

- 232762008 |Excision of vegetations from implanted mitral valve (procedure)| has Indirect device, Mitral valve prosthesis device (physical object).

In this example, the *vegetation* is being excised. The *mitral valve prosthesis device* is where the vegetation is located, but the *mitral valve prosthesis*, itself, is not excised. Thus, the mitral valve prosthesis device is the Indirect device.

Recipient category

Recipient Category specifies the type of individual or group upon which the action of the procedure is performed.

For example,

- 105455006 |Donor for medical or surgical procedure (person)| has Recipient Category, Donor if the subject of the record is the Blood product donor (person).

This can be used in blood banking procedures to differentiate the donor vs the recipient of blood products.

Recipient category

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

Procedure site - direct

Procedure Site - Direct is used when the action of the procedure is directly aimed at anatomical or acquired body structure or site, rather than something else located there (e.g. a device), i.e. when the Method is Removal - action or one of its subtypes (Excision, Surgical biopsy, or etc.). Removal of tissue lesions (cysts, tumors, or etc.) are considered to be *removal of the site* and should also use Procedure site - Direct.

For example,

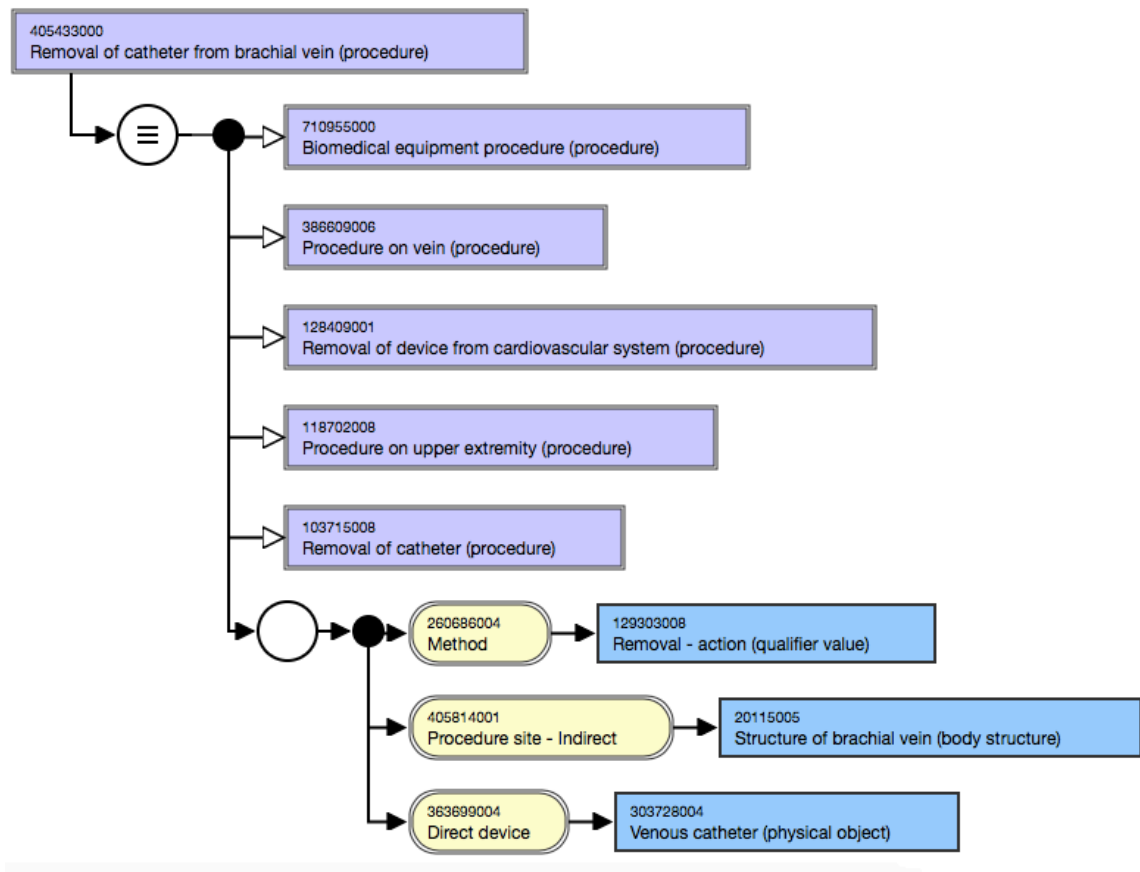
- 54321008 |Cardiac flow imaging (procedure)| has Procedure site - Direct, Coronary artery structure (body structure)

Procedure site - indirect

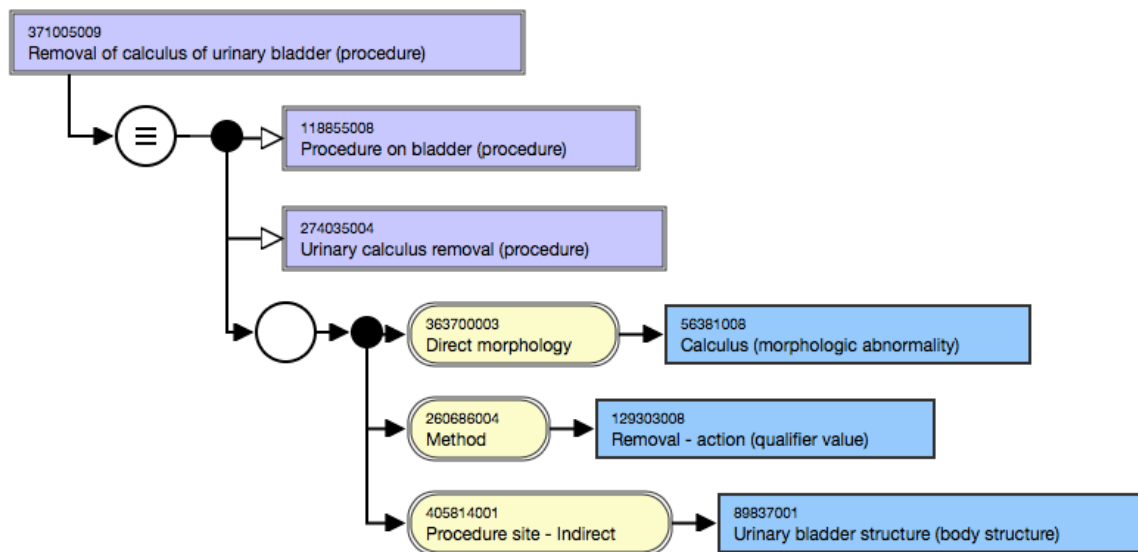
Procedure Site - Indirect describes the anatomical site, which is acted upon, but is not the *direct object* of the procedure, i.e. the site is indirectly acted on by the procedure. The *site* may be a device, calculus, thrombus, foreign body, or another non-tissue entity. These procedures usually involve another value that is the *direct object* of the action.

For example,

- 405433000 |Removal of catheter from brachial vein (procedure)| has:
 - Method, Removal - action (qualifier value)
 - Procedure site - Indirect, Structure of brachial vein (body structure)
 - Direct device, Venous catheter (physical object)



- 371005009 |Removal of calculus of urinary bladder (procedure)| has:
 - Direct morphology, Calculus (morphologic abnormality)
 - Method, Removal - action (qualifier value)
 - Procedure site - Indirect, Urinary bladder structure (body structure)



Procedure device

Procedure Device is used to model devices associated with a procedure. This attribute is used to define high-level, general concepts that aggregate procedures according to the device involved.

Procedure Device subsumes the more specific attributes, Direct Device, Indirect Device, Using Device, and Using Access Device. The more specific attributes should be used instead of Procedure Device, if possible.

For example,

- 276272002 |Catheter procedure (procedure)| has Procedure device, Catheter, device (physical object)

Procedure device

The attribute values in the Procedure Device hierarchy include Device (physical object) and its descendants.

There are a limited number of drug delivery devices in *SNOMED CT*. These concepts descend from Drug-device combination product (product) which is a descendant of both Device (physical object) and Pharmaceutical / biologic product (product). Although they carry the hierarchy tag of (product), they are acceptable values for attributes in the Procedure Device attribute hierarchy.

Procedure morphology

Procedure Morphology is used to specify the morphology, or abnormal structure, involved in a procedure. It is used when defining general concepts that subsume direct and indirect morphology. It subsumes the more specific attributes, Direct and Indirect Morphology. These should be used, if possible.

Morphologically abnormal structures

Hematoma, calculus, foreign body, blood clot, embolus, and some other morphologies are not strictly body structures. But, they are included in the body structure hierarchy under *morphologically abnormal structure* and are valid values for the *Procedure Morphology* attributes.

Using device

Using Device refers to the instrument or equipment utilized to execute an action. It is used when the device is actually used to carry out the action, that is the focus of the procedure. If the device is simply the means to access the site of the procedure, then *Using Access Device* is the appropriate attribute.

For example,

- 51064005 |Core needle biopsy of larynx (procedure)| has Using device, Core biopsy needle, device (physical object)

Using energy

Using Energy refers to the energy used to execute an action.

For example,

- 65952009 |Gamma ray therapy (procedure)| has Using energy, Gamma radiation (physical force)

Using substance

Using Substance describes the Substance used to execute the action of a procedure. It is not the substance on which the procedure's method directly acts, the Direct Substance.

For example,

- 285754008 |Contrast radiography of esophagus (procedure)| has Using substance, Contrast media (substance)

Using access device

Using Access Device specifies the instrument or equipment used to access the site of a procedure.

For example,

- 301761003 |Arthroscopic synovial biopsy (procedure)| has Using access device, Arthroscope, device (physical object)

2.4.10.2.2 Evaluation Procedure Defining Attributes

The following defining attributes are unique to Evaluation procedures. Evaluation procedures may also use the attributes in the *Procedure Attributes Summary* table from the HRCM (see also *Procedure Defining Attributes* page).

Has specimen

Has Specimen indicates the type of specimen on which a measurement or observation is performed.

Component

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

Measurement method

Measurement Method specifies the method by which a laboratory procedure is performed. It provides additional specificity. For measurement procedures, the *method* attribute is given the value Measurement - action (qualifier value).

Property

Property specifies the kind of property (quality or characteristic) being measured.

Scale type

Scale Type refers to the scale of the result of an observation of a diagnostic test.

Time aspect

Time Aspect specifies temporal relationships for a measurement procedure.

2.4.10.2.3 Surgical Procedure Defining Attribute

The following defining attribute is unique to Surgical procedures. Surgical procedures may also use the attributes in the *Procedure Attributes Summary* table from the HRCM (see also *Procedure Defining Attributes* page).

Surgical approach

Surgical Approach specifies the directional, relational, or spatial access to the site of a surgical procedure. The range for Surgical Approach is descendants of << 103379005 |Procedural approach (qualifier value)|

- 172883004 |Intranasal ethmoidectomy (procedure)| has Surgical approach, Intranasal approach (qualifier value)

2.4.10.2.4 Administration of Substance via Specific Route Procedure Defining Attribute

The following defining attribute is unique to Administration of Substance via Specific Route procedures. Administration of Substance via Specific Route procedures may also use the attributes in the *Procedure Attribute Summary* table from the HRCM (see also *Procedure Defining Attributes* page).

Route of administration

Route of administration represents the route by which a procedure introduces a substance into the body. The domain for this attribute is descendants of 433590000 |Administration of substance via specific route (procedure)|.

For example,

- 410572008 |Intravitreal steroid injection (procedure)|, has the Route of administration, Intravitreal route (qualifier value)

2.4.10.2.5 Specific Procedure Modeling

Topic links

Surgical procedure

 Surgical procedure (operation) vs. non-surgical action

 Surgical repair

 Fistula

 Plastic repair

Bilateral procedures

Regime/therapy

Endoscopy vs. endoscopic procedure

Centesis

Transplantation and grafting

Imaging guidance

 Fluoroscopic guidance

Excision, incision, biopsy

 Excision

 Complete or total excision

Partial excision

Lesion or tissue

Excisional biopsy

Incision

Incisional biopsy

Division, lysis, transection, bisection

Division and lysis

Transection and bisection

Skeletal system

Osteotomy

Reduction and fixation of fractures

Immunization and vaccination

Encounter

Surgical procedure

A *surgical procedure* is defined as a procedure that involves intentional non-transient alteration of structures of the body, and/or a procedure that necessarily involves cutting into the body. This definition includes all procedures defined by *Method* (attribute) with Surgical action (qualifier value).

SNOMED CT classifies concepts as surgical procedures if their methods are *surgical actions* based on the action hierarchy. The surgical action hierarchy distinguishes surgical from non-surgical actions based on the definition above. Note the *Or* in the sentence; actions that do not involve cutting or incision, but do involve the intentional non-transient alteration of anatomy, are still surgical.

Operation

In *SNOMED CT*, *operation* is synonymous with surgical procedure.

Surgical procedures are not defined simply as procedures done by a surgeon (despite some dictionary definitions). Surgeons can perform many non-surgical actions and surgical procedures need not necessarily be performed by a surgeon, i.e. if a non-surgeon performs a surgical procedure, it is still a surgical procedure.

Medical procedure

The use of the term *medical procedure* is deprecated, i.e. not recommended, because it lacks reproducible meaning. It might be defined as *a procedure done by a physician*, but even that is deprecated, because it is provider-specific.

Surgical procedure (operation) vs. non-surgical action

As mentioned above, the definition of surgical procedure includes *intentional non-transient alteration of structures of the body and/or necessarily involves cutting into the body*. Non-surgical actions do not significantly or non-transiently alter anatomy and do not necessarily involve cutting or incision.

For example,

- Fine needle biopsy (procedure) or brush biopsy (procedure)
- Phlebotomy, a synonym for venipuncture for blood test (procedure)

- Aspiration (procedure)
- Closed reduction of dislocation (procedure)

Examples of borderline actions, classified as surgical actions,

- Core needle biopsy (procedure); more invasive and more tissue removal compared to fine-needle biopsy
- Centesis (procedure), theoretically, combining puncture with removal, alters body structure (see also, *Centesis* below)

Under revision

48635004 |Fine needle biopsy (procedure)| could be viewed as a kind of *centesis*, but the former is non-surgical and the latter is surgical. *Sampling - action (qualifier value)*, in general, is not necessarily a surgical action. If sampling involves the surgical removal of part of something, then *Surgical biopsy (procedure)* should be the action.

Surgical repair

The definition of *surgical repair* is restoring, to the extent possible, the anatomical structure, using a surgical action. *Repair* is an objective or intended accomplishment, not a means (e.g. suturing, transplanting, etc.) nor a need (e.g. normal functioning, cosmetic appearance, pain relief, etc.).

Surgery that restores structure is usually intended to restore function and appearance. Restoring function, however, is not necessary for a procedure to be considered a repair. It is also possible for surgery to restore function, without restoring structure (e.g. surgery to attach a prosthetic limb after amputation). This type of surgery would not be strictly categorized as a repair.

The *Method* attribute is used to model both the objective of a procedure and the means used to accomplish it. If a procedure requires both a repair action and another type of action, then two relationship groups should be used.

Fistula

Closure action is a kind of *repair* action. All fistula closures use the *closure* action and are auto-classified as kinds of repair procedures.

For example,

- 79433000 |Closure of colon fistula (procedure)| has Method (attribute), Closure - action (qualifier value) with a parent, Repair of colon (procedure)

Plastic repair

Surgery that accomplishes a *repair* (a structural restoration) often use the suffix *-plasty*. The term *plastic repair* is also used. In order to avoid redundancy, the following terms are used:

- *Prosthetic repair*, using external (non-body) materials
- *Plastic repair*, reshaping the body

-plasty

The suffix *-plasty* is widely used in concepts that apply to prosthetic repairs (e.g. total hip arthroplasty). So *-plasty* may refer to any general repair (prosthetic, plastic, or other), and not just plastic repairs.

Bilateral procedures

The naming pattern is as follows:

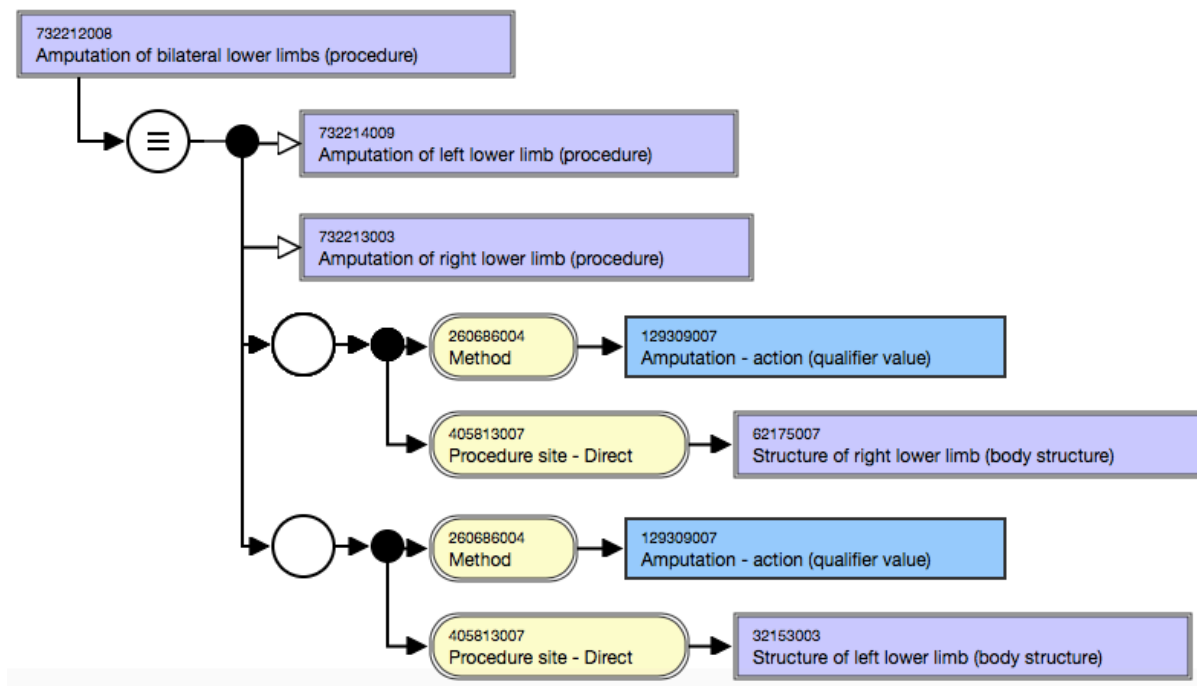
- FSN: X procedure of bilateral X (procedure)
- PT: Bilateral X procedure

- SYN: X procedure of both Xs
- Other synonyms may be added if requested, e.g. *left and right X*

For example, 732212008 |Amputation of bilateral lower limbs (procedure)|

- FSN: Amputation of bilateral lower limbs (procedure)
- PT: Bilateral lower limb amputation
- SYN: Amputation of bilateral lower limbs
- SYN: Amputation of both lower limbs

The concept is modeled as follows:



Regime/therapy

A regime/therapy is a set, sequence, or group of procedures, a *subtype* of procedure. The FSN semantic tag is (*regime/therapy*). These procedures are either:

- Repeated multiple times, over an extended period of time

For example,

- 716872004 |Antineoplastic chemotherapy regimen (regime/therapy)|, This regime/therapy might include individual instances of administration of chemotherapy agents; the instances are at separate times, over a predetermined or planned period of time.
- 229586001 |Rest, ice, compression and elevation treatment program (regime/therapy)|, This regime/therapy refers to repeated rest, ice, compression and elevation (RICE) for an indefinite period of time.

- Focused on a single purpose, but do not have any single sub-procedure as a necessary part.

For example,

- 385695003 |Cast care (regime/therapy)|, The sub-procedures are all done for the purpose of properly monitoring and maintaining an orthopedic cast, but the sub-procedures may vary from one cast, patient, or healthcare setting to the next. Sub-procedures may include inspecting the cast, checking the skin, reinforcing padding, or etc. There is not a single sub-procedure as a necessary part, although the purpose of the sub-procedures is to take care of a cast.

- It is possible to have a regime/therapy as an *instance* of care. An instance of *cast care* could be the specific care for Mr. Smith's cast on the morning of April 23rd, consisting of the set of procedures: examining the cast; examining his arm; asking about his symptoms; and cleaning the skin.

Has focus

Regime/therapy may be the value for the *Has focus (attribute)*.

For example,

- 385978009 |Cardiac rehabilitation assessment (procedure)| with Has focus, cardiac rehabilitation (regime/therapy)

Endoscopy vs. endoscopic procedure

Endoscopic procedures are distinguished from *endoscopy* procedures. The distinction depends on the Action (qualifier value) of the Method (attribute).

In an endoscopy, the Method is *Inspection - action (qualifier value)*. For these procedures, *Endoscope, device (physical object)* is the value for *Using device (attribute)*.

For example,

- 427595003 |Capsule endoscopy (procedure)| has the Relationship group
 - Using device, Endoscope, device (physical object)
 - Procedure site, Direct, Gastrointestinal tract structure (body structure)
 - Method, Inspection - action (qualifier value)

In an endoscopic procedure, the Method (attribute) has some other action. It is accomplished by gaining access to the procedure site via an endoscope. For these procedures *Endoscope device (physical object)* is the value for *Using Access Device (attribute)*. This specifies that the endoscope is used to access the site.

For example,

- 53767003 |Endoscopic biopsy (procedure)| has the Relationship group
 - Using access device, Endoscope, device (physical object)
 - Method, Biopsy, action (qualifier value)

Centesis

Centesis may be defined as the act of puncturing a body cavity or space with a hollow needle and drawing out fluid. Each centesis procedure involves both a puncture action and a needle aspiration action. It is correct to have two relationship groups for centesis procedures.

One group has a Method, puncture action and a Procedure site - Direct, the structure being punctured.

For example,

- 91602002 |Thoracentesis (procedure)| has Procedure site - Direct, Pleural membrane structure (body structure)

The second group has a Method, aspiration action and a Procedure site - Indirect, space being aspirated.

For example,

- 91602002 |Thoracentesis (procedure)| has Procedure site - Indirect, Pleural cavity structure (body structure)

! Inactivation

The value *centesis - action* was inactivated, since it had two actions with different direct and indirect objects.

Transplantation and grafting

! DRAFT - UNDER REVISION

Transplantation includes procedures that are not grafting

Most, but not all, transplantations involve attachment or fixation of a biological graft into place in the recipient (However, bone marrow and stem cell transplantation does not involve the action of attachment or fixation; the action is infusion). In the Action attribute hierarchy, *transplantation* is not a kind of surgical - action, but a kind of grafting - action. If it were, then bone marrow transplantation would be a surgical procedure, but it is not.

Procedures that involve the attachment or fixation of biological tissue are both grafting and transplantation. If the grafted material is not biological, then the procedure cannot be a type of transplantation, i.e. all transplantation involves only biological grafts. If the transplanted material is not attached or fixed in place, then the procedure cannot be a type of grafting, i.e. all grafting involves attachment or fixation.

Grafting includes procedures that are not transplantation

The term *graft* might be defined as any free (unattached) tissue or organ for transplantation. However, the meaning has evolved and also includes grafts and implants that are not biological material (All transplants, however, consist of biological material).

The action *grafting* necessarily implies that the action involves attachment or fixation of the (biological or artificial) graft into place in the recipient. In the action hierarchy, *grafting* is defined as a kind of surgical introduction. Thus, all procedures defined with *grafting - action (qualifier value)* are surgical procedures.

Procedure	Material	Method	Notes	Examples
77465005 Transplantation (procedure)	Biological material	<ul style="list-style-type: none"> 410820007 Surgical transplantation - action (qualifier value) 129406001 Transplantation - action (qualifier value) 	<ul style="list-style-type: none"> Most, but not all, involve the action, attachment or fixation of the graft in the recipient 	32413006 Transplantation of heart (procedure)

119561005 Grafting procedure (procedure)	Biological or artificial material	<ul style="list-style-type: none"> 129407005 Grafting - action (qualifier value) 	<ul style="list-style-type: none"> Necessarily involves the action, attachment or fixation of the graft in the recipient Use of free or unattached tissue or organ for transplantation 	226203006 Tendon graft (procedure)
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Imaging guidance (see also *Clinical imaging procedure naming conventions*)

Imaging guidance can be modeled using the attribute *Has Intent*. The concept 429892002 | Guidance intent (qualifier value), a child of 363675004 | Intents (nature of procedure values) (qualifier value), is the value for Has Intent for imaging guided procedures.

For example,

- 432666003 | Biopsy of brain using computed tomography guidance (procedure) has two relationship groups, the second one below with *Has Intent*,
 - Method: Biopsy - action (qualifier value)
 - Procedure Site - Direct: Brain structure (body structure)
 - Procedure Site - Direct: Brain structure (body structure)
 - Method: Computed tomography imaging - action (qualifier value)
 - Has Intent: Guidance intent (qualifier value)

Biopsy of brain using computed tomography guidance

432666003 | Biopsy of brain using computed tomography guidance (procedure) is subsumed by 702707005 | Biopsy of head (procedure) and by 34227000 | Computerized axial tomography of brain (procedure).

Fluoroscopic guidance

Using fluoroscopic guidance (procedure) is a subtype of fluoroscopy (procedure).

For example,

- 710291004 | Endoscopy using fluoroscopic guidance (procedure) with the following relationship groups,
 - Using device: Endoscopic device (physical object)
 - Method: Inspection - action (qualifier value)
 - Method: Fluoroscopic imaging - action (qualifier value)
 - Has intent: Guidance intent (qualifier value)

Excision, incision, biopsy

Excision, incision, and biopsy may be difficult to interpret. They are organized according to the following general structure.

Excision

Organ excision. Any excisional act involving the organ; usually (*organ*)-*ectomy*, or similar, is a synonym. *Organ excision*, itself, does not specify whether it is complete or partial, nor does it specify what is excised.

For example,

- 107963000 |Liver excision (procedure)| or one of the synonyms, Hepatectomy

Complete or total excision

Concepts may include *complete* or *total* to indicate complete removal or excision of the organ.

For example,

- 63016009 |Total resection of urinary bladder (procedure)| with the synonyms Complete cystectomy, Total excision of bladder, and etc

Partial excision

Concepts may include *partial* to indicate removal or excision of part of the organ. Specifying *partial excision* does not differentiate between a partial excision *of* or *from* the organ.

For example,

- 708929007 |Laparoscopic partial excision of kidney using robotic assistance (procedure)| or one of the synonyms, Partial nephrectomy, laparoscopic with robot assistance

Lesion or tissue

Concepts may indicate removal of a lesion or tissue; excision of a lesion or tissue from an organ may be complete or partial.

For example,

- 72106008 |Excision of lesion of liver (procedure)|
- 69031006 |Excision of breast tissue (procedure)|



Lesion modeling

The word *lesion* can be used to refer to both structural and functional abnormalities. If a procedure (or disorder) refers to a lesion in a way that makes it clear that it is a generic term for a structural abnormality, then the correct modeling approach is to use Procedure morphology (attribute) for procedures or [Associated morphology (attribute), Morphologically abnormal structure (morphologic abnormality) for disorders].

Excision(al) biopsy

Excisional biopsy of entire organ (organ structure)

For example,

- 447412005 |Excisional biopsy of lymph node of neck (procedure)|

Excisional biopsy of organ generally means that *tissue* or a *lesion* or *suspected lesion* is necessarily entirely excised, not the entire organ. It is a partial excision of (from) the organ. This is true even when small polyps are removed.

For example,

- 116237003 |Excisional biopsy of lesion of rectum by transanal approach (procedure)|

Incision

Organ incision. Any incisional act involving the organ; usually (*organ*)-*otomy*, or similar, is a synonym

For example,

- 45558009 |Incision of lung (procedure)| or the synonym, pneumonotomy

Incision

Any *incision* procedure that does not necessarily involve division (as opposed to ordinarily does not involve division) remains primitive without an available negation operator.

Incisional biopsy

Incisional biopsy of organ; incisional biopsy of lesion of organ; usually with open approach. Incisional biopsy of [organ] necessarily implies incision and removal of a lesion, and is by definition a *partial excision*, since the site is the organ, and an excision is done, but the entire lesion is not necessarily removed.

For example,

- 237378001 |Incisional biopsy of breast (procedure)|

Biopsy

A *biopsy* may not be an excision.

For example,

- 445713002 |Brush biopsy of endocervix (procedure)|
- 48426002 |Fine needle biopsy of kidney (procedure)|

Modeling biopsy

Biopsies, like other removal procedures, may have two direct objects, the *morphology* and the *site*. It is permissible to use Procedure site - Direct for biopsies, even if subtypes might have a direct object that is a morphology.

Division, lysis, transection, bisection

Division and lysis

Division action is a subtype of Incision - action (qualifier value). This does not mean that all procedures, that include the word *division*, should necessarily be modeled with Method, Division - action (qualifier value); like those where the division is accomplished using *blunt dissection*, not incision.

For example,

- *Division of adhesions* concepts, like 173269002 |Division of adhesions of lip (procedure)|, should be modeled the same as *lysis of adhesions* concepts, like 45602008 |Lysis of adhesions of peritoneum (procedure)|

Both use *dissection - action*. Adhesions are *broken down* by blunt dissection, often without incising them. This does not exclude procedures that may also involve division by incision.

The preferred name of *division of adhesions* concepts can be changed to *lysis of adhesions* for consistency. The use of *lysis of adhesions* also helps with correct modeling and avoidance of interpreting *divisions* as necessarily being kinds of incision.

Transection and bisection

Transection is defined as a division across the longitudinal axis of a structure by cutting. *Bisection* is defined as division into two parts by cutting. Transection - action (qualifier value) is a subtype of Bisection - action (qualifier value), which is a subtype of Division- action (qualifier value) and Incision - action (qualifier value).

For example,

- 53176004 |Transection of muscle of eye (procedure)|
- 60158005 |Bilateral bisection of ovary (procedure)|

Skeletal system

Since the skeletal system includes bones and cartilage, it is possible to have a procedure on the skeletal system, i.e. on cartilage, that is not a procedure on bone.

For example,

- 77825002 |Division of cartilage of wrist (procedure)| is a procedure on the skeletal system (procedure)

Skeletal system subdivision

SNOMED CT considers the *skeletal system subdivision* part of the entire bone (system). This may change if there are procedures on cartilaginous skeleton that involve skeletal system subdivisions.

Osteotomy

Osteotomy is defined as *cutting into or through a bone*; there are 3 meanings in SNOMED CT:

- Cutting into a bone, regardless of whether the bone is divided (incision, general meaning). Model using Method, Incision - action (qualifier value), and Procedure site - Direct (attribute), bone structure (or subtypes).

For example,

- 118483001 |Incision of rib (procedure)|

- Cutting through a bone and dividing it (division by cutting). Model using Method, Division - action (qualifier value), and Procedure site - Direct (attribute), bone structure (or subtypes).

For example,

- 447867002 |Division of ulna (procedure)|

- Cutting into a bone without cutting through it and therefore without dividing it (incision without division). This is unnecessary. Procedures that do not explicitly involve division are modeled simply as *Incision*.

Inactivated

- Osteotomy - action (qualifier value)
- Incision of bone without division as a synonym for *Incision of bone*

Reduction and fixation of fractures

Reduction and fixation has two actions by two different means; open reduction of a fracture and insertion of an orthopedic fixation device. This provides an opportunity for general concept inclusion axioms (GCIs) in order to fully represent the meanings, without heavy postcoordination modeling. *Open reduction of a fracture* necessarily involves open manipulation of the fracture and *internal fixation of a fracture* necessarily involves the insertion of an orthopedic internal fixation device.

For example,

- 74011006 |Open reduction of fracture of tibia and fibula with internal fixation (procedure)|

Immunization and vaccination

Immunization may be active (introduction of a vaccine) or passive (introduction of immunoglobulin/antibodies). A *vaccine* is a substance that can induce active immunity. *Vaccination*, by definition, is the introduction of a vaccine, and is, therefore, synonymous with active immunization. Some descriptions include the word *vaccination*,

where it is clear that vaccination is intended. Other descriptions have preferred terms with the word *vaccination*, and synonyms with the word *immunization*, to include both active and passive immunization.

For example,

- 38598009 |Measles-mumps-rubella vaccination (procedure)| has *vaccination* in all descriptions
- 86198006 |Influenza vaccination (procedure)| has the synonym, influenza *immunization*

Encounter

An *encounter* is defined as an in-person meeting between a patient and a healthcare provider for the purpose of the provision of healthcare services to the patient. An encounter is a kind of procedure.

For example,

- 185349003 |Encounter for check up (procedure)|

An *indirect encounter* is not actually an encounter, since there is no face-to-face meeting. Therefore encounter and indirect encounter are siblings in the procedure hierarchy.

For example,

- 11797002 |Telephone call by physician to patient or for consultation (procedure)|

2.4.10.2.6 Chemotherapy Regime/Therapy Naming Conventions

Chemotherapy regimens, which are internationally recognized and implemented, are acceptable content and may be added to the (regime/therapy) hierarchy as subtypes of 716872004 |Antineoplastic chemotherapy regimen (regime/therapy)|.

Trade names, which are indicated by an acronym, e.g. ABVD chemotherapy regimen, where *A* represents trade name Adriamycin®, should not be spelled out, but may be referenced in the acronym used to describe the regimen.

Generic drug names are not capitalized, i.e. all lower case, and should represent the International Non-proprietary Name (INN) of the substance.

Examples,

ABVD chemotherapy regimen. *A* represents the trade name Adriamycin® (INN = doxorubicin):

- FSN: Doxorubicin, bleomycin, vinblastine and dacarbazine chemotherapy regimen (regime/therapy)
- PT: ABVD chemotherapy regimen
- Synonym: Doxorubicin, bleomycin, vinblastine and dacarbazine chemotherapy regimen
- Synonym: ABVD chemotherapy protocol

R-CHOP chemotherapy regimen. *H* represents the non-INN generic name hydroxydaunomycin (INN = doxorubicin) and *O* represents the trade name Oncovin® (INN = vincristine):

- FSN: Rituximab, cyclophosphamide, doxorubicin, vincristine and prednisone chemotherapy regimen (regime/therapy)
- PT: R-CHOP chemotherapy regimen
- Synonym: Rituximab, cyclophosphamide, doxorubicin, vincristine and prednisone chemotherapy regimen
- Synonym: R-CHOP chemotherapy protocol

2.4.10.2.7 Measurement Procedure Naming Conventions

In *SNOMED CT*, *measurement procedure* is the preferred way of expressing a laboratory test. Naming conventions for measurement procedures are as follows:

General naming pattern: Action, Analyte, Specimen

Action

This is consistent with the general rule for the FSN for new procedure concepts.

- *Action* (the Method) is named first, when possible
- Modifier of the first component: *Scale Method*
 - Scale Method refines, and precedes the action in the naming order (Scale Method, Action)
 - Naming pattern: (Scale Method, Action), Analyte, Specimen

Analyte

This is also consistent with the general rule for FSNs for new procedure concepts.

- *Action* (the Method) is named first followed by the object acted directly upon, when possible
- Applying this convention to measurement procedures, the object being acted directly upon (measured) is the *analyte*

Specimen

- Modifier of third component: *Timing*
- *Timing* provides information and precedes *specimen* in the naming order (Timing, Specimen)

Word order for additional properties

Additional properties such as ratio, concentration, percentage, and count follow the *action*.

Screening

Measurements done by screening should be specified with *by screening method*, added at the end of the description.

For example,

- Measurement of substance X in Y specimen by *screening method*

The FSN should have *measurement of X antibody by screening method*, not *X antibody assay by screening method*.

2.4.10.2.8 Clinical Imaging Procedure Naming Conventions

Almost all imaging procedures can be unambiguously expressed in a number of ways. There is a balance between flexibility in language and efficiency in terminology maintenance. Consequently, all variants for imaging modalities are not routinely included in *SNOMED CT*. Submissions for additional descriptions must be justified explicitly.

At a minimum, procedures are ordinarily expressed with the modality and body site. Existing content may have inconsistencies, but new content should follow the naming conventions that follow.

✓ The use of *near synonyms* is acceptable for clinical imaging procedures:

For example,

- 79516005 |Renal arteriography (procedure)| has the synonym renal angiography
- 726077005 |Computed tomography arteriography of bronchial artery (procedure)| has the synonym CT *angiography* of bronchial artery
- 709552006 |Computed tomography angiography of iliac artery (procedure)| has the synonym CT *angiogram* of iliac artery

2.4.10.2.8.1 X-ray

Under revision

There is inconsistency with naming *Radiology of X* vs *X-ray of X* and modeling of X-ray concepts. Preliminary analysis has been completed and a new approach recommended. Remodeling is pending.

Approach 1: Radiography of X

- FSN: Radiography of X (procedure)
- PT: Radiography of X

For example,

- 49345004 |Radiography of hand (procedure)|

Approach 2: X-ray of X

- FSN: X-ray of X (procedure)
- PT: X-ray of X

For example,

- 426581005 |X-ray of both feet (procedure)|

Diagnostic radiography

363680008 | Radiographic imaging procedure (procedure) | is at the top-level of the hierarchy of imaging procedures utilizing X-rays. The phrase *diagnostic radiography* is allowed as an FSN of subtypes of radiographic imaging procedure.

For example,

- 66596009 |Diagnostic radiography for foreign body detection and localization (procedure)|

Inactivated concept

Diagnostic radiologic examination (procedure) had a synonym of *X-ray*. It may have been interpreted more narrowly, because of the potential for a narrower interpretation of *radiologic* vs. *radiographic* and *diagnostic*.

Modeling: New content requests

An X-ray concept may have the action, 312254007 |Plain X-ray imaging - action (qualifier value)| or the broader supertype action, 278110001 |Radiographic imaging - action (qualifier value)|. A submitter should clearly identify which of the actions is appropriate.

2.4.10.2.8.2 Ultrasonography

Ultrasonography

- FSN: Ultrasonography of X (procedure)
- PT: Ultrasonography of X
- SYN: Ultrasound scan of X
- SYN: Ultrasound of X

For example,

- 709590000 |Ultrasonography of perineum (procedure)|

- FSN: Ultrasonography of perineum (procedure)
- PT: Ultrasonography of perineum
- SYN: Ultrasound scan of perineum
- SYN: Ultrasound of perineum

Doppler ultrasonography

- FSN: Doppler ultrasonography of X (procedure)
- PT: Doppler ultrasonography of X
- SYN: Doppler ultrasound scan of X
- SYN: Doppler ultrasound of X

For example,

- 710306004 |Doppler ultrasonography of venous structure (procedure)|
 - FSN: Doppler ultrasonography of venous structure (procedure)
 - PT: Doppler ultrasonography of vein
 - SYN: Doppler ultrasound scan of vein
 - SYN: Doppler ultrasound of vein

Obstetric ultrasonography

An obstetric ultrasound may require a complex description. However, the same rules apply, as follows:

- FSN: Obstetric ultrasonography of X (procedure)
- PT: Obstetric ultrasonography of X
- SYN: Obstetric ultrasound scan of X
- SYN: Obstetric ultrasound of X

For example,

- 169670003 |Antenatal ultrasound scan at 17-22 weeks (procedure)|
 - FSN: Antenatal ultrasound scan at 17-22 weeks (procedure)
 - PT: Antenatal ultrasound scan at 17-22 weeks

2.4.10.2.8.3 Computed Tomography (CT)

Exception

CT is an exception to the rule that all abbreviations should have their expanded form in parentheses in descriptions.

Axial

Descriptions with *computerized axial tomography (CAT)* are not acceptable. The *axial* part of the phrase is no longer accurate because there are other techniques that also create images on multiple planes or axes.

Scan

Computed tomography descriptions do not routinely include computed tomography *scan of X*.

The word *scan* is not systematically added in new descriptions and should not be included in preferred terms. However, specific requests to add descriptions with the word *scan*, are not denied. *Computerized axial tomography scan of X* is considered obsolete and should not be added as a new description. To avoid inactivating existing computed tomography concepts, existing FSNs will not be changed (A batch change of the FSNs, without inactivation of the concepts, requires committee approval).

Computed tomography

- FSN: Computed tomography of X (procedure)
- PT: CT of X
- SYN: Computed tomography of X

For example,

- 241566009 |Computed tomography of elbow (procedure)|
 - FSN: Computed tomography of elbow (procedure)
 - PT: CT of elbow
 - SYN: Computed tomography of elbow

Computed tomography angiography

- FSN: Computed tomography angiography of X (procedure)
- PT: CT angiography of X
- SYN: CT angiogram of X
- SYN: Computed tomography angiography of X

For example,

- 419559003 |Computed tomography angiography of renal artery (procedure)|
 - FSN: Computed tomography angiography of renal artery (procedure)
 - PT: CT angiography of renal artery
 - SYN: Computed tomography angiography of renal artery

Computed tomography venography

- FSN: Computed tomography venography of X (procedure)
- PT: CT venography of X
- SYN: CT venogram of X
- SYN: Computed tomography venography of X

For example,

- 432842007 |Computed tomography venography of intracranial vein (procedure)|
 - FSN: Computed tomography venography of intracranial vein (procedure)
 - PT: CT venography of intracranial vein
 - SYN: Computed tomography venography of intracranial vein

Venography

Venography may simply be a timing phase of *angiography*. It is agreed that venography may be a useful term in an FSN, i.e. there may be a meaningful technique difference between *simple angiography* and *purposeful venography*.

Computed tomography arthrography

- FSN: Computed tomography arthrography of X (procedure)
- PT: CT arthrography of X
- SYN: CT arthrogram of X
- SYN: Computed tomography arthrography of X

For example,

- 418940000 |Computed tomography arthrography of intratarsal joint (procedure)|
 - FSN: Computed tomography arthrography of intratarsal joint (procedure)
 - PT: CT arthrogram of intratarsal joint
 - SYN: CT arthrography of intratarsal joint

2.4.10.2.8.4 Magnetic Resonance Imaging (MRI)

Exception

MRI and MR are exceptions to the rule that all abbreviations should have their expanded form in parentheses in descriptions.

Magnetic resonance imaging

Descriptions:

- FSN: Magnetic resonance imaging of X (procedure)
- PT: MRI of X
- SYN: Magnetic resonance imaging of X

For example,

- 6007000 |Magnetic resonance imaging of chest (procedure)|
 - FSN: Magnetic resonance imaging of chest (procedure)
 - PT: MRI of chest
 - SYN: Magnetic resonance imaging of chest

Magnetic resonance angiography

Descriptions:

- FSN: Magnetic resonance angiography of X (procedure)
- PT: Magnetic resonance angiography of X
- SYN: Magnetic resonance angiogram of X
- SYN: MR angiography of X

For example,

- 432103005 |Magnetic resonance angiography of carotid artery (procedure)|
 - FSN: Magnetic resonance angiography of carotid artery (procedure)
 - PT: MR angiography of carotid artery
 - SYN: Magnetic resonance angiography of carotid artery

Magnetic resonance venography

Descriptions:

- FSN: Magnetic resonance venography of X (procedure)
- PT: Magnetic resonance venography of X
- SYN: Magnetic resonance venogram of X
- SYN: MR venography of X

For example,

- 21101000087100 |Magnetic resonance venography of limb (procedure)|
 - FSN: Magnetic resonance venography of limb (procedure)
 - PT: Magnetic resonance venography of extremity
 - SYN: Magnetic resonance venography of limb

Magnetic resonance arthrography

Descriptions:

- FSN: Magnetic resonance arthrography of X (procedure)
- PT: Magnetic resonance arthrography of X
- SYN: Magnetic resonance arthrogram of X
- SYN: MR arthrography of X

For example,

- 19741000087109 |Magnetic resonance arthrography of right knee (procedure)|
 - FSN: Magnetic resonance arthrography of right knee (procedure)
 - PT: Magnetic resonance arthrography of right knee
 - SYN: MR arthrography of right knee

2.4.10.2.8.5 Contrast for Imaging

It is essential to express when contrast is part of a procedure and that descriptions are constructed consistently.

For example,

- 702501008 |Computed tomography of knee with contrast (procedure)|
 - FSN: Computed tomography of knee with contrast (procedure)
 - PT: CT of knee with contrast
 - SYN: Computed tomography of knee with contrast

Exception

Fluoroscopic angiography and fluoroscopic-guided angiography procedures do not require *with contrast*.

For example,

- 418867007 |Fluoroscopic angiography of abdominal vascular structure (procedure)|

Although vascular contrast and other contrast are regularly used in imaging procedures, it is agreed that there is no need to specify *vascular* contrast for procedures involving the vasculature.

For example,

- 431326009 |Computed tomography of neck with contrast (procedure)|

Unacceptable example,

- CT of neck with *vascular* contrast

It is agreed that it is unnecessary to add the word *media* to contrast.

It is agreed that the link word to associate the contrast use with the procedure is *with* not *for* or etc.

Contrast

There is a suggestion that additional concept detail is required when it is necessary to know the more precise nature of contrast (e.g. iodinated with various osmolalities, barium, or gas).

Imaging without contrast

Although considered a negation, this term is used in clinical records. *Without contrast* imaging procedures are acceptable.

For example,

- 566341000119106 |Computed tomography of ankle without contrast (procedure)|
 - FSN: Computed tomography of ankle without contrast (procedure)
 - PT: CT ankle without contrast
 - SYN: Computed tomography of ankle without contrast

Without contrast

There is a case for explicitly adding a concept qualification when naming procedures that are explicitly performed *without contrast*.

In the UK and Australia, it was reported that there are no procedures that specify *without contrast* pre-coordinated in the national subset. With this information, implementation guidance may be provided.

Unacceptable concept qualification

With and without and *With or without* imaging concepts are not acceptable due to ambiguity. Two concepts should be used to express these separately.

2.4.10.2.8.6 Imaging Guided Procedures

There are numerous procedures where the imaging component is considered a supplemental or secondary technique to help accomplish the primary goal. The pattern is:

Procedure using guidance

- FSN: Y (procedure) using (DI Modality guidance) (procedure)
- PT: (DI Modality) guided Y (procedure)
- SYN: Y (procedure) using (DI Modality guidance)

For example,

- 407971000119109 |Percutaneous needle biopsy of liver using computed tomography guidance (procedure)|
 - FSN: Percutaneous needle biopsy of liver using computed tomography guidance (procedure)
 - PT: CT guided biopsy of liver
 - SYN: Percutaneous needle biopsy of liver using computed tomography guidance

Computed tomography guided procedure

- FSN: Y using computed tomography guidance (procedure)
- PT: CT guided Y
- SYN: Y using computed tomography guidance

For example,

- 431864000 |Injection using computed tomography guidance (procedure)|
 - FSN: Injection using computed tomography guidance (procedure)
 - PT: CT guided injection
 - SYN: Injection using computed tomography guidance

Fluoroscopy guided procedure

- FSN: Y using fluoroscopic guidance (procedure)
- PT: Fluoroscopy guided Y
- SYN: Y using fluoroscopic guidance

For example,

- 430278000 |Biopsy using fluoroscopic guidance (procedure)|
 - FSN: Biopsy using fluoroscopic guidance (procedure)
 - PT: Biopsy using fluoroscopic guidance
 - SYN: Fluoroscopic guidance for biopsy

Fluoroscopic guidance

The term *fluoroscopic Y* is interpreted as *Y using fluoroscopic guidance (procedure)*. Procedures such as 432540009 |Biopsy of wrist using fluoroscopic guidance (procedure)| are subtypes of Fluoroscopy (procedure).

(See also *Fluoroscopy and Fluoroscopic Imaging* page)

Magnetic resonance imaging guided procedure

- FSN: Y using magnetic resonance imaging guidance (procedure)
- PT: MRI guided Y (procedure)
- SYN: Y using magnetic resonance imaging guidance

For example,

- 433008009 |Core needle biopsy of breast using magnetic resonance imaging guidance (procedure)|
 - FSN: Core needle biopsy of breast using magnetic resonance imaging guidance (procedure)
 - PT: MRI guided core needle biopsy of breast
 - SYN: Core needle biopsy of breast using magnetic resonance imaging guidance

Ultrasonography guided procedure

- FSN: Y using ultrasonographic guidance (procedure)
- PT: Ultrasonography guided Y
- SYN: Y using ultrasonographic guidance

For example,

- 710790002 |Puncture and aspiration using ultrasonographic guidance (procedure)|
 - FSN: Puncture and aspiration using ultrasonographic guidance (procedure)
 - PT: Ultrasonography guided puncture and aspiration
 - SYN: Puncture and aspiration using ultrasonographic guidance

X-ray guided procedure

- FSN: Y using X-ray guidance (procedure)
- PT: X-ray guided Y
- SYN: Y using X-ray guidance

For example,

- 718674009 |Injection of steroid using X-ray guidance (procedure)|
 - FSN: Injection of steroid using X-ray guidance (procedure)
 - PT: X-ray guided steroid injection
 - SYN: Injection of steroid using X-ray guidance

2.4.10.2.8.7 Fluoroscopy and Fluoroscopic Imaging

Simple fluoroscopy

Simple fluoroscopy is *real time* imaging (usually on TV monitors/image intensifiers) of a body part or system. Only rarely is it an imaging process alone (without use of contrast or some interventional procedure). Fluoroscopy is most often used to guide or direct a primary procedure/purpose.

The usual convention in clinical practice is to ignore the fluoroscopic element and refer to a procedure entirely by the primary component, e.g. angiography. However, this is unacceptable in *SNOMED CT*, where the imaging component must be explicitly described. *SNOMED CT* uses the adjectival form, i.e. fluoroscopic arteriography in the FSN; the noun, i.e. fluoroscopic arteriogram, is acceptable as a synonym.

- FSN: Fluoroscopy of X (procedure)

- PT: Fluoroscopy of X
- SYN: Fluoroscopy - X

For example,

- 169005008 |Fluoroscopy of esophagus (procedure)|
 - FSN: Fluoroscopy of esophagus (procedure)
 - PT: Fluoroscopy of esophagus
 - SYN: Fluoroscopy - esophagus

Fluoroscopic guidance

- FSN: Y using fluoroscopic guidance (procedure)
- PT: Fluoroscopy guided Y
- SYN: Y using fluoroscopic guidance

For example,

- 710293001 |Colonoscopy using fluoroscopic guidance (procedure)|
 - FSN: Colonoscopy using fluoroscopic guidance (procedure)
 - PT: Fluoroscopy guided colonoscopy
 - SYN: Colonoscopy using fluoroscopic guidance



Fluoroscopic guidance

Fluoroscopic Y is interpreted as *Y using fluoroscopic guidance (procedure)*. Such procedures are subtypes of fluoroscopy (procedure).

For example,

- 432540009 |Biopsy of wrist using fluoroscopic guidance (procedure)|

Fluoroscopic arteriography

- FSN: Fluoroscopic arteriography of X (procedure)
- PT: Fluoroscopic arteriography of X
- SYN: Fluoroscopic arteriogram of X
- SYN: Fluoroscopic angiography of X
- SYN: Fluoroscopic angiogram of X

For example,

- 16051000087102 |Fluoroscopic arteriography of right cervical vertebral artery (procedure)|
 - FSN: Fluoroscopic arteriography of right cervical vertebral artery (procedure)
 - PT: Fluoroscopic arteriography of right cervical vertebral artery
 - SYN: Fluoroscopic arteriogram of right cervical vertebral artery
 - SYN: Fluoroscopic angiography of right cervical vertebral artery
 - SYN: Fluoroscopic angiogram of right cervical vertebral artery

Fluoroscopic venography

- FSN: Fluoroscopic venography of X
- PT: Fluoroscopic venography of X
- SYN: Fluoroscopic venogram of X

For example,

- 392491000119105 |Fluoroscopic venography of right extremity (procedure)|
 - FSN: Fluoroscopic venography of right extremity (procedure)
 - PT: Fluoroscopic venography of right extremity
 - SYN: Fluoroscopic venogram of right extremity

Fluoroscopic arthrography

- FSN: Fluoroscopic arthrography of X (procedure)
- PT: Fluoroscopic arthrography of X
- SYN: Fluoroscopic arthrogram of X

For example,

- [723775001](#) |Fluoroscopic arthrography of right sacroiliac joint (procedure)|
 - FSN: Fluoroscopic arthrography of right sacroiliac joint (procedure)
 - PT: Fluoroscopic arthrography of right sacroiliac joint
 - SYN: Fluoroscopic arthrogram of right sacroiliac joint

Dual energy X-ray photon absorptiometry

- FSN: Dual energy X-ray photon absorptiometry of X (procedure)
- PT: Dual energy X-ray photon absorptiometry of X
- SYN: DXA of X
- SYN: DEXA of X

For example,

- [723193006](#) |Dual energy X-ray photon absorptiometry of vertebral column (procedure)|
 - FSN: Dual energy X-ray photon absorptiometry of vertebral column (procedure)
 - PT: Dual energy X-ray photon absorptiometry of vertebral column
 - SYN: DXA of vertebral column
 - SYN: DEXA of vertebral column

2.4.10.2.8.8 Positron Emission Tomography (PET)

Positron emission tomography (procedure)

- FSN: Positron emission tomography of X (procedure)
- PT: PET of X
- SYN: Positron emission tomography of X

For example,

- [702767007](#) |Positron emission tomography of whole body (procedure)|
 - FSN: Positron emission tomography of whole body (procedure)
 - PT: Positron emission tomography of whole body

2.4.10.2.8.9 Single Photon Emission Computed Tomography (SPECT)

Single photon emission computerized tomography (procedure)

- FSN: Single photon emission computed tomography of X (procedure)
- PT: Single photon emission computed tomography of X
- SYN: SPECT of X

For example,

- [709549003](#) |Single photon emission computed tomography of heart (procedure)|
 - FSN: Single photon emission computed tomography of heart (procedure)
 - PT: Single photon emission computed tomography of heart
 - SYN: SPECT of heart

2.4.10.2.8.10 Multi-modality Imaging: PET/CT and SPECT/CT

There are very few imaging procedures which are truly *multi-modality* procedures. Two procedures are usually conducted in parallel, rather than as one. Positron emission tomography with computed tomography (PET/CT) and Single photon emission computed tomography with computed tomography (SPECT/CT), however, are produced by one piece of equipment, possibly by a single technician, but with multiple imaging energies.

Positron emission tomography with computed tomography

- FSN: Positron emission tomography with computed tomography of X (procedure)
- PT: PET CT of X
- SYN: Positron emission tomography with computed tomography of X

For example,

- 16554361000119106 |Positron emission tomography with computed tomography of brain (procedure)|
 - FSN: Positron emission tomography with computed tomography of brain (procedure)
 - PT: PET CT of brain
 - SYN: Positron emission tomography with computed tomography of brain

Single photon emission computed tomography with computed tomography

- FSN: Single photon emission computed tomography with computed tomography of X (procedure)
- PT: Single photon emission computed tomography with computed tomography of X
- SYN: SPECT CT of X

For example,

- 16534151000119105 |Single photon emission computed tomography with computed tomography of liver (procedure)|
 - FSN: Single photon emission computed tomography with computed tomography of liver (procedure)
 - PT: Single photon emission computed tomography with computed tomography of liver
 - SYN: SPECT CT of liver

2.4.10.2.8.11 Nuclear Medicine (Radionuclide) Imaging

Nuclear medicine imaging uses radionuclides or radioisotopes.

Radionuclide scan

- FSN: Radionuclide scan of X (procedure)
- PT: Radionuclide scan of X
- SYN: Radioisotope scan of X

For example,

- 710313004 |Radionuclide scan of peritoneal cavity (procedure)|
 - FSN: Radionuclide scan of peritoneal cavity (procedure)
 - PT: Radionuclide scan of peritoneal cavity
 - SYN: Radioisotope scan of peritoneal cavity

Radionuclide scan using isotopes (with other agents)

- FSN: Radionuclide scan of X using Y (procedure)
- PT: Radionuclide scan of X using Y
- SYN: Radioisotope scan of X using Y

For example,

- 710312009 |Radionuclide scan of perfusion of liver using technetium Tc^{99m} aggregated albumin (procedure)|
 - FSN: Radionuclide scan of perfusion of liver using technetium Tc^{99m} aggregated albumin (procedure)
 - PT: Radionuclide scan of perfusion of liver using technetium Tc^{99m} aggregated albumin
 - SYN: Radioisotope scan of perfusion of liver using technetium Tc^{99m} aggregated albumin

2.4.10.2.8.12 Diagnostic Imaging for Multiple Body Sites

Adjacent structures

Concepts which describe adjacent structures, imaged in one procedure, are acceptable.

For example,

- 432672003 |Magnetic resonance imaging of pelvis and hip (procedure)|

Unacceptable

Multiple procedures or a combination of different procedures in one concept are unacceptable.

Unacceptable examples,

- Computed tomography angiography of aorta, abdomen, pelvis and lower limb
- Ultrasonography of abdomen and ultrasonography of pelvis with transrectal ultrasonography
- Ultrasonography of pelvis and obstetric ultrasonography with transvaginal ultrasonography
- Ultrasonography of knee and Doppler ultrasonography of vein of lower limb

2.4.10.2.8.13 Imaging Adjustments for View, Projection, or Technique

It may be important, from both clinical and administrative perspectives, to capture variations or modifications of imaging technique. The variations may impact correct acquisition and interpretation of images.

Examples of modifications include:

- Axial (qualifier value)
- Skyline projection (qualifier value)
- Decubitus (qualifier value)

Post-coordination

Though these examples are qualifying values in *SNOMED CT*, they are not allowable for post-coordination of diagnostic imaging procedures.

2.4.10.2.9 Fully Specified Names for Procedures

When possible, the FSN for a procedure should name the action of the procedure (the method) first, and then the object that the action acts directly upon.

Anatomical site

An *anatomical site* is the direct object of the action. The word/s naming the site should follow the word/s naming the action.

For example,

- Repair of pulmonary artery (procedure). The action is *repair* and the site is *pulmonary artery*.

Device

A *device* is the direct object of the action. The word/s naming the device should follow the word/s naming the action. If there is a site that is not the direct object of the action, the word/s naming it, should come after the word/s naming the device.

For example,

- Introduction of catheter into pulmonary artery (procedure). The action is *introduction*, the direct object is *catheter*, and the indirect site is *pulmonary artery*.

Substance

A *substance* is the direct object of the action. The word/s that name the substance should follow the words that name the action. If there is a site that is not the direct object of the action, the word/s naming it should follow the word/s naming the substance.

For example,

- Injection of hormone into subcutaneous tissue (procedure). *Injection* is the action, *hormone* is the direct object, and *subcutaneous tissue* is the indirect site.

Morphologic abnormality

A *morphologic abnormality* is the direct object of the action. The morphology term should follow the action term. If there is a site, it should follow the morphology term.

For example,

- Excision of cyst of breast (procedure). *Excision* is the action, the direct object is the morphologic abnormality *cyst*, and *breast* is the site.
- Operation on aneurysm of carotid artery (procedure). The action is *operation*, the direct object is the morphologic abnormality *aneurysm*, and the site is *carotid artery*.

Past tense verbs and sentence types

A procedure concept should be a noun phrase that names the procedure. It should not contain information that it was done, or is to be ordered, carried out, or planned.

- Past tense verbal phrases should not be used to name procedures, since *past tense* invokes a temporal context, i.e. the procedure was done in the past. Any existing concepts with past tense verbs, should be moved to the Situation with explicit context hierarchy.
- Sentence function types, i.e. imperative, declarative, interrogative, or exclamatory are disallowed in procedure concepts.

Example,

- Excision of ganglion of tendon sheath of hand (procedure). This is an acceptable FSN expressed with a noun phrase.

Unacceptable example,

- *Hand tendon ganglion excised* indicates the procedure was done, as a past tense declarative statement. This should be in the Situation with explicit context hierarchy, not the Procedure hierarchy.

2.4.11 Qualifier Value*

Definition	Examples
One of several possible values for an attribute used to define concepts	<ul style="list-style-type: none"> • 7771000 Left (qualifier value) • 260389003 No reaction (qualifier value)

The *Qualifier value* hierarchy contains some of the concepts used as values for attributes. These concepts may be used as values of an attribute in a defining relationship in precoordinated and postcoordinated expressions.

The values for attributes may also be from other hierarchies.

For example,

- 18639004 |Left kidney structure (body structure)| has Left (qualifier value) for the attribute Laterality

However, 233604007 |Pneumonia (disorder)| has Lung structure (body structure) for the attribute Finding site (from the body structure hierarchy).

Number (qualifier value) hierarchy

Concepts to describe numeric values have been added as descendants of 260299005 |Number (qualifier value)|. While the FSN and PT for these concepts use numeric characters, the concepts represent descriptions of a number and are not actually numeric values. To reinforce this, a synonym with the textual description of the number is created for each concept.

For example,

- Zero point two is the synonym for 732349004 |0.2 (qualifier value)|

True numeric values

Textual descriptions of numbers provide a path to representing true numeric values, should that become an option.

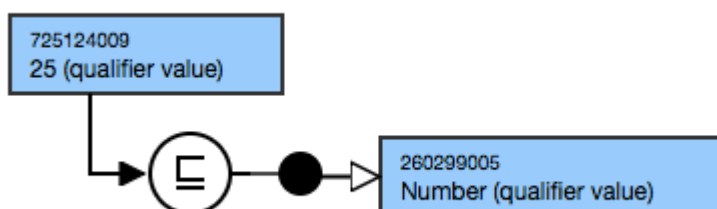
Modeling

Concepts representing numbers should be modeled with the proximal primitive pattern, and unless explicitly identified as an exception in the Editorial Guide, with the parent concept, 260299005 |Number (qualifier value)|. No exceptions have been identified.

Definition status	900000000000074008 Necessary but not sufficient concept definition status (core metadata concept)
	<ul style="list-style-type: none"> • Exceptions: none identified

For example,

- The following illustrates both the *stated* and *inferred* views:



Naming Conventions for Numeric Values

FSN

Use the following pattern for the FSN, with X = number to be represented

Trailing zeros are not allowed (e.g. 10, not 10.0). Preceding zeros are required (e.g. 0.5, not .5)

X (qualifier value)

Examples,

- 25 (qualifier value)
- 37.5 (qualifier value)
- 125 (qualifier value)

PT	Use the following pattern for the PT, with X = number to be represented Trailing zeros are not allowed (e.g. 10, not 10.0). Preceding zeros are required (e.g. 0.5, not .5) X Examples, <ul style="list-style-type: none"> • 25 • 37.5 • 125
SYN	A synonym representing the concept as a textual description is required Synonyms are not case sensitive. No commas or other punctuation is allowed. An exception is the dash Examples, <ul style="list-style-type: none"> • Twenty-five • Thirty-seven point five • One hundred and twenty-five

Unit of presentation (unit of presentation) hierarchy

The Unit of presentation hierarchy is used to support harmonization between *SNOMED CT's Drug Concept Model* and the *International Organization for Standardization's Identification of Medicinal Products (IDMP)* standards for product strength.

Unit dose

The Unit dose (qualifier value) is unacceptable for representing unit of presentation.

Modeling

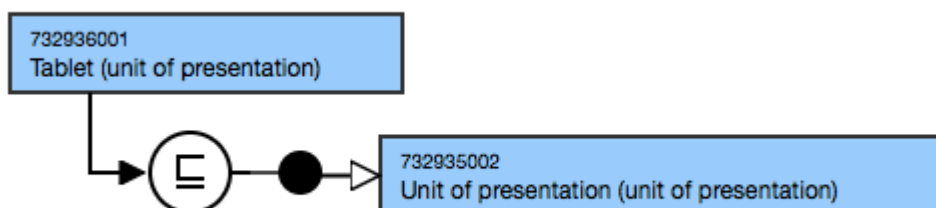
The Unit of presentation hierarchy is a descendant of 258666001 |Unit (qualifier value)| and 362981000 |Qualifier value (qualifier value)|. The hierarchy requires a (unit of presentation) semantic tag so that the concepts in the hierarchy can be distinguished from similar concepts in other hierarchies.

Concepts representing unit of presentation should be modeled with the proximal primitive pattern, and unless explicitly identified as an exception in the Editorial, with the parent concept, 732935002 |Unit of presentation (unit of presentation)|. No exceptions have been identified.

Definition status	900000000000074008 Necessary but not sufficient concept definition status (core metadata concept) <ul style="list-style-type: none"> • Exceptions: none identified
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For example,

- The following illustrates both the *stated* and *inferred* views:



Naming Conventions for Unit of Presentation	
FSN	Use the following pattern for the FSN, with X = unit of presentation X (unit of presentation) Examples, <ul style="list-style-type: none"> • Actuation (unit of presentation) • Capsule (unit of presentation) • Suppository (unit of presentation) • Tablet (unit of presentation)
PT	Use the following pattern for the PT, with X = unit of presentation X Examples, <ul style="list-style-type: none"> • Actuation • Capsule • Suppository • Tablet
SYN	Synonyms are not allowed unless explicitly identified as an exception in the Editorial Guide

Disposition (disposition) hierarchy

The Disposition hierarchy is required to support the remodeling of the Substance hierarchy. These concepts are used as the attribute values for the Has disposition attribute. They define grouper concepts of dispositions in the Substance hierarchy, and in other hierarchies. The (disposition) semantic tag is used to differentiate concepts in this hierarchy from similar concepts in other hierarchies.

Modeling

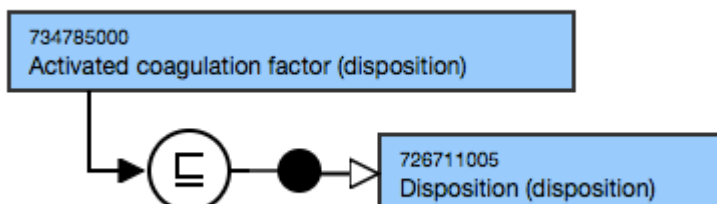
The hierarchy is a descendant of 362981000 |Qualifier value (qualifier value)|. It requires a (disposition) semantic tag to provide context.

Concepts representing disposition should be modeled with the proximal primitive pattern, and unless explicitly identified as an exception in the Editorial Guide, with the parent concept, 726711005 |Disposition (disposition)| or one of its descendants. No exceptions have been identified.

Definition status	900000000000074008 Necessary but not sufficient concept definition status (core metadata concept) <ul style="list-style-type: none"> • Exceptions: none identified
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For example,

- The following illustrates both the *stated* and *inferred* views:



Naming Conventions for Disposition	
FSN	Use the following pattern for the FSN, with X = disposition X (disposition) Examples, <ul style="list-style-type: none"> • Coagulation factor inhibitor (disposition) • Acute phase reactant (disposition) • Human immunodeficiency virus fusion inhibitor (disposition)
PT	Use the following pattern for the PT, with X = disposition X Examples, <ul style="list-style-type: none"> • Coagulation factor inhibitor • Acute phase reactant • HIV fusion inhibitor

✓ Modeling

Techniques, as qualifier values, should include the word *technique* in their FSNs.

For example,

- 702658000 |Microbial culture technique (qualifier value)|

Unit of mass (qualifier value) hierarchy

The *International System of Units unit of mass (qualifier value)* hierarchy has concepts representing metric *units of mass*. The concepts are modeled with the proximal primitive pattern and the parent, 258681007 |International System of Units unit of mass (qualifier value)|, unless explicitly identified as exceptions. *Metric units of mass* are used with concepts in the *SNOMED CT Medicinal product (product) hierarchy*.

Definition status	900000000000074008 Necessary but not sufficient concept definition status (core metadata concept) <ul style="list-style-type: none"> • Exceptions: none identified
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Since these descriptions are based on International System of Units (SI) terms, they are represented exactly like the SI terms. Consequently they do not follow *SNOMED CT* naming conventions, i.e. they are exceptions.

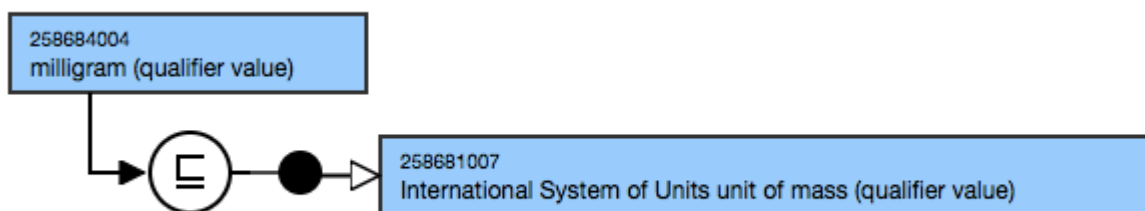
- An FSN should be lower case with case sensitivity, *ci*. It is the expanded form.
- A PT should be lower case with case sensitivity, *CS*. It is abbreviated without the expanded form.
- A SYN should be lower case with case sensitivity, *ci*. It is also the expanded form.

The naming pattern is as follows:

- FSN: X = lower case metric unit of mass
- PT: X = abbreviation of metric unit of mass
- SYN: X = lower case metric unit of mass

For example,

- 258684004 |milligram (qualifier value)|
 - FSN: milligram (qualifier value)
 - PT: mg
 - SYN: milligram



2.4.12 Record Artifact*

Definition	Examples
Clinical documents, or parts thereof	<ul style="list-style-type: none"> 422813005 Document section (record artifact) 416575001 Perioperative record (record artifact)

A *Record artifact* is an entity that is created by a person or persons for the purpose of providing other people with information about events or states of affairs.

In general, a record is *virtual*, that is, it is independent of its particular physical instantiation/s. It consists of information elements (usually words, phrases and sentences, but also numbers, graphs, and other information elements).

Record artifacts need not be complete reports or records. They can be parts of a larger Record artifact.

For example,

- A 184225006 |Computer record of patient (record artifact)| is a Record artifact that also may contain other Record artifacts in the form of individual documents or reports, e.g. 726738003 |Cytology report (record artifact)|. These may, in turn, contain more finely granular Record artifacts, such as sections, and even section headers e.g. 422813005 |Document section (record artifact)|.

2.4.13 Situation with Explicit Context

Definition	Examples
<ul style="list-style-type: none"> Concepts that include <i>context</i> information; a subtype of the situation to which it applies, with an attribute associating it with the relevant clinical finding or procedure 	<ul style="list-style-type: none"> 407565004 Angiotensin II receptor antagonist not tolerated (situation) 417886001 Treatment adjusted per protocol (situation)

Variable meanings according to context

Depending on context, concepts can be used in many different ways with various meanings.

A *disorder* concept can represent:

- Possible diagnosis or part of a differential diagnosis
- Diagnosis applied to a family member or some other contact person
- Diagnosis explicitly excluded
- Diagnosis, now known to be incorrect, but which was the basis for a particular course of treatment
- Absent feature of a related disorder
- Diagnosis that the patient believes or fears they have

A *procedure* concept can represent:

- Requested, recommended or planned procedure

- Procedure for which consent has been given or withheld
- Procedure that is contraindicated
- Procedure that has been canceled or postponed
- Procedure for which follow up is now being arranged
- Procedure which caused a complication

A *symptom* concept can represent:

- Confirmed absence of a symptom
- Symptom deduced and reported by a third party as a witness of a clinical event
- Inability or failure to obtain information about a symptom
- Symptom which the patient is advised to respond to in a particular manner

A *finding* concept can represent:

- Absence of a finding
- Inability or failure to check for a finding
- Finding which, if present, is to trigger a particular change in clinical management
- Finding which is the goal or target of a treatment

A *product* concept can represent:

- Allergy or other contraindication to a product
- Assertion that a product caused a particular side effect
- Various therapeutic activities of a product
- Instructions given to a patient for use of a non-prescription medication
- Clinical authorization of a prescription
- Issuing of a prescription for a course of treatment
- Supply (dispensing) of a specified quantity of a product
- Administration of a single dose of a product
- Change of a product dosage
- Discontinuation of a product
- Specialist's recommendation to use a particular product, if certain circumstances apply

2.4.13.1 Situation with Explicit Context Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 243796009 Situation with explicit context (situation)	
Domain Constraint	<< 243796009 Situation with explicit context (situation)
Parent Domain	-
Proximal Primitive Constraint	<< 243796009 Situation with explicit context (situation)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 243796009 Situation with explicit context (situation)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
408731000 Temporal context (attribute)	1	0..*	0..1	<< 410510008 Temporal context value (qualifier value)
408732007 Subject relationship context (attribute)	1	0..*	0..1	<< 125676002 Person (person)

Author View of Attributes and Ranges for 413350009 Finding with explicit context (situation)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
246090004 Associated finding (attribute)	1	0..*	0..1	<< 404684003 Clinical finding (finding) OR << 272379006 Event (event)
408729009 Finding context (attribute)	1	0..*	0..1	<< 410514004 Finding context value (qualifier value)
408731000 Temporal context (attribute)	1	0..*	0..1	<< 410510008 Temporal context value (qualifier value)
408732007 Subject relationship context (attribute)	1	0..*	0..1	<< 125676002 Person (person)

Author View of Attributes and Ranges for 129125009 Procedure with explicit context (situation)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
363589002 Associated procedure (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)
408730004 Procedure context (attribute)	1	0..*	0..1	<< 288532009 Context values for actions (qualifier value)
408731000 Temporal context (attribute)	1	0..*	0..1	<< 410510008 Temporal context value (qualifier value)
408732007 Subject relationship context (attribute)	1	0..*	0..1	<< 125676002 Person (person)

2.4.13.2 Situation with Explicit Context Defining Attributes

The following defining attributes correspond to the *Situation with Explicit Context Attributes Summary* table. The first two attributes are used with Situations, Findings, and Procedures with Explicit Context.

Temporal context

This attribute indicates the *time* of the procedure or finding. It may be *actual*, i.e. occurred in the present, in the past, at a specified time; or in the future, i.e. it is planned or expected. The most general value is simply Current or past (actual), meaning that the concept was actual (not planned or expected), but not specifying anything further about the time. The word *specified* in the Temporal context| means that there is a date or time stamp associated with the concept in the record. The date and/or time is a point and/or interval, that applies to the concept.

For example,

- 161550001 |History of hematuria (situation)| with Associated finding, Blood in urine (finding) and Temporal context, In the past (qualifier value)

Subject relationship context

This attribute is used to specify the subject of the Clinical finding or Procedure being recorded, in relation to the *subject of the record*.

For example,

- 161077003 |Father smokes (situation)| with Associated finding, Smoker (finding) and Subject relationship context, Father of subject (person)

The following two attributes are used with Findings with Explicit Context.

Associated finding

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

When Associated finding is used in post-coordinated expressions, its range is broader than when used in pre-coordinated content. Associated finding should not reference concepts that already have precoordinated context.

For example,

- 443999008 |Risk of exposure to communicable disease (situation)| with Associated finding, Exposure to communicable disease (event)

For example, to create the concept, History of thyroid disease in father,

- Subject relationship context (attribute) with the value, father (person)
- Associated finding (attribute), with the value, Disorder of thyroid gland (disorder)

Incorrect example,

- Using Family history with explicit context (situation),
 - Subject relationship context (attribute) with the value, father (person)
 - Associated finding with value, Family history: Thyroid disorder (situation)

Finding context

This attribute represents a situation in which a *Clinical finding* or *Event* is known or unknown. If known, whether it is present, absent, or uncertain (possible). It also represents that the finding is not actual, but anticipated or possible in the future.

For example,

- 161922009 |No cough (situation)| with Associated finding, Cough (finding) and Finding context, Known absent (qualifier value)

The following two attributes are used with Procedures with Explicit Context.

Associated procedure

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

For example,

- 183976008 |Operative procedure planned (situation)| with Associated procedure, Surgical procedure (procedure)

Procedure context

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

For example,

- 183976008 |Operative procedure planned (situation)| with Procedure context, Planned (qualifier value)

2.4.13.3 Situation with Explicit Context Modeling

SNOMED CT contains concepts that include *context* information and some that are regarded as *context-free*. A concept includes *context* information if the name of the concept explicitly represents information that might otherwise be represented by another less *context-rich* concept in a particular place within an electronic health record or EHR.

In *SNOMED CT*, *context* describes the effects of embedding a concept in a clinical situation, i.e. when it is used in an EHR.

For example,

- When the concept 22298006 |Myocardial infarction (disorder)| is used in an EHR it takes on a specific contextualized meaning. The meaning might be an assertion, by the person entering the information, that on a given date, the patient was diagnosed with a *myocardial infarction*. Or, it may be used to document a complication of smoking, a protocol for chest pain, a medication contraindication, a part of a patient's medical history, a possible diagnosis justifying a diagnostic test, a diagnosis excluded by a diagnostic test, a patient's family history, or etc.
- The concept for *breast cancer*, 254837009 |Malignant neoplasm of breast (disorder)|, might be used to indicate a current diagnosis of breast cancer, family history of breast cancer, or a past history of breast cancer. Each of these three meanings differs in regard to the *context* in which breast cancer is described.
 - Current diagnosis of breast cancer indicates that the breast cancer is present now, and in this patient.
 - Family history of breast cancer refers to breast cancer occurring in a family member of a patient.
 - Past history of breast cancer indicates that the breast cancer occurred in the patient, at some *time in the past*, and it is not necessarily present now.

Not only are the differences significant relative to a patient's health record, but they are also important to population-based data retrieval, e.g it is incorrect to retrieve those who have a family history of breast cancer when searching for patients with a diagnosis of breast cancer.

Default context

When a *SNOMED CT* concept appears in an EHR without any explicitly stated context, that concept is considered to have a *default context*. When a concept is entered into an EHR, the information in the health record structure or its information model, can override the default context.

The default context for a *Clinical finding* concept implies that the finding is present (vs. being absent), that it applies to the subject of the record (the patient), and that it is current (or at a specified time in the past, linked to the concept).

The default context for a *Procedure* concept implies that the procedure was completed, that it was performed on the subject of the record (the patient), and that it was done at the present time (or at a specified time in the past, linked to the concept).

Explicit context

In addition to default contexts, concepts in the *Situation* hierarchy (given the appropriate record structure) represent Clinical findings and Procedures that:

Have not yet occurred

For example,

- 165137000 |Endoscopy arranged (situation)|

Refer to someone other than the patient

For example,

- 160303001 |Family history: Diabetes mellitus (situation)|
- 395083002 |Discussed with next of kin (situation)|

Have occurred at some time prior to the time of the current entry in the record

For example,

- 161514008 |History of aortic aneurysm (situation)|

Attributes

These attributes are used to represent *Clinical finding* and *Procedure* in the Situation hierarchy.

	Clinical Finding	Procedure
Attributes	Associated finding	Associated procedure
	Finding context	Procedure context
	Subject relationship context	Subject relationship context
	Temporal context	Temporal context

Expressing context

Context typically alters the meaning of a concept, i.e. the resulting concept is no longer a subtype of the original concept.

Precoordinated expression. Clinical context is specified in the description and entered into a field in a patient's EHR.

For example,

- The *precoordinated expression* 266897007 |Family history: Myocardial infarction (situation)| might be put directly in a blank field in a patient's EHR. A family history of myocardial infarction is not a *subtype* of myocardial infarction, so *family history* modifies the context.
- The *precoordinated expression* 54355006 |Intracranial injury, without skull fracture (disorder)| might be put directly in a blank field in a patient's EHR. The disorder Intracranial injury, without skull fracture is not a *subtype* of skull fracture, so *without* modifies the context.

Postcoordinated expression. Clinical context is specified by combining concepts.

For example,

- 281666001 |Family history of disorder (situation)|, combined with 246090004 |Associated finding (attribute)| = 22298006 |Myocardial infarction (disorder)|. These two concepts indicate a family history of myocardial infarction.

Concept or expression in an EHR field. A concept is placed in a field with a predefined meaning in an electronic health record. The meaning is conveyed by the context in which it is recorded.

For example,

- *Hip replacement planned* might be represented as 397956004 |Prosthetic arthroplasty of the hip (procedure)| within a section of a patient's EHR called *Planned actions*. A planned hip replacement is not a kind of hip replacement, so the *Planned actions* record section modifies the context
- 2004005 |Normal blood pressure (finding)| might be placed in a field labeled as *Goal* in a patient's EHR. A goal of normal blood pressure is not a kind of Normal blood pressure (finding), so the *Goal* field in the EHR modifies context

Concepts in medical records

When a user places a concept from *SNOMED CT* in a patient's EHR, it transforms the concept from a theoretical representation of a clinical notion to an actual instance of the concept.

For example,

- If the concept 192644005 |Meningococcal meningitis (disorder)| is entered in a patient's EHR, it usually indicates that the patient has had an instance of this disease. Similarly the entry of 38102005 |Cholecystectomy (procedure)| would imply that the patient has undergone this procedure.

The placement of a concept in an EHR field may:

- Affect the quality of the meaning, but not the instance. The placement of 194828000 |Angina (disorder)| in a field labeled *Current problems*, *Past medical history*, or *History of* indicates that an instance of angina has occurred in the patient. The specific field affects the *quality* of the meaning, but not the instance. The adopted context is compatible with the *default context*.
- Critically affect the meaning and the instance. The placement of 49049000 |Parkinson's disease (disorder)| in a *Family history* field or 41339005 |Coronary angioplasty (procedure)| in a *Planned procedures* field does not indicate that an instance of the disorder or the procedure has occurred in the patient. The adopted context is incompatible with the *default context* (In these circumstances, the electronic health application programmer needs to identify the appropriate context values from a authoritative list and link them to the concepts placed in the fields to substitute for their default contexts).

When a *Situation with explicit context* concept is used in an EHR, it should contain all of the context attributes and applicable values in order to guarantee accurate meaning if that concept (plus context) is subsequently transferred to another record environment.

Elaboration: changing concept meaning

Elaboration in *SNOMED CT* refers to any addition to or change of the meaning of a concept that may be brought about when it is embedded in a clinical situation. Embedding a concept in a clinical situation may *elaborate* the semantic interpretation of a concept in one of the following ways:

1. Subtype qualification
2. Axis modification
3. Affirmation or Negation
4. Combination

Subtype qualification

Subtype qualification is elaboration that results in a concept that is a subtype of the original unelaborated *focus concept*. A focus concept is the part of a *SNOMED CT* expression that represents a clinical finding, observation, event, or procedure. It may be given context by a surrounding *context wrapper* and may be made more specific by a *refinement*.

For example,

- A past history of replacement of the left hip may be represented by a *SNOMED CT* expression in which the Focus concept, hip replacement is refined by *laterality*, *left* and enclosed in a context wrapper representing *past history*.

A subtype qualification refines the meaning of a concept.

For example,

- 71620000 |Fracture of femur (disorder)| may be elaborated by indicating whether the fracture is open or closed or whether it is the left or right femur that is fractured. A patient with an *open fracture of*

the neck of the left femur has a type of fracture of the femur. Refining the morphology, site, and laterality act as subtype qualifications.

- 708038006 |Acute exacerbation of asthma (disorder)| may be elaborated by adding *severity*. A patient with a severe exacerbation of asthma has a type of asthma exacerbation. *Severity* acts as a subtype qualification.
- 236886002 |Hysterectomy (procedure)| may be elaborated by specifying a priority and a surgical approach. A patient who had a *routine vaginal hysterectomy* had a type of *hysterectomy*; priority, i.e. routine, and approach, i.e. vaginal, *Priority* and *approach* are subtype qualifications.

Subtype qualification

Subtype qualification has also been considered a *qualifier* (e.g. ENV136060, GEHR, CTV3) or a *secondary status term* (e.g. NHS Context of Care). In *SNOMED CT*, *subtype* expresses more clearly the distinctive property of a qualifier. This is helpful because the meaning of *modify* and *qualify* are synonymous in many dictionaries and some International Organization of Standardization (ISO) authorities.

Axis modification

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

For example,

- The concept 22298006 |Myocardial infarction (disorder)| may be elaborated by including it in a clinical record specifying *family history*. A record of a *family history of myocardial infarction* does not imply that the patient has had any type of *myocardial infarction*. Therefore, *family history* changes the focus from the default context to a specified context.
- The concept 52734007 |Total replacement of hip (procedure)| may be elaborated by stating that the procedure is planned for some future date. A record of planned total hip replacement does not imply that the patient has actually had a total hip replacement, i.e. it is not the default context for a procedure.
- The concept 167272007 |Urine protein test not done (situation)| uses the context-modifying attribute Procedure context (attribute) and a value of Not done (qualifier value). This concept is not a subtype of 167271000 |Urine protein test (procedure)|, i.e. its axis (hierarchy) is modified.

Axis modification

Axis modification is not the same as *affirmation* (present) or *negation* (not present) of a concept, where the essential characteristics of the concept are unchanged.

Affirmation and Negation

Depending on perspective, *affirmation* and *negation* may simply be viewed as the inversion of meaning of an unelaborated concept that represents a *Clinical finding*. A concept may be stated in the *negative* in a clinical situation (e.g. *meningism not present*). This creates the potential for a concept to represent two meanings, one of which is the inverse of the other. However, the effects of negation on interpretation are far-reaching and distinct from other elaborations.

Negation, like axis modification, results in a concept that is not a subtype of the unelaborated concept. However, negation explicitly rules out the unelaborated concept.

For example,

- *Family history of myocardial infarction* does not imply that a patient had a myocardial infarction.
- *No headache* implies that *patient has headache* is untrue. A negative statement may expand further in the opposite direction of a positive statement. If *headache* is a subtype of pain then *patient has headache* implies *patient has pain*. However, *patient has no headache* does not imply *patient has no pain*. Conversely, *patient has headache* does not imply *patient has occipital headache*, but *patient has no headache* implies *patient does not have occipital headache*.

A *concept* may be stated to be possible in a *clinical situation*. Statements that explicitly indicate uncertainty can be considered in two possible ways:

- Somewhere between affirmation and negation
- As a type of elaboration

Combination

Two or more concepts may be embedded in a clinical situation in a way that links them together. Linkages may include:

- Simple combination of concepts
- Combination of a concept that is present and another that is absent

Context shift

Once a *concept* has *context-shifted* and become *context-dependent*, it should not be used in an expression, that once again shifts context. In other words, when one context attribute is given an axis modifying value, the other context attributes are fixed.

For example,

- The model for 430679000 |Family history of diabetes mellitus type 2 (situation)| is *ISA* situation-with-explicit-context with,
 - Subject relationship context, Person in the family (person)
 - Associated finding, Diabetes mellitus type 2 (disorder)
 - Finding context, Known present (qualifier value)
 - Temporal context, Current or past (actual) (qualifier value)

Even though the *Family* part of the concept results in an explicit axis shift of the Subject relationship context only, *SNOMED CT* requires default values for Finding context and Temporal context, rather than allowing them to be unspecified.

To negate a *concept* with Finding Context, Known Present (qualifier value), Finding Context becomes Known Absent (qualifier value).

For example,

- The concept 160273004 |No family history: Hypertension (situation)| negates 160357008 |Family history: Hypertension (situation)| by changing the value of Finding Context to Known Absent with Temporal Context, All times past (qualifier value). It is *ISA* Situation-with-explicit-context,
 - Temporal context, All times past (qualifier value)
 - Associated finding, Hypertensive disorder, systemic arterial (disorder)
 - Finding context, Known absent (qualifier value)
 - Subject Relationship Context, Person in family of subject (person)

Context attributes

When a Situation with explicit context concept is used in a electronic health application, it should contain all of the context attributes and applicable values in order to guarantee accurate meaning if that concept (plus context) is subsequently transferred to another record environment.

✔ **Modeling: Qualifier values**

Acceptable

- *Done and Not done*

For example,

- 164726002 |Visual testing done (situation)|
- 164853006 |Electrocardiogram not done (situation)|

- *Declined*

For example,

- 135814003 |Diuretic declined (situation)|

Unacceptable

- *Offered and Not offered*

✔ **Modeling: No known allergy**

The pattern is:

716186003 |No known allergy (situation)|

FSN: No known allergy (situation)

PT: No known allergy

SYN: NKA - No known allergy

No known X allergy (situation)

For example, 428197003 |No known insect allergy (situation)|

FSN: No known insect allergy (situation)

PT: No known insect allergy

2.4.14 SNOMED Model Component*

Definition	Types
Concepts and attributes necessary to organize and structure SNOMED terminology and its derivatives	<ol style="list-style-type: none"> 1. 900000000000442005 Core metadata concept (core metadata concept) 2. 900000000000454005 Foundation metadata concept (foundation metadata concept) 3. 106237007 Linkage concept (linkage concept) 4. 370136006 Namespace concept (namespace concept)

SNOMED Model component module (metadata)

- ▼ ● SNOMED CT Model Component (metadata)
 - ▼ ● Core metadata concept (core metadata concept)
 - ▶ ● Case significance (core metadata concept)
 - ▶ ● Characteristic type (core metadata concept)
 - ▶ ● Definition status (core metadata concept)
 - ▶ ● Description type (core metadata concept)
 - ▶ ● Identifier scheme (core metadata concept)
 - ▶ ● Modifier (core metadata concept)
 - ▶ ● Module (core metadata concept)
 - ▼ ● Foundation metadata concept (foundation metadata concept)
 - ▶ ● Reference set (foundation metadata concept)
 - ▶ ● Reference set attribute (foundation metadata concept)
 - ▼ ● Linkage concept (linkage concept)
 - ▶ ● Attribute (attribute)
 - ▶ ● Link assertion (link assertion)
 - ▼ ● Namespace concept (namespace concept)
 - ● Core Namespace (namespace concept)
 - ● Extension Namespace {1000000} (namespace concept)
 - ● Extension Namespace {1000001} (namespace concept)
 - ● Extension Namespace {1000002} (namespace concept)
 - ● Extension Namespace {1000003} (namespace concept)
 - ● Extension Namespace {1000004} (namespace concept)

Core metadata concept

Subtypes of [900000000000442005 |Core metadata concept \(core metadata concept\)|](#) provide structural information required to support International Release data. This supporting information includes sets of enumerated values that apply to attributes of concepts, descriptions, and relationships.

Foundation metadata concept

Subtypes of the [900000000000454005 |Foundation metadata concept \(foundation metadata concept\)|](#) provide supporting metadata and structural information for derivative release structures including Reference Sets.

Linkage concept

A [106237007 |Linkage concept \(linkage concept\)|](#) links two or more concepts to express compositional meanings. All concept codes that can be used as a *Relationship Type* are included under Linkage concept. The Concept Model attributes are approved for use.

Linkage concept is a subclass of *SNOMED CT* model component. The Linkage concept hierarchy has the sub-hierarchies:

- Attribute (attribute)
- Link assertion (link assertion)

Linkage concept attributes

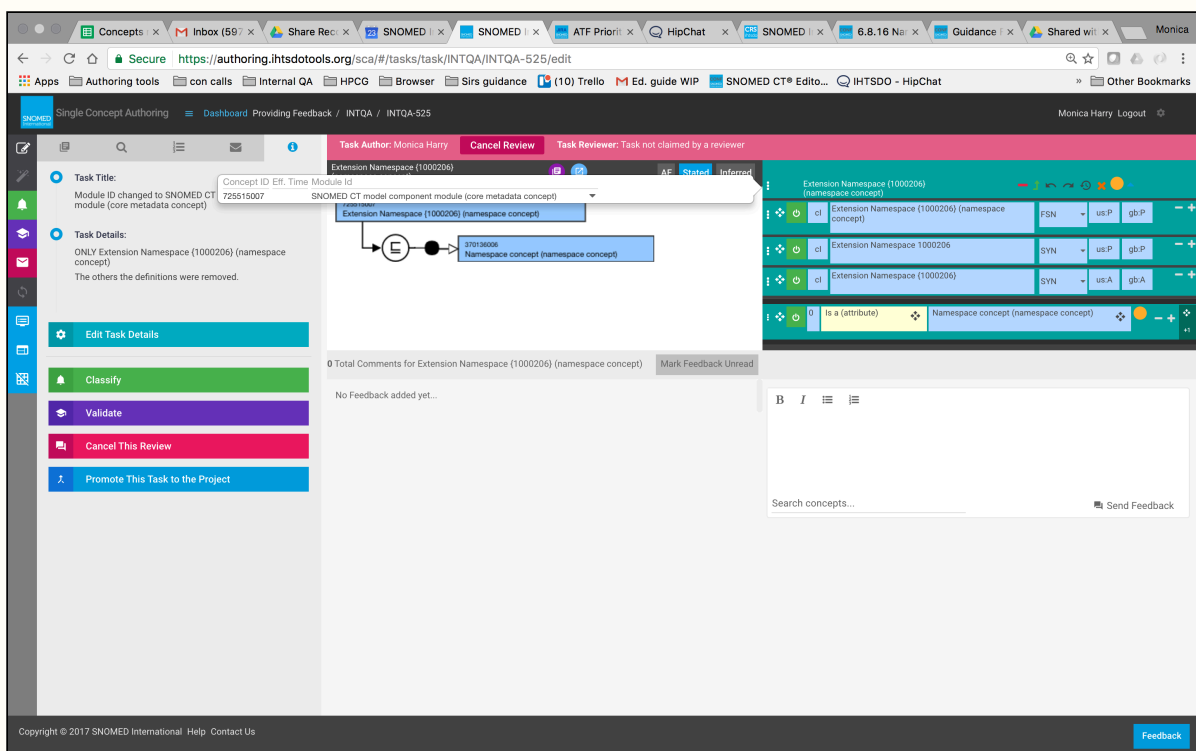
Concepts in the Linkage concept sub-hierarchy are used to construct relationships between two *SNOMED CT* concepts, i.e. they indicate the relationship type between those concepts. Some attributes (relationship types) can be used to logically define a concept (defining attributes).

Namespace concept

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

For more information

New namespace concepts are requested via *Freshdesk*. An internal author adds new IDs as received. It is also necessary to change the Module ID per the following:



For further details search for *Change or Add to SNOMED CT* on the IHTSDO website at: <http://www.snomed.org/snomed-ct/learn-more>.

2.4.15 Social Context*

Definition	Examples
Social conditions and circumstances related to healthcare Subtypes include: ethnic group, lifestyle, occupation, person, racial group, religion/philosophy, social concept	<ul style="list-style-type: none"> 413465009 Afro-Caribbean (ethnic group) 116060000 Eating habit (life style) 24413000 Carpenter, general (occupation) 133932002 Caregiver (person) 415794004 Unknown racial group (racial group) 61154002 Hinduism (religion/philosophy) 22575004 Middle class economic status (social concept)

Social Context

These concepts represent social aspects affecting patient health and treatment.

2.4.16 Special Concept*

Definition	Examples
Inactive and navigational (support locating concepts in hierarchies) concepts	<ul style="list-style-type: none"> 363664003 Erroneous concept (inactive concept) 394899003 Oral administration of treatment (navigational concept)

Inactive concepts

Inactive concepts are no longer active in the terminology. Subclass concepts indicate the reason a concept is inactive.

Navigational concepts

The concepts in navigational hierarchies are used for structured data entry. They can order data by priority or another convention (e.g. *cranial nerve order* or *topics related to diabetes*).

Navigational concepts exist only to support navigation. They:

- Are not suitable for recording or aggregating information
- Are direct subtypes of the concept 363743006 | Navigational concept (navigational concept)
- Have no other supertype or subtype relationships
- Are linked to other concepts only by navigational links

2.4.17 Specimen*

Definition	Examples
Entities that are obtained (usually from patients) for examination or analysis	<ul style="list-style-type: none"> 384744003 Lymph node from sentinel lymph node dissection and axillary dissection (specimen) 122880004 Urine specimen obtained by clean catch procedure (specimen)

Specimen concepts can be defined by attributes which specify the:

- Normal or abnormal body structure from which they are obtained
- Procedure used to collect the specimen
- Source from which it was collected
- Substance of which it is comprised

2.4.17.1 Specimen Attributes Summary

When authoring in this domain, these are the approved attributes and allowable ranges. They are from the Human Readable Concept Model (HRCM).

Domain Information for 123038009 Specimen (specimen)	
Domain Constraint	<< 123038009 Specimen (specimen)
Parent Domain	-
Proximal Primitive Constraint	<< 123038009 Specimen (specimen)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 123038009 Specimen (specimen)					
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint	
118168003 Specimen source morphology (attribute)	1	0..*	0..1	<< 49755003 Morphologically abnormal structure (morphologic abnormality)	
118169006 Specimen source topography (attribute)	1	0..*	0..1	<< 442083009 Anatomical or acquired body structure (body structure)	
118170007 Specimen source identity (attribute)	1	0..*	0..1	<< 125676002 Person (person) OR << 35359004 Family (social concept) OR << 133928008 Community (social concept) OR << 276339004 Environment (environment) OR << 260787004 Physical object (physical object)	
118171006 Specimen procedure (attribute)	1	0..*	0..1	<< 71388002 Procedure (procedure)	
370133003 Specimen substance (attribute)	1	0..*	0..1	<< 105590001 Substance (substance)	

2.4.17.2 Specimen Defining Attributes

The following defining attributes correspond to the *Specimen Attributes Summary* table.

Specimen source morphology

Specimen source morphology specifies the morphologic abnormality from which a specimen is obtained.

For example,

- 447407009 |Specimen from necrotic tissue (specimen)| has the Specimen source morphology, Necrosis (morphologic abnormality)

Specimen source topography

Specimen source topography specifies the body site from which a specimen is obtained.

For example,

- 16209771000119101 |Specimen from left lower lobe of lung obtained by bronchoalveolar lavage procedure (specimen)| has the Specimen source topography, Segment of lower lobe of left lung (body structure)

Specimen source identity

Specimen source identity specifies the type of individual, group, or physical location from which a specimen is collected.

For example,

- 419695002 |Environmental swab (specimen)| has the Specimen source identity, Environment (environment)

Specimen procedure

Specimen procedure identifies the procedure by which a specimen is obtained.

For example,

- 384744003 |Lymph node from sentinel lymph node dissection and axillary dissection (specimen)| has the Specimen procedure, Dissection procedure (procedure)

Specimen substance

Specimen substance specifies the type of substance of which a specimen is comprised.

For example,

- 110897001 |Bone marrow cytological material (specimen)| has the Specimen substance, Bone marrow fluid (substance)

2.4.18 Staging and Scales*

Definition	Examples
Used for results of evaluation procedures; includes assessment and tumor staging scales	Assessment <ul style="list-style-type: none"> • 273472005 Functional status index (assessment scale) Staging <ul style="list-style-type: none"> • 254294008 Tumor-node-metastasis (TNM) head and neck tumor staging (tumor staging)

Assessment scale requests

- Generally, requests to add current, i.e. latest, versions of Assessment Scale concepts, are accepted.
- Updated versions of existing content are also accepted.
- Older versions may be added, if justification is appropriate.

Modeling

Concepts of the type Assessment using X assessment scale are modeled with a proximal primitive parent of Assessment with 445536008 |Assessment using assessment scale (procedure)| or one of its subtypes, as appropriate.

For example,

- 445719003 |Assessment using visual analog pain scale (procedure)|

⚠ For more information

Please see Content Tracker item *IHTSDO-882* for information on developing concept models for assessment scales.

(See also *Why is Content Rejected* page, *Proprietary Names* for information about use of Questionnaire and Scale names)

2.4.19 Substance

Definition	Examples
Active chemical constituents of allergens, agents, substances, chemicals, drugs, and materials (not Pharmaceutical/Biological Products)	<ul style="list-style-type: none"> 116272000 Dietary fiber (substance) 52454007 Albumin (substance)

Concepts from the Substance hierarchy are used to represent general substances and chemical constituents of Pharmaceutical / biologic products, which are in a separate hierarchy.

Combined substances

In order to add a combined substance to the Substance hierarchy, the physiologic or biologic action of the combination must be enhanced or synergistic. Combinations that do not have an enhanced or synergistic effect (e.g. combinations created for convenience) are unacceptable.

For example,

- Acceptable combined substances include:
 - 703744001 |Ampicillin and sulbactam (substance)|
 - 703743007 |Piperacillin and tazobactam (substance)|

⚠ Out of scope

Substances of the pattern *X molecule of Y organism (substance)* that are not used in human medicine are out of scope of *SNOMED CT*.

For example,

- Ribonucleic acid of Porcine respiratory and reproductive syndrome virus (substance)

When an author is creating a new concept and there is no exact match in the Substance hierarchy to the substance being named in the FSN then a new substance concept should be created. The FSN and PT of the new substance concept should be the same as that used in the FSN.

Terminology in new concepts should match the terminology used as the FSN and PT of the substance concept selected as the causative agent.

For example,

- 418689008 |Allergy to grass pollen (disorder)|
- modelled with |Causative agent|
- 256277009 |Grass pollen (substance)|

2.4.19.1 Substance Attribute Summary

When authoring in this domain, this is the approved attribute and allowable range. It is from the Human Readable Concept Model (HRCM).

Domain Information for 105590001 Substance (substance)	
Domain Constraint	<< 105590001 Substance (substance)
Parent Domain	-
Proximal Primitive Constraint	<< 105590001 Substance (substance)
Proximal Primitive Refinement	-

Author View of Attributes and Ranges for 105590001 Substance (substance)				
Attribute	Grouped	Cardinality	In Group Cardinality	Range Constraint
726542003 Has disposition (attribute)	0	0..*	0..0	<< 726711005 Disposition (disposition)
738774007 Is modification of (attribute)	0	0..*	0..0	<< 105590001 Substance (substance)

2.4.19.2 Substance Defining Attributes

Editorial guidelines draft

Editorial guidelines are in development for the Substance hierarchy.

The current Substance editorial guidelines draft is located on the Substance Project Confluence space at: [Reference Documentation - Substances](#)

The following defining attributes corresponds to the *Substance Attribute Summary* table.

Has disposition

This attribute enables the creation of an association between a substance concept and a disposition (A disposition is defined as a behavior that a substance will exhibit or participate in, given the appropriate context).

Is modification

This attribute indicates that the concept is a structural modification of another concept.

2.4.19.3 Substance Naming Conventions

Route of administration, Dose form

Substance descriptions should not refer to route of administration or dose form (e.g. inhaled, topical, oral, etc.). These attributes are applicable to product formulations, not substances.

 **Total**

Descriptions, including fully specified names (FSN), Preferred terms (PT), and/or synonyms (SYN), in the Substance hierarchy should not contain the word *total*. Due to the inability to differentiate and create appropriate relationships between the *base* substance and *total* substance (e.g. *cholesterol* versus *total cholesterol*) in this hierarchy, existing concepts were inactivated. Concepts containing the word *total* (e.g. *total cholesterol*) should not be added to the Substance hierarchy.

DNA and RNA

Naming conventions for deoxyribonucleic acid (DNA), ribonucleic acid (RNA), ribosomal RNA			
	DNA of X organism	RNA of X organism	Ribosomal RNA of X organism
FSN	Deoxyribonucleic acid of X organism (substance)	Ribonucleic acid of X organism (substance)	Ribosomal ribonucleic acid of X organism (substance)
PT	US/GB, with initial letter case sensitive: X organism DNA	US/GB, with initial letter case sensitive: X organism RNA	US/GB, with initial letter case sensitive: X organism rRNA
SYN	Matches FSN	Matches FSN	Matches FSN
Parent concept	Most distal appropriate descendant of 118249006 Microbial deoxyribonucleic acid (substance)	Most distal appropriate descendant of 118248003 Microbial ribonucleic acid (substance)	Most distal appropriate descendant of 118251005 Microbial ribosomal ribonucleic acid (substance)

Antibodies and antigens

Naming conventions for antibodies and antigens				
	Antigen of X organism	Surface antigen of inactivated X organism	Antibody to X organism	Immunoglobulin G, M, A, E, D antibody to X organism
FSN	<ul style="list-style-type: none"> Antigen of X organism (substance) 	Surface antigen of inactivated X organism (substance)	Antibody to X organism (substance)	Immunoglobulin G, M, A, E, D antibody to X organism (substance)
PT	US/GB, with initial letter case sensitive: X organism antigen	US/GB, with initial letter case insensitive: Inactivated X organism surface antigen	US/GB, with initial letter case sensitive: X organism antibody	US/GB, with initial letter case sensitive: X organism IgG, M, A, E, D
SYN	<ul style="list-style-type: none"> Matches FSN With initial letter case sensitive: X organism antigen With initial letter case sensitive: X organism surface Ag (antigen) 	<ul style="list-style-type: none"> Matches FSN With initial letter case insensitive: Surface antigen of inactivated X With initial letter case insensitive: Inactivated X organism surface Ag (antigen) 	<ul style="list-style-type: none"> Matches FSN Anti-X antibody With initial letter case sensitive: X organism antibody With initial letter case sensitive: X organism Ab (antibody) 	<ul style="list-style-type: none"> Matches FSN Anti-X organism IgG, M, A, E, D
Parent Concept	Most distal appropriate descendant of 116633006 Microbial antigen (substance)	Most distal appropriate descendant of 116633006 Microbial antigen (substance)	Most distal appropriate descendant of 116642004 Antimicrobial antibody (substance)	<ul style="list-style-type: none"> Most distal appropriate descendant of 399812006 Antibody class (substance) X species antibody (substance) if in <i>SNOMED CT</i>

Naming conventions for antivenom

Antivenin and antivenom concepts in the Substance hierarchy should be descendants of Antivenin (substance).

- Use *antivenom*, not antivenin, for FSNs and Preferred Terms
 - FSNs should be based on the scientific name, if there is a one-to-one correspondence.
 - Preferred Terms are based on the common name.
 - Synonyms are based on the scientific name.
 - Synonyms containing antivenin are not created routinely, but may be created upon request.
- Existing concepts that are not consistent with this naming convention are corrected by batch.
- Naming conventions for polyvalent antivenoms (effective against multiple organisms) do not comply with this naming convention, and are evaluated on a case-by-case basis.



Reference

Current version of *WHO Guidelines for the Production, Control and Regulation of Snake Antivenom Immunoglobulins*.

3 Style Guide

3.1 General Naming Conventions

Naming conventions should follow the *Style Guide*. In general:

- Be consistent and reproducible
- Follow *natural* or human language when possible
- Be unambiguous to users
- Be clear for translation purposes

Word order

Naming conventions should not be based on word order preferences (e.g. to search or display). Creating multiple word order variants for these purposes is outside the scope of the *International Release of SNOMED CT*.

3.2 Abbreviations

Abbreviations are shortened forms of words or phrases. Because they may not be understood by all users, they allow for misinterpretation. Consequently they are not permitted in fully specified names (FSN). They are not allowed in preferred terms (PT) or synonyms (SYN) unless they are accompanied by the fully expanded term.

Exceptions

Abbreviations are allowed in FSNs when they are:

- Part of an official name of an organization or instrument
- Part of the approved name for bacterial subspecies

For example,

- *Salmonella enterica* subsp. *indica* (organism)
- Representing an immunoglobulin

For example,

- IgG for immunoglobulin G

Acronyms

FSNs

Acronyms are a specific type of abbreviation. They are formed from the initial letters of words and may be pronounced as words.

For example,

- CT of head is the preferred term for Computed tomography of head (procedure)

Acronyms can be misinterpreted because they are not fully spelled out and have different meanings in different situations. Acronyms are not allowed in FSNs.

Exception

An acronym is allowed in an FSN when it has become a word in its own right, i.e. included in dictionaries; understood without expansion to its original full form (e.g. Laser device (physical object)).

Preferred terms and synonyms

Acronyms are allowed in PTs or SYNs when accompanied by the fully expanded term.

- Acronyms that stand alone, i.e. have no other text in the description are followed by a space-hyphen-space, then the fully expanded term.

For example,

- ROS - removal of suture is a synonym for 30549001 |Removal of suture (procedure)|
- 387727008 |Intermittent positive pressure breathing treatment (regime/therapy)| has the synonym, IPPB - intermittent positive pressure breathing therapy

Modeling

The first word after the dash should be lower case as per usual capitalization rules.

- Those that have additional text are to be followed by a space then the expanded form in parentheses.

For example,

- Nontraumatic AKI (acute kidney injury) is a synonym for 140031000119103 |Acute nontraumatic kidney injury (disorder)|

Modeling

Only the fully expanded term, not the acronym, should be in parentheses.

3.3 Articles

Descriptions should not include articles, e.g *an* and *the*.

For example,

- Neoplasm of respiratory tract (disorder), not neoplasm of the respiratory tract
- Rupture of diaphragm (disorder), not rupture of the diaphragm

Legacy descriptions

There are legacy descriptions that contain articles such as *the*. They will be corrected over time.

3.4 Capitalization

The first word in all descriptions should be capitalized, unless it would change the meaning (e.g. pH measurement). The rest of the words in the description should be lower case.

Although this is generally true, names of people, organizations, taxonomic groups (e.g. species, genus, family), abbreviations, and some other descriptions should have the proper case. The following values, part of the *SNOMED CT* model component domain, provide details.

Case Sensitivity			
Case Sensitivity Indicator	Values	Meaning	Examples
cl	900000000000020002 Only initial character case insensitive (core metadata concept)	First letter of the description may or may not be capitalized; Cannot change the case of the rest of the description	<ul style="list-style-type: none"> Family history: Alzheimer's disease (situation) Born in Australia (finding) Neonatal jaundice with Dubin-Johnson syndrome (disorder) Borderline abnormal ECG (finding)
CS	90000000000017005 Entire term case sensitive (core metadata concept)	Cannot change any case in the description	<ul style="list-style-type: none"> Addison's disease (disorder) Down syndrome (disorder) English as a second language (finding) Angiokeratoma of Fordyce (disorder) WBC enzyme determination (procedure) pH measurement (procedure) mm (qualifier value)
ci	900000000000448009 Entire term case insensitive (core metadata concept)	<p>Entire description may be lower case</p> <p>Descriptions contain names of things which do not require either capitalization at the beginning of or anywhere else in any word, i.e. there are not proper names, abbreviations, or etc.</p>	<ul style="list-style-type: none"> Fracture of tibia (disorder) Abdominal aorta angiogram (procedure)

Case sensitivity

Case sensitivity can be changed on an existing description without inactivating it.

SNOMED CT descriptions representing assessment scales and staging systems should be capitalized per the name of the scale or staging system. Legacy concepts may not follow this pattern.

For example,

- Ages and Stages Questionnaires Third Edition (assessment scale)
- Fagerstrom test for nicotine dependence (assessment scale)
- National Cancer Institute histologic grading system (staging scale)
- Clark system for melanoma staging (staging scale)

Gram staining is a common laboratory technique used to differentiate bacteria based on their cell wall constituents. Laboratory test results may be *Gram positive* or *Gram negative*. The technique was developed by a Danish physician, Hans Christian Gram. Consequently *Gram*, when referring to the technique, should always begin with an upper case *G*.

3.5 Eponyms

Eponyms are names that are derived from proper names (usually the person who made the discovery or created the original description). They are found in many areas of medical terminology, including anatomic structures, morphologic abnormalities, diseases, findings, and procedures (e.g. Rutherford Morison's pouch, vein of Galen, Aschoff body, Kell blood group, Down syndrome, Moro reflex, and Whipple procedure).

It is neither desirable nor possible to completely avoid using eponyms in a health terminology; although, if possible, they should be avoided. This helps to improve clarity of meaning and to facilitate translation to other languages. Fully specified names (FSN) should be full descriptions, whereas synonyms may be eponymous terms.

For example,

- Structure of great cerebral vein (body structure) has the synonym Vein of Galen
- Complete trisomy 21 syndrome (disorder) has the synonym Down syndrome
- Pancreaticoduodenectomy (procedure) has the synonym Whipple procedure

It is permitted and encouraged to include eponyms as descriptions (non-FSN descriptions) whenever they are understandable, reproducible, and useful in a given context.

Exceptions

Exceptions require careful consideration since eponyms meanings may change over time. They are allowed when:

- The full description is exceptionally long and unwieldy (e.g. Hemi-Fontan operation (procedure) instead of *bidirectional Glenn shunt with end-to-side anastomosis of proximal superior vena cava to right pulmonary artery with isolation from right atrium*).
- The eponym is the only precise, clinically relevant name available.
- A non-eponymous name would necessarily be vague or subject to misinterpretation (e.g. Hodgkin lymphoma, Burkitt lymphoma).
- A brand name has become an eponym. In this case, some brand names have come to stand for a category of product and not the particular brand itself (e.g. in US English, Kleenex, Band-Aid, or Popsicle).
 - These *proprietary* eponyms may be included in the International Release as descriptions (non-FSN descriptions) if they meet the criteria for international inclusion.
 - They should follow the same rules as other eponyms. Whenever possible, they should not be included in FSNs (e.g. plastic adhesive bandage strip for Band-Aid).

3.6 Patient vs Subject

Descriptions should use the word *subject*, not *patient*, if required. Subject is broader than patient.

For example,

- 420058008 |Provider of history other than subject (person)|

Subject refers to the subject of record, who may, in some circumstances, not be the patient.

3.7 Plurals

Fully specified names (FSNs)

In general, concepts are represented in the singular, rather than the plural.

For example:

- Disorder of lung (disorder), not disorder of lungs
- Acute cholecystitis due to biliary calculus (disorder), not biliary calculi

FSNs should not be plural unless the concept necessarily involves multiples.

Unintended plurals

Unintended plurals might be incorrectly interpreted. An unintended plural is the use of a plural when, in fact, there is only one entity.

Correct example,

- *Multiple cranial nerve palsies*; the word *multiple* indicates that there can never be just one, so the plural *palsies* is correct

Incorrect example,

- *Trochlear lesion* versus *trochlear lesions*; users would use this concept to refer to a single trochlear lesion, thus the plural form would be incorrect

Exceptions

Organizational nodes or grouper concepts may be plural.


For example,

- 234320004 |Procedures for splenic lesions (procedure)|
- 194732001 |Diseases of mitral and aortic valves (disorder)|, has IS A 195002007 |Multiple valve disease (disorder)|

A concept that necessarily involves multiples should have a plural FSN.

For example,

- Bilateral atrophy of testes (disorder)

 It is advisable to keep track of these exceptions in a separate subset or using a special term type, so that they can be excluded when the singular/plural distinction is important for mapping.

3.8 Punctuation

Comma (,)

A comma is allowed in an FSN when required for meaning or to add clarity.

For example,

- Computed tomography of head, neck, abdomen and pelvis (procedure)

A comma is not allowed to change *sort order* for use in the search function.

Unacceptable example,

- Frostbite, acute

Apostrophe (')

Eponymous descriptions should not include an apostrophe or final *s*, unless the name normally ends in *s*. With rare exception, a concept with an eponym should have at least one description that follows this rule.


For example,

- Down syndrome, a synonym for Complete trisomy 21 syndrome (disorder)
- Sjogren syndrome (disorder)
- Meigs syndrome (disorder)

When common usage requires it, there should be at least one description that has the apostrophe *s*. For descriptions with a possessive apostrophe where the name normally ends in *s*, the apostrophe should follow the *s*.

For example,

- Alzheimer's disease (disorder)
- Bowen's disease (disorder)
- Reiter's disease (disorder)
- Meigs' syndrome (disorder)

 Existing eponymous descriptions with the possessive *s*, but no apostrophe, need not be inactivated, but newly added descriptions should either have no *s*, or else include the apostrophe.


Special character (<, >, &, %, \$, @, #)

The special characters <, >, &, %, \$, @, # are not permitted in FSNs. All instances of FSNs with these characters should be spelled out in full text.

For example,

- FD&C Yellow #2 should be FD and C Yellow Number Two

The characters &, %, and # are permitted in preferred terms or synonyms.

 The characters @ and \$ are not used in any descriptions.

Hyphen and dash (-)

A *hyphen* is used to join words and to separate syllables. Hyphens may be used in FSNs with no space before and after the hyphen. Hyphens should also follow rules of style for the dialect and language in which the descriptions are used.

For example,

- Anti-infective agent (product)
- Zollinger-Ellison syndrome (disorder)
- Zellweger's-like syndrome (disorder)
- Tick-borne hemorrhagic fever (navigational concept)
- Phospho-2-dehydro-3-deoxygluconate aldolase (substance)

A *dash* may be used to separate two phrases or names, to contrast values, to show a relationship between two things, or to separate ranges of values. A dash should not be used in an FSN, with rare exception (e.g. Urine: red - blood is an FSN), because it may obscure the exact meaning of the description. The dash should be replaced with words that clarify the meaning.

For example,

- Four alternative disability and speech-reading test (procedure) has the *Synonym* FADAST - Four alternative disability and speech-reading test
 Note: This description uses a hyphen, between *speech* and *reading*, which is appropriate for an FSN.
- Disability assessment schedule (assessment scale) has the *Synonym* DAS - Disability assessment schedule
- Communication Activities of Daily Living (assessment scale) has the *Synonym* CADL - Communication Activities of Daily Living

Exceptions

When there is a need to distinguish categories from more specific subtypes with the same name, a dash followed by the word *category*, may be used.

Examples,

- Malignant glioma - category (morphologic abnormality) distinguishes the category of malignant gliomas from those neoplasms that are called Glioma, malignant (morphologic abnormality). The neoplasm called malignant glioma is one of several subtypes of the malignant glioma - category, and does not have the same meaning as the category itself.
- Metanephrine - category (substance) distinguishes the category of metanephrine from those substances that are called metanephrine. The substance called metanephrine is one of several subtypes of the metanephrine - category, and does not have the same meaning as the category itself.

Colon (:)

Colons, in general, should not be used in FSNs.

Exceptions

Colons are allowed in the FSNs of organisms, substances, or products where the colon is part of the name. They are also allowed in ratios and in tumor stages.

For example,

- Salmonella II 43:g,t:[1,5] (organism)
- Lidocaine hydrochloride 1.5%/epinephrine 1:200,000 injection solution vial (product)
- pT3: tumor invades adventitia (esophagus) (finding)

Colons may be allowed in non-FSN descriptions.

For example, to separate an abbreviation from the rest of a name or a specimen from the finding.

- Urine: red - blood (finding)

Forward slash (/)

The forward slash should not be used in FSNs. When the slash is part of the authoritative name (e.g. representation of heterozygosity in hemoglobinopathies), a hyphen (no space before or after) is used in the FSN. The forward slash, without spaces, may be used in a preferred term or synonym.

For example:

- FSN: Sickle cell-hemoglobin C disease (disorder)
- SYN: Hemoglobin S/C disease
- FSN: Per cubic millimeter (qualifier value)
- SYN: /mm³

Exceptions

A forward slash may be used to represent units of measure and laboratory test results. They may also be used in *and/or* when part of FSNs. There should be no space either before or after the slash.

For example,

- Nitroglycerin 0.3mg/hr disc (product)
- Ibuprofen 5%/Levomethol 3% gel (product)
- Milligram/deciliter haptoglobin (qualifier value)
- Bone structure of head *and/or* neck (body structure)

A forward slash may be allowed in non-FSN descriptions in a variety of contexts. Some common examples of use are in acronyms with findings, and as an abbreviation meaning *and/or* concepts.

Plus sign (+)

Plus sign

Plus signs are no longer in use. They may be present in legacy descriptions.

Caret symbol (^)

A pair of caret symbols is used to enclose character strings that should display as superscript.

For example,

- Technetium Tc^{99m} labeled carbon (substance)
- Blood group antigen Sd^a (substance)

The single caret is used to represent exponents, i.e. *powers of*, in alignment with the Unified Code for Units of Measure (UCUM) guidance on the use of powers of ten.

For example,

- 10³ for the third power of ten

Pipe character (|)

A description cannot contain a pipe character, |. Since the | is used to indicate the beginning and end of a description, it may cause confusion.

Umlaut (¨)

An umlaut should only be accepted for terms that do not have equivalences in English. Synonyms without umlauts should be added to facilitate searching in English.

For example,

- 83901003 |Sjögren's syndrome (disorder)| and one of its synonyms, Sjogrens syndrome

3.9 Sentence Types

Concepts should be names or short noun phrases. Full statements or sentences are unacceptable.

Procedure concepts should not contain phrases that can be categorized as a sentence function type, i.e. imperative, declarative, interrogative, or exclamatory. A procedure description should be a noun phrase that names the procedure, and should not contain information that it was done, or is to be ordered, carried out, or planned.

For example,

- 11227005 |Excision of ganglion of tendon sheath of hand (procedure)| is a noun phrase giving the proper description for the procedure

Unacceptable example,

- Hand tendon ganglion excised (situation) indicates the procedure was done, as a past tense declarative statement

This is a situation with explicit context, not a procedure.

3.10 US vs. GB English

All fully specified names (FSN) should be represented in US English. When there is a difference between the US and GB spelling, there should be US and General British (GB) preferred terms (PT) and/or synonyms (SYN).

For example:

- FSN: Benign tumor of endocrine pancreas (disorder)
- PT-US: Benign tumor of endocrine pancreas

- PT-GB: Benign tumour of endocrine pancreas

Proper nouns

Where an FSN represents the name of an organization or trademarked name, a synonym with variant GB or US spelling is not required.

References for Spelling		
	References	Notes
US-GB differences	Wikipedia, the free encyclopedia* *Note: Wikipedia may be used as a starting point, or source, for authoritative references, but not as an actual reference	<ul style="list-style-type: none"> • First point of reference • Provides a summary for authors, addresses many US-GB spelling differences, and provides references
US Medical English	Stedman's Medical Dictionary Merriam-Webster Online Dictionary American Medical Association (AMA) Manual of Style	NA
GB English	Dorland's Medical Dictionary - medical terminology Chambers 21st Century Dictionary - general	NA

Oxford English Dictionary

Oxford English Dictionary spelling is different from British English. A summary of the points of difference can be found at http://en.wikipedia.org/wiki/Oxford_spelling_. In those cases where British English and Oxford English Dictionary differ, *SNOMED CT* follows the British English spelling.

The addition of an Oxford English Dictionary term is allowed but not required. When added it should be marked as acceptable in the British English dialect. In some cases it is also accepted or preferred in US English.

Principles for selecting preferred spelling variants

- *SNOMED CT* may include (or add) more than one description, each with a different spelling for a given concept. That is if the above references provide evidence of acceptability in the dialects for which they are being added.
- For spelling of preferred terms in a dialect, where the reference sources provide multiple options, a judgment about the most common spelling may be needed. This may be determined by reviewing journal articles containing the word in question.
 - Articles should be from highly cited journals, e.g BMJ (for British English) or NEJM or JAMA (for US English).
 - For concepts that are not clinical, appropriate scientific journals should be consulted, e.g. Science (US publisher) or Nature (UK publisher).

3.11 Verbs

-ion

In *SNOMED CT*, the verb form describing the clinical action within a fully specified name and a preferred term should be the ending *-ion*, not *-ing*.

For example,

- *Incision* instead of incising
- *Destruction* instead of destroying
- *Harvest* instead of harvesting

Exceptions

The *-ing* ending may be used when there is not an *-ion* or other appropriate verb form and when the *-ing* form is in common usage.

For example,

- 310476005 |Suturing of tricuspid valve (procedure)|

Past tense

A past tense verbal phrase should not be used to name a procedure, since it indicates that the procedure was done in the past.

Unacceptable example,

- *Hand tendon ganglion excised* indicates the procedure was done, as a past tense declarative statement.

However, the following is an acceptable example using a noun phrase,

- 11227005 |Excision of ganglion of tendon sheath of hand (procedure)|



Situation hierarchy

Existing descriptions containing past tense verbs should be moved to the Situation with explicit context hierarchy.

Appendix A: SNOMED CT Requirements

Key requirements that drive the design, development, and maintenance of *SNOMED CT* are as follows. They are related to:

1. Electronic health applications (most often electronic health records or EHRs)
 - Support for effective delivery of high quality healthcare to individuals and populations
2. The terminology
3. Implementation and migration
4. The intended user communities
 - International, multilingual applicability
 - Supporting particular localities
5. National and strategic priorities

These requirements are interrelated. The design objective is to enable all user communities to realize the potential benefits. However, the needs of different user communities may vary. To meet the overall objectives, the design must consider the entire range of needs. The approach must also be scalable, to enable extension to new user communities.

Medical Vocabularies - J. Cimino

The headings in this section are the requirements identified in Desiderata for Controlled Medical Vocabularies in the Twenty-First Century by J.J. Cimino published in *Methods of Information in Medicine* 1998:37:394-403. Following each, is an explanation of the way in which *SNOMED CT* meets the requirement.

Content, content, and content

SNOMED CT content must be adequate both in scope and quality and must:

- Cover a wide variety of domains and different organizational needs, clinical disciplines, and medical specialties
- Meet the needs of an expanding scope, while retaining quality, with a structured systematic approach

Nonvagueness and nonambiguity

Codes must have one meaning (*nonvagueness*) and no more than one meaning (*nonambiguity*). These characteristics are sometimes called *concept orientation*, but *SNOMED CT* deprecates the use of the word *concept* to describe codes or their meanings.

A code and its meaning may be expressed by more than one term. The terms vary between languages and dialects. In any language or dialect there may be several synonymous terms.

Code permanence

Once assigned a meaning, a code must not change its meaning. Refinements, due to changes in the state of knowledge, may lead to inactivation of codes from *SNOMED CT*. An inactivated code may be replaced by a new, more precisely defined code.

Nonsemantic identifiers

The structure of an identifier (code) should not contain any semantic information about its meaning or relationships.

Polyhierarchy

SNOMED CT supports multiple hierarchies. A code may have more than one hierarchical parent and various paths to its root code.

Formal definitions

When possible, the meaning of codes should be formally defined by relationships to other codes.

Reject *not elsewhere classified*

Codes with the phrase, *not elsewhere classified*, are not allowed in *SNOMED CT*. However, many classifications contain terms with this phrase. A term with *not elsewhere classified* includes general variants that are not specifically represented. The meaning of such a code may change over time. As codes with more specific meanings are added, this narrows the codes included in the *not elsewhere classified* codes.

Multiple granularities

Different users will need to express more or less finely granular meanings. *SNOMED CT*:

- Must accommodate a wide range of levels of detail
- Must recognize the relationships between meanings at different levels of granularity
- Should allow selection of codes that include navigation to other codes with more or less finely grained meaning
- May need to restrict the levels of granularity used in different applications or in different contexts within the same application

Multiple consistent views

The view of a code's meaning, with multiple hierarchical parents, should not depend on reaching it by following the hierarchy from a particular parent.

Beyond terminology codes - represent context

The meaning of a code in a patient record may be altered by its context. Standards for patient record architectures and modeled healthcare communication are changing. The role of *SNOMED CT* in the context of these structures should be evaluated and appropriate recommendations made.

Evolve gracefully

Terminologies need to change over time. *SNOMED CT* should implement these changes in ways that are well-documented and tracked and that provide a path for systems and users.

Recognize redundancy

The same information can often be coded in different ways. A controlled terminology, that has an adequate scope, cannot exclude this possibility. Instead it should facilitate recognition of equivalent terms.

Electronic Health Applications

The anticipated benefits of *SNOMED CT* are derived from use of information to support effective delivery of high quality healthcare to individuals and populations.

Individuals

Aide-memoire for clinicians

Clinically relevant information in an electronic health record acts as an *aide-memoire* for the clinician, enabling recall of previous interactions.

Structured data entry

Structured data entry enhances the value of an electronic health record in various ways. It may:

- Simplify recording of frequently collected data
- Ensure that information is collected in a reliable and reproducible way
- Help clinicians to think logically about a patient's condition

Clinical applications may combine several data entry methods. Some of the most commonly used methods are as follows:

- Searching a coded terminology for matching terms using words or phrases
- Navigating a hierarchical structure to refine or generalize meanings

- Using templates or protocols to record structured information; may be based on answers to questions or values entered on a data entry form
- Parsing of natural language to identify and retrospectively code and structure data
- Typing, speech recognition, and document scanning

SNOMED CT requirements for data entry

Data entry may require selection from a list. Such lists must be manageable in size and appropriate to the needs of the user.

- A multilingual, multidisciplinary terminology requires mechanisms that limit and/or prioritize access to terms and codes in ways that are appropriate to:
 - Languages and dialects
 - Countries, organizations, disciplines, specialties, and users
 - Contexts within a record or protocol
- To display a code's description in a list that has not been derived from a text search, the term must be intelligible and appropriate to the user.

When a code is entered in a record it may require structured entry of additional qualifying information.

- Qualifying information may be coded.
For example, the code named *removal of kidney* may require a statement of laterality.
- Qualifying information may be numeric.
For example, the code named *hemoglobin measurement* may enable entry of a numeric value expressed in a substance concentration.

To meet all the needs for coded structured data entry in a health record, a terminology must have an adequate scope.

- The main body of *SNOMED CT* covers the required scope.
 - It may be difficult to meet the needs of some organizations, specialties, and users; they may need specific terms or codes to meet their own operational requirements. Therefore, *SNOMED CT* is structured to allow for additions to meet specific needs.

A clinical terminology requires frequent changes including new codes, terms, and relationships between codes. Changes may be required due to new:

- Health risks
- Health and disease process information
- Drugs, investigations, therapies, and procedures

Presentation

The presentation of clinical information may:

- Highlight key information and indicate links between items, thus helping clinicians understand patients' conditions.
- Be determined entirely by record structure without regard to the terminological resource (e.g., may be in chronological order, by author, or by the type of recorded event).
- Be enhanced based on its semantic content (e.g., grouping procedures, investigation results, or observations relevant to a particular disease process).

Decision support

Interfaces between recorded clinical information and appropriate decision support tools and reference works may assist the clinician in selecting diagnostic tests, making diagnoses, and choosing treatment. Decision support requires selective retrieval and processing of information in an individual health record to determine whether the patient has particular characteristics relevant to the decision support protocol. The algorithms for establishing the presence of characteristics should include relationships between coded meanings and other aspects of record structure. Performance is also important, as decision support algorithms are typically run in real-time during data recording. Decision support algorithms may:

- Depend on numeric or other values (and their units) associated with particular observations
- Include the context in which information is recorded, e.g., the date of recording and any stated relationships between individual items of information
- Include information such as age, sex, clinical conditions, findings, surgical procedures, medication, and social/environmental factors, such as occupation
- Use codes or identifiers from other terminologies, classifications, or proprietary schemes. Mapping tables are required to allow applications that use a terminology to interface with these resources

Communication

Effective delivery of high quality healthcare to individuals requires communication between those involved in providing care. This requires communication within and across teams or organizations.

The primary objective of many clinical communications is to convey information from human to human. Communications with this purpose should include human-readable text. Relying on text from coded data is not recommended. Coded data is therefore not relevant to the requirement for human-to-human communication.

A receiving application may process clinical communications. This information may need to be retrieved and processed to meet terminology requirements. To meet terminology requirements, messages and other means of electronic communication must permit the communication of *SNOMED CT* identifiers and associated structures.

Communication specifications, such as those produced by HL7 and CENTC251, define the structures to meet requirements. The coded information is used in two distinct situations:

- Coded elements that must be filled with codes enumerated in the specifications. The codes enumerated in the specifications generally communicate, mission critical features of the message. Some of the enumerated codes and the codes in a clinical terminology may have overlapping meanings.
- Coded elements that are populated with clinical codes from appropriate coding schemes. The open coded elements may require the full expressiveness of a terminology. Some of the open coded elements may be restricted to codes that express particular types of meaning.


For example, HL7 requires that coding schemes meet certain criteria, one of which is the ability to express limited subsets of codes appropriate to particular elements.

There are two situations in which communication of coded information may be of value for human-to-human communication. They are where:

- The storage capacity or communication bandwidth is restricted. Receiving applications must contain (or have real-time access to) a table listing the text description associated with each code.
- The translation between the languages of the sender and the recipient is needed. A coded representation of a meaning may allow the appropriate description in the recipient's language.

Recording a particular code may trigger a communication. And, receipt of a code, may trigger specific processing in the receiving application.

For example, recording a decision to prescribe a medicine might trigger an electronic prescription sent to the pharmacy. Receipt of such a prescription might trigger dispensing and stocking activities.

 The relationship of a trigger, is an additional characteristic of a code, that may be context dependent.

Patient involvement

Patients may wish to view, and comprehend, their own records. For *SNOMED CT* to meet this requirement, the inclusion of patient-friendly terms should be considered. However, this requirement should not take precedence over accurate professional terminology.

Patients may also be allowed to contribute to their own records, i.e. be users of *SNOMED CT*.

For example, patients with diabetes may monitor and record their blood glucose levels.

Populations

Identify and monitor health needs

The provision of effective high-quality care to populations requires an understanding of the state of health and healthcare needs of that population. Information recorded about individual patients must be available for analysis to determine trends.

- It must be possible to analyze data recorded with *SNOMED CT*.

Population trends are usually monitored at a higher level, using codes that are more general than those used in individual patient records. This may be accomplished through one or both of the following methods:

- Using hierarchical relationships and/or equivalences defined within *SNOMED CT*.
- Mapping *SNOMED CT* codes to codes in appropriate classifications.

Appropriate analysis of information requires reliable and reproducible queries.

- The scope of *SNOMED CT* must cover the types of information relevant to analysis.
- Analysis may require data about multiple clinical characteristics. Queries must account for both the terminology and the record structure.

Audit quality of service

The requirements for analysis of quality of service are similar to those for analysis of health needs. The main difference is that the scope of the analysis must be extended to cover consultations, referrals, procedures, medications, and other interventions.

Support research

The requirements for research are also similar to those for analysis of health needs, however, there is a need to allow for:

- Recording interventions in ways that do not compromise blind and double blind trials.
- Adding *SNOMED CT* content for experimental observations or treatments, which may never require permanent addition to the terminology.

Reduce bureaucracy; manage and fund care delivery

The management and funding of healthcare delivery often depends on recording and reporting of particular information, e.g. bundled or packaged care. Automating this process offers a way of reducing bureaucratic overhead, i.e. mapping clinical information recorded with *SNOMED CT* to appropriate forms..

Some information required for management and funding purposes is specifically related to claims for particular events or services.

For example, funding general practitioners in the NHS is dependent on meeting immunization administration and cervical cytology screening targets.

The scope of *SNOMED CT* must be adequate to meet these needs, or must be capable of extension to meet these needs, without presenting irrelevant terms or coded meanings to those not requiring them.

Enable reporting of external health statistics

Organizations, such as WHO and some government bodies, require specific data related to healthcare statistics. Organizations should be able to use clinical information recorded with *SNOMED CT*. When this is not possible, the clinical information should at least support their manual generation. Using structured data entry allows for direct mapping to statutory national and international classifications such as ICD, CPT, OPC, and etc.

Identify patients in need of interventions proactively

Population-based preventive care should be offered to specific groups, based on sex, age, medical history and other factors. Health information applications based on information recorded with *SNOMED CT* can be used to identify patients so they can be offered appropriate care.

Implementation and Migration

Electronic health application

A terminological resource is only one part of an electronic health application. Implementation of *SNOMED CT* should support applications in meeting user needs, rather than adding a burden to development.

The functions required to implement a terminology can be divided into those that are:

- Performed without reference to data stored in a particular application record structure.
- Involved in storing, retrieving, or processing application data.

Applications may make use of different aspects of *SNOMED CT*. Some may require *SNOMED CT* for a very limited range of uses for which there may be minimal value. These applications may not require all the functions for a full implementation or all the concepts and codes in *SNOMED CT*.

- There may be a general benefit in consistency with other more terminology rich applications.

Existing information

A substantial body of clinical information may already be present in an electronic health application. Much of this information is represented using existing coding schemes, terminologies, and classifications. This information may be of value to individual patient records or to populations. Similarly, there are many queries and decision support protocols that contain information based on existing terminologies.

A new terminology should make provisions for the continuing use of information stored in records, queries, and protocols represented by other terminologies. There are two general approaches to this:

- Conversion of legacy data into a form consistent with *SNOMED CT*.
- Allowing legacy and *SNOMED CT* data to coexist. Legacy codes must be recognizably different from *SNOMED CT* codes. In addition, the relationship between codes in *SNOMED CT* and legacy codes must be recognized when retrieving data.

Reliability and reproducibility

Information represented with *SNOMED CT* codes must be reliable and reproducible. This means:

- The meaning of a code should not change over time.
- Information should be reproducible independent of the application.
- The query of codes should be reliable. This means:
 - There should be complete recall, including specific, more detailed codes and expressions subsumed by general codes and expressions in the query.
 - There should be specificity and precision excluding codes and expressions that are not subsumed by the codes and expressions in the query.
 - The effects of the following should be taken into account:
 - Precoordinated relationships between codes in records or queries.
 - Postcoordinated qualifications applied to codes or expressions in records or queries.
 - Relationships between codes and other contextual information implied by the record structure.

User Communities

Language

The terms required by users of a clinical terminology vary according to the local languages and dialects.

- When using a terminology, users must see terms in a language and dialect with which they are familiar. The terms must be clear and unambiguous independent of any hierarchical context or formal definition.

- The display of terms must not be confused by inclusion of terms in other languages or dialects.
- The terms used in different languages and dialects are not mutually exclusive. A term may be common to several languages or dialects of a language.
- When a code is presented without a specific reference to a term, an appropriate preferred term should be displayed. A term may be a preferred term in one dialect and a synonym in another.

Some terms differ only in spelling conventions (e.g. color, colour). The same spelling variants may recur in many different terms.

- It may be appropriate to recognize these cases and handle them differently from other term variants.

An individual instantiation of an application may only require access to a single language or dialect. It is inappropriate to install and maintain all language and dialect variants.

An application may need to support several languages with the ability to switch between languages and dialects in real-time to meet the needs of users.

Specialty

Some specialties or disciplines prefer to use different terms to describe the same meaning. A particular specialist may use a precise term, while a generalist may use a different term to describe the same condition.

Use of terms

The following table lists factors affecting term use and examples of each.

Factors affecting term use	
Factor	Examples
Geographic and seasonal differences	Malaria is more common in certain regions Hay fever is more common in spring, summer, and fall
Cultural perceptions of health	Acceptance of alternative therapies
Discipline or specialty	Obstetricians use <i>fundus</i> to mean <i>fundus of the uterus</i> ; gastroenterologists use the same term to mean <i>fundus of the stomach</i> Surgeons record operative procedures relevant to their specialties
Professional criteria	The definition of hypertension may vary based on professional guidelines
National or organizational requirements, including those for administrative or funding purposes	Performance measure results affecting reimbursement
Topics of special interest to individual clinicians	Infectious disease specialist with an interest in tropical diseases

Organization, country, and user

Particular terms may be specific to an organization. They may not be included in the International Release of *SNOMED CT*. Organizations and users must be able to add terms or codes to *SNOMED CT*, without devaluing the main body of *SNOMED CT*.

It may be necessary to combine several subsets and extensions to meet the needs of a country, an organization, or a specialty. There must be consistent rules for combining subsets and extensions.

The requirements of a particular user may change according to the role they are performing. A single instance of an application may need to support different requirements of several users.

Summary

A summary of the *SNOMED CT* requirements is as follows. Additional information may be found throughout this Guide, as well as in other documents on the SNOMED International website at at: <http://www.snomed.org/snomed-ct/learn-more>.

Terminology Structure	
Coded meaning	<ul style="list-style-type: none"> The central component is coded meanings Each code must have a single clear and unambiguous meaning
Identifier	<ul style="list-style-type: none"> Components must have unique identifiers The internal structure of these identifiers must not imply the meaning or relationships of a code
Description	<ul style="list-style-type: none"> Represents the association between terms (text strings) and the meanings that they describe (may be language or dialect dependent)
Preferred Term	<ul style="list-style-type: none"> Represents the special association between each code and a preferred term (used to display the meaning, unless there is an alternative preference) The preferred term association is language or dialect dependent
Fully Specified Name	<ul style="list-style-type: none"> Provides each code with a structured fully specified name that unambiguously describes its meaning The fully specified name is defined in a reference language (the language of first use) Translations of the fully specified name may also be required
Hierarchy	<ul style="list-style-type: none"> Represents hierarchical relationships between coded meanings The form of representation allows a coded meaning to have multiple hierarchical parents (supertypes) It guarantees that any alternative hierarchical view of a coded meaning is consistent
Relationship	<ul style="list-style-type: none"> Represents non-hierarchical relationships between coded meanings

Content	
Scope	<ul style="list-style-type: none"> The scope is adequate to meet the requirements of various countries, organizations, disciplines, and specialties The extent to which the content requirements are covered develops over time However, the initial release should cover: <ul style="list-style-type: none"> The scope of the existing clinical terminologies All versions of the <i>Read Codes</i> and NHS Clinical Terms All versions Other scope requirements identified by the Editorial Board
Updates	<ul style="list-style-type: none"> The content is regularly updated
Granularity	<ul style="list-style-type: none"> Allows coded meanings to be expressed at different levels of granularity
Not Elsewhere Classified (NEC); Not Otherwise Specified (NOS)	<ul style="list-style-type: none"> Codes with <i>not elsewhere classified</i> or <i>not otherwise specified</i> must be inactivated and no new ones may be added

Content	
Extension	<ul style="list-style-type: none"> • Allows extensions to the main body of work • Extensions are distinguishable from components of the main body; should be traceable to a responsible organization • Allows for distinguishing and tracing the code source or identifier used in patient records

Maintenance and Distribution	
Distribution	<ul style="list-style-type: none"> • Distributed in a format that is readily usable by application developers • This format is fully specified and is not changed from release to release • May be distributed for use with associated software, such as a browser
Persistence	<ul style="list-style-type: none"> • The meaning of a code is persistent; It is not changed or deleted by updates • A code may be marked as inactivated when its meaning is found to be ambiguous, redundant or otherwise incorrect • Changes to the association between a concept and a code do not change or delete the description. The description is marked as inactivated, and a new corrected description is created
History	<ul style="list-style-type: none"> • All changes to components are tracked and saved in history files (includes details about new components and changes to the status of components) • When a component is made inactive, relationships or references indicate the replacement or equivalent component

Subsets	
Concepts	<ul style="list-style-type: none"> • Includes a mechanism for representing subsets of concepts appropriate for a language, dialect, or specialty. It should allow: <ul style="list-style-type: none"> • Specification of the synonyms, preferred terms, and translated fully specified names in each language or dialect • Rational combination of languages and modification of language subsets to meet the needs of organizations or specialties
Codes	<ul style="list-style-type: none"> • Includes mechanisms for representing subsets of codes for a country, organization, discipline, or specialty. The form of representation should allow: <ul style="list-style-type: none"> • An indication of the priority, or frequency of use • Rational combinations of subsets to meet the needs of users or groups of users
Specified Contexts	<ul style="list-style-type: none"> • Includes mechanisms for representing subsets of codes and concepts for particular contexts in a record, decision support protocol, or data entry field
Combinations	<ul style="list-style-type: none"> • Include consistent rules for combining subsets to meet the requirements of users
Distribution and Installation	<ul style="list-style-type: none"> • Subsets are distributed in a format that is readily usable by system developers. The format is fully specified and does not vary from release to release. The distribution format allows: <ul style="list-style-type: none"> • Subsets to be installed separately • Related or interdependent subsets to be selected and installed as groups • Subsets to be updated with each new release

Subsets	
Configuration	<ul style="list-style-type: none"> It is possible to configure an application to use a particular subset or combination of subsets; changing configurations does not require reinstallation
Relationships	
Navigating Relationships	<ul style="list-style-type: none"> Includes relationships that allow hierarchical navigation from a chosen code to a code that represents either a subtype or part of the chosen code Supports navigation from a specific code to more general codes that represent a supertype of that code
Aggregation of Related Codes	<ul style="list-style-type: none"> Includes relationships that allow aggregation of related codes to enable comprehensive and accurate retrieval from patient records These relationships, together with appropriate history and cross-reference tables, enable the aggregation to include inactivated codes with similar or equivalent meanings
Defining Characteristics	<ul style="list-style-type: none"> Includes formal definitions of codes represented by relationships with defining characteristics (e.g. the anatomical site of the code named <i>appendicitis</i> is the <i>vermiform appendix</i>)
Qualifying Characteristics	<ul style="list-style-type: none"> Enables a code recorded in a patient record to be qualified by adding relevant qualifying characteristics Each qualifying characteristic is itself a code with a specified relationship to a qualified code Specifies possible qualifying characteristics for each code or for a group of related codes (e.g. an anatomical site could be added to the code named <i>osteoarthritis</i>)
Kind-of-Value	<ul style="list-style-type: none"> Enables codes to be qualified by the addition of relevant values Specifies the types of values that can be added to particular codes (e.g. a substance concentration value can be added to the code named <i>hemoglobin concentration</i>)
Additional Characteristics	<ul style="list-style-type: none"> Is able to assert other characteristics of a code that may be time- or context-dependent (e.g. new medical information may require updates to some codes)
Retrieval	
Analysis	<ul style="list-style-type: none"> Enables the consistent and reproducible storage of information, which is subsequently retrieved for analysis; this requires retrieval that allows the inclusion of subtypes and equivalent codes to be included. Equivalent codes may include: <ul style="list-style-type: none"> Codes represented in another (legacy) coding scheme Redundant codes that were inactivated Combinations of general codes and qualifying characteristics Analysis usually requires retrieval of selected records from a population of patient records; usually performed in batch

Retrieval	
Patient Review	<ul style="list-style-type: none"> Enables the consistent and reproducible storage of information, which is subsequently retrieved for patient recall for preventive procedures or review; requirements similar to those for analysis
Decision Support	<ul style="list-style-type: none"> Enables the consistent and reproducible storage of information, which is subsequently retrieved for decision support Requirements are broadly similar to those for analysis <ul style="list-style-type: none"> Decision support requires retrieval of selected records from an individual patient record Requires real-time processing to determine code meaning equivalence
Presentation	<ul style="list-style-type: none"> Enables the consistent and reproducible storage of information, which is subsequently retrieved for presentation Requirements are similar to those for decision support <ul style="list-style-type: none"> Must be real-time, but usually involves filtering by broad categories of code; less precise than for decision support

Searches and Text Parsing	
Searches and Text Parsing	<ul style="list-style-type: none"> <i>SNOMED CT</i> facilitates searches for descriptions <ul style="list-style-type: none"> A simple keyword index may be generated from the descriptions and used for more effective searching although this may not be optimal due to: <ul style="list-style-type: none"> Use of abbreviations Word form variants Word order variants Word equivalences and combinations Locally added mnemonics for frequently used descriptions Composite coded meanings that can only be represented by: <ul style="list-style-type: none"> Combinations of a code with one or more qualifying characteristics Multiple codes related together by the patient record structure components Searches with multiple redundant hits for a single code <ul style="list-style-type: none"> When several synonyms of the same code match the search key When techniques for word equivalences and combination are applied and return alternative descriptions related to the same code for two or more word equivalences Searches with multiple redundant hits for a large number of closely related coded meanings Search keys matching descriptions associated with a code with a more general meaning and many of its more specific hierarchical descendants <p>A further complication is the application of searches within subsets. This restricts the range of available concepts or codes; efficiency may depend on the relationships of keyword indices and subsets</p>
Parsing or Encoding Free Text	<ul style="list-style-type: none"> The use of natural language parsing to encode free-text derived from typing, scanning, or voice recognition is increasing; the text of descriptions and associated search indices may assist with this process

Implementation	
Terminology Services	<ul style="list-style-type: none"> Terminology services should be implemented independent of application data; by individual applications or by terminology servers accessible by many applications
Advice	<ul style="list-style-type: none"> Application data cannot be specified to the same level of detail as terminology services. It is dependent on the general functionality of the application and its record structure Providing advice early in the <i>SNOMED CT</i> implementation process is required. This helps with some issues that may not be immediately apparent to developers
Limited Applications	<ul style="list-style-type: none"> The advice provided should not place onerous requirements on applications with limited needs for the <i>SNOMED CT</i> terminology It is inappropriate to have <i>all-or-nothing</i> requirements for <i>SNOMED CT</i> enabled applications

Legacy Data and Migration	
Code Recognition	<ul style="list-style-type: none"> It should be possible to distinguish a code from an earlier coding schemes (SNOMED, Read Codes, or NHS Clinical Terms) from the identifiers used in <i>SNOMED CT</i>
Equivalence	<ul style="list-style-type: none"> It must be possible to relate each code in early coding schemes (SNOMED, Read Codes, or NHS Clinical Terms) to a code in <i>SNOMED CT</i>
Query/Protocol Conversion	<ul style="list-style-type: none"> There must be support to convert queries and protocols, based on early coding schemes (SNOMED, Read Codes, or NHS Clinical Terms), to <i>SNOMED CT</i> compatible forms
Record Conversion	<ul style="list-style-type: none"> It should be possible to convert legacy data, based on early coding schemes (SNOMED, Read Codes, or NHS Clinical Terms), to <i>SNOMED CT</i> compatible forms. This is subject to medico-legal constraints
Migration of Terminology-Dependent Products	<ul style="list-style-type: none"> Projects in the UK NHS, that currently make use of Read Codes or NHS Clinical Terms, must plan migration to allow future use of <i>SNOMED CT</i>

Data Structure	
Patient Record Architectures	<ul style="list-style-type: none"> • <i>SNOMED CT</i> is intended to represent clinical meanings in patient records <ul style="list-style-type: none"> • A patient record consists of a series of related statements that are organized under headings • The statements and headings may contain clinical codes derived from <i>SNOMED CT</i> • Headings, and other contextual elements, may modify the meaning of related statements • The relationship between a terminology, such as <i>SNOMED CT</i>, and a record architecture can be summarized as follows: <ul style="list-style-type: none"> • <i>SNOMED CT</i> codes and terms may populate different elements in the record structure <ul style="list-style-type: none"> • Different <i>SNOMED CT</i> codes may be applicable to different elements in the record • Some codes may not be appropriate for inclusion in the record • The meaning of a <i>SNOMED CT</i> code may be modified by its context within the record structure • <i>SNOMED CT</i> should be evaluated within the context of evolving standards for patient record architectures. Recommendations based on the evaluations may include: <ul style="list-style-type: none"> • Possible changes to record architectures in order to realize benefits from <i>SNOMED CT</i> • Changes to <i>SNOMED CT</i> to better fit into record structures • Selecting <i>SNOMED CT</i> codes for use in specific record structure contexts
Expression Coordination and Equivalence	<ul style="list-style-type: none"> • Some codes may be entered in a precoordinated or a postcoordinated manner <p style="margin-left: 20px;">For example, Primary cemented total hip replacement might be entered by selecting the precoordinated code, Primary cemented total hip replacement or by selecting the code, Joint replacement and adding the qualifying characteristics, Body structure = hip joint and Qualifier value = Cemented component fixation</p> • The coded meanings are stored in the forms entered; a retrieval query must search for the precoordinated, and all possible postcoordinated, ways of expressing equivalent meanings <ul style="list-style-type: none"> • In the precoordinated form, irrespective of the method of data entry, the application must recognize the equivalent precoordinated form at the time of data entry • In the postcoordinated (decomposed) form, irrespective of the method of data entry, the application separates the precoordinated code into its defining characteristics, at the time of data entry • All of these methods depend on appropriate defining characteristics for recognition of equivalence; formal definitions of <i>SNOMED CT</i> codes must be as complete as possible. Missing defining characteristics may result in problems with equivalence

Communication	
Clinical Information	<ul style="list-style-type: none"> The ability to communicate clinical information (represented by <i>SNOMED CT</i>) between applications must be supported Message specifications and other communication structures must accommodate <i>SNOMED CT</i> identifiers, and combinations of identifiers, in order to express postcoordinated coded meaning
Message Specifications	<ul style="list-style-type: none"> Current message specifications (e.g EDIFACT, HL7, and XML) use plain text files; <i>SNOMED CT</i> identifiers must use plain text so that they are appropriate for these messages
Postcoordinated Expressions	<ul style="list-style-type: none"> Communication of postcoordinated expressions may be possible using specific qualifier fields in messages. This can also be accomplished by using syntactic representation of identifier combinations; these must be consistent with message syntax and field size limitations

Mapping	
Classification	<ul style="list-style-type: none"> Based on recorded codes, mapping tables are used to generate statistical and administrative data Automation of the process depends on the nature of the classification, the richness of the mapping table, and the functionality of the mapping software
Grouping	<ul style="list-style-type: none"> Mapping tables are used to generate groupings for funding, administration, and etc Mapping to a classification, then using the classification codes to generate groupings, is an alternative method
Communication Specifications	<ul style="list-style-type: none"> Codes are mapped to specific values, in an enumerated list, associated with a message or communication specification Recognizing these mappings may prevent double data entry, when sending or receiving such messages
Reference Works	<ul style="list-style-type: none"> Codes are used to establish links with decisions-support protocols or other references Mapping between these codes and reference sources may help to facilitate their use

Availability	
Limited Applications	<ul style="list-style-type: none"> Applications vary in their ability to use terminological components Special consideration may be necessary for applications that require only limited use of <i>SNOMED CT</i>
Concepts in Different Languages	<ul style="list-style-type: none"> Translating <i>SNOMED CT</i> into other languages is required Multiple translations may support communication of clinical information across language barriers
Patients	<ul style="list-style-type: none"> Patients may be users of <i>SNOMED CT</i> if they record information in their own medical records This may require limited licensing of <i>SNOMED CT</i> for populations, in general

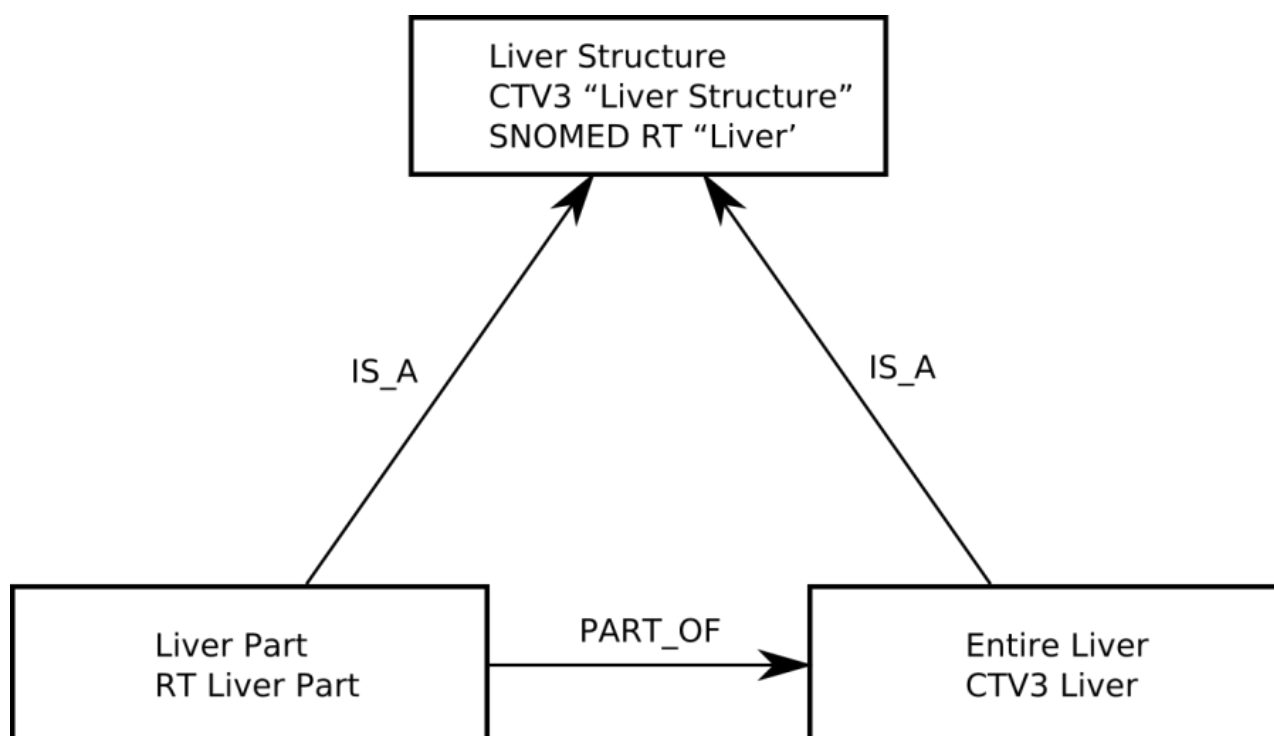
Appendix B: Concept Models

The *SNOMED CT* concept model specifies the way in which *SNOMED CT* concepts are defined using a combination of formal logic and editorial rules. Concept model rules specify the top level concepts under which concepts are arranged in the subtype hierarchy and the types of relationships that are permitted between concepts in particular branches of the hierarchy.

Anatomical Concept Model

The Structure-Entire-Part (SEP) model

SNOMED CT uses a structure-entire-part triple, known as the *SEP triple*, to represent anatomical structures. The following Relationships provided a way for the anatomy in CTV3 to be mapped to RT:



The *SNOMED CT* anatomy hierarchy differentiates classes of entire anatomical entities from classes of *parts of* entire anatomical entities.

Entire concept: Denotes a class that is instantiated by entire anatomical entities of some kind: entire heart is instantiated by all individual hearts.

Entity Part concept: Denotes a class that is instantiated by all anatomical entities that are a proper part of some entity of a given kind: heart part is instantiated by all entities that are a proper part of some heart, e.g. my mitral valve, your right ventricle, Joe's sinus node. Heart part is not instantiated by any heart.

Entity Structure concept: Subsumes both the related Entire and Part *concepts*. Consequently, it denotes a class which is instantiated by anything that instantiates either the Entire or the Part. For instance, Heart structure is instantiated by my heart, my mitral valve, your heart, your right ventricle, Joe's sinus node, Joe's heart, etc.

The code named Liver structure in *CTV3* is equivalent to Liver structure in the diagram above. Both the *CTV3* code for Liver structure and the *SNOMED RT* code for Liver are interpreted to mean Some or all of the liver. *Site* attributes

(PROCEDURE SITE, FINDING SITE) will usually take the value liver structure rather than entire liver, since typically the site of a *liver disorder* or *procedure on the liver* is not necessarily the entire liver.

Purpose of the Structure concept

Adding the Entity Structure codes is a convenience to assist with the logic-based aggregation of references to the entity or its parts. The implication of this view is that the E of the SEP triple is the code that should be regarded as the one that represents the real anatomical entity that is named.

For example, the code for entire liver is the one that should correspond to the code for liver in the Foundational Model of Anatomy (FMA). The subtype hierarchy for entire liver fits much better with the FMA hierarchies, and indeed it might be possible to completely reconcile *SNOMED's* non-Structure components with FMA anatomy.

A database has been developed that categorizes codes in the physical anatomical entity hierarchy according to their status as S structure, P Part or E Entire, and provides the corresponding S and P code for each E code. This should provide some value to implementers. It can help with navigation, coordination with formal ontologies of anatomy, and selection of codes for *postcoordination*.

Naming conventions

S concepts are usually named x structure (body structure) or structure of x (body structure). E concepts are usually named entire x (body structure) or x entire (body structure). P concepts are usually named x part (body structure) or part of x (body structure).

Plurals

Outside the anatomy section of *SNOMED CT*, plurals were primarily used as headers, while the individual concept names were singular. In the anatomy section, we have taken plurals to represent meaningful differences from their singular counterparts.

For example, *Skin structure of all fingers* in the FSN would mean more than one finger, while *Skin of finger* would not imply more than one.

Conventions for merging concepts from SNOMED RT and Clinical Terms v.3

Where there were two concepts with the same name, the SNOMED RT code was to become the S code, and the CTV3 code was to become the E code. There are still instances of unrecognized pairing of the RT-CTV3 S-E pair, where neither codes FSN has been changed according to the naming conventions in this document. When these unmatched pairs are identified, it is our practice to change the FSNs accordingly, and to make the E code have a subtype IS-A link to the S code.

S concepts without a corresponding E concept

Some S codes do not currently have a corresponding E code subtype, and there was no policy that required that such E codes be created during the merger of SNOMED RT and CTV3. However, it is likely that such a policy will be enforced in the future.

S Structure codes can subsume entities other than E or P

The SEP triple may give the impression that all S codes have exactly two children, one E and one P, with all of the remaining descendants placed under P. Again, in the past this degree of modeling consistency was not always followed. Some codes were purposely made subtypes of the S that are not strictly part of the corresponding E.

For example, perirenal tissue is a kidney structure but not a part of the kidney. It is used to define perirenal abscess so that it is subsumed by renal abscess. While a perirenal abscess is not strictly within the substance of the kidney, it is still considered a kind of renal abscess, and the S anatomy hierarchy is used to support this inference.

This policy has introduced undesirable variation and arbitrariness into the terminology, and future revisions will seek to eliminate these variations. Where a code is needed for a site that is really meant to extend to entities that are not part of any kidney, this will be made clear in the name, e.g. Structure of kidney and perirenal tissue.

Countable vs non-countable *E* entities

The *E* code needs to be interpreted with care when the *x* name refers to entities that do not have the property of identity, meaning that they are not countable wholes, or could be interpreted as non-countable. In this circumstance, the interpretation of *E* means some portion of the thing being named.

For example, tissue and types of tissue such as fascia, muscle, tendon, bone tissue, connective tissue, skin, mucosa/mucous membrane, nerve tissue, etc. Muscle, tendon, bone and skin can identify a type of tissue as well as an individual organ of that type. Bone tissue has no identity, but a particular bone does have identity.

To use skin as the archetypal example, the *E* code for *skin of finger* means a portion of the skin of a finger, so all of its subtypes must also be portions of skin. The *S* code for *skin of finger* then has a subtype *P* which would mean proper part of a portion of skin of finger. This admits subtypes that are not kinds of skin, but may be parts of skin, including layers, e.g. epidermis of finger (meaning a portion of epidermis of finger) could be a proper part of a portion of skin of finger.

Tissues, layers, membranes: portions

We regard the *E* code for *x* tissue, *x* layer to have the meaning *portion of X tissue*, and therefore regional subdivisions of tissue types are direct subtypes.

For example, transitional epithelium of urinary tract, as an *E* kind of code, should be a supertype of transitional epithelium of urinary bladder. The reason is that (portion of) transitional epithelium of urinary bladder is a kind of (portion of) transitional epithelium of urinary tract.

We also deal with layers the same way.

For example, we regard serosal layer and serosa tissue as meaning the same thing, since all serosal tissue is configured as a layer, and it can't be a serosa without being a layer; and their *E* codes mean portion of serosal layer or portion of serosal tissue.

As another example, layer of retina would be a supertype of nerve fiber layer of retina, and also a supertype of retinal epithelium, where retinal epithelium represents a portion of the epithelium of the retina and is therefore a kind of (portion of) a layer.

Groups

The identity/countability issue extends to a problem differentiating groups of entities from one of the group.

For example, consider *x* = *lymph node group*, *y* = *lymph node*. In this case, the group should be linked to the member via an appropriate *Relationship* (not yet in *SNOMED CT*), such as has-member. In those cases where *y* is always necessarily a member of group *x*, it could be linked via a member-of *Relationship* (also not yet in *SNOMED CT*).

What does part of mean?

There are several possible ways of interpreting *part of*. In *SNOMED CT*, *A part of B* means that in normal anatomy, the entire structure *A* is structurally included in *B*. Another way of saying it is that *A* is part of *B* if there is no part of *A* that is not also part of *B*.

For example, the humerus is not part of the shoulder region, because the distal humerus is part of the humerus, and the distal humerus is not part of the shoulder region.

We do *not* use part of for non-anatomical meanings, such as grouping tests together in batteries, nor do we use it to indicate *Relationships* that are not strict anatomical inclusion.

Some recent work has begun to differentiate between part of that is reflexive (that is, an entity is in some sense a *part of itself*, much the same that a set can be viewed as a subset of itself), versus *proper part of*, where an entity cannot be a proper part of itself. For now, we regard part of *Relationships* as implying strict parthood.

There is sometimes confusion about parthood as opposed to location.

For example, an embryo is not part of a mother's body, but a kidney is. The anatomy section is composed mainly of canonical parts; but a few abnormal parts are included to permit them to be used as the location of tumors or injuries.

For example, a Meckels diverticulum is a body structure that is part of the small intestine, and it is also a morphological abnormality. Likewise some stomas and other post-surgical structures are considered part of the body. A transplanted liver or kidney would be considered part of the body, as a post-surgical structure, even though the transplanted organ is not genetically identical. Likewise transplanted bone marrow is part of the body.

Non-living implants and devices, and foreign bodies, on the other hand, are considered to be located in the body, but not part of the body.

Can the *SNOMED CT* relationships table be used to construct a part of hierarchy?

The currently distributed *part of Relationships* need to be much more extensively modeled and quality assured. At present they are not *defining*, that is, their Characteristic Type in the relationship file is *additional*, and, therefore, they do not affect the classifier behavior. A substantial amount of effort has gone into a draft of the updated *part of Relationships*; these will require review and approval before incorporation into the release. This will eventually result in the SEP triplet structures and *part of relations* being strictly paralleled. It is a matter of time to implement and quality assure the changes.

Why are part of relationships not defining?

The SEP structure, combined with the inference mechanism that is used with *SNOMED CT*, allows us to take advantage of anatomical Relationships to infer subsumption, IS_A Relationships between disorders, procedures, and other entities without reference to *part of Relationships*. The SEP structure also permits us to sufficiently define anatomical structures without reference to *part of Relationships* (making them *necessarily true*, but not among the *necessary and sufficient* conditions).

For example, the *Structure of left hand* can be sufficiently defined as a hand structure with laterality = *left*. This definition is sufficient. Converting the *part of Relationships* to have Characteristic Status = *defining* will require significant changes to the current model.

Entities with mass versus purely spatial massless entities

Points, lines, and surfaces can be considered to be massless. The FMA calls these *immaterial*. It is important to differentiate the codes/names for these entities from those that are intended to represent entities that have mass. At present, the concepts under anatomical spatial entity represent massless entities. Massless entities are not represented using the SEP model. It is conceivable that users may want to reference parts of a surface, and to enable this we would need to apply the SEP model to anatomical spatial entities, or else adopt defining *part of Relationships*.

Attributes used to define body structure concepts

Laterality

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

Unilateral

Unilateral: with the addition of lateralized content in the International Release, the need for unspecified unilateral concepts is obviated, as well as potentially dangerous if used directly in a patient record. Unilateral concepts will not be accepted and a review of existing content for potential inactivation is underway.

Disorder Combinations

Combined disorders and clinical life phases (CLPs)

The model for combined disorders is based on the reimagining of clinical disorders as clinical life phases which represent a period of a person's life during which they are experiencing one or more pathological conditions (pathological structures, dispositions or processes). The subtype relationship in this case is analogous to the subset relation of set theory in which Y is a subtype of X if all members of Y are wholly included as members of X rather than Y being more specific than X. In this manner, a combined life phase consisting of CLP_a and CLP_b will inherit both CLP_a and CLP_b as parents as all individuals with the combined CLP of CLP_a and CLP_b are also individuals with CLP_a and are individuals with CLP_b.

Temporal relationships and the meaning of co-occurrence

Relations between two time intervals may be described using a formalism known as Allen's interval algebra^[1]. The basic relations (and their converses) between 2 time intervals are illustrated below where a and b are individual CLPs and relations are represented by small letters and their converses by capital letters. Note the relation "equals" is its own converse.

precedes	meets	overlaps	finished by	contains	starts	equals	started by	during	finishes	overlap-ped by	met by	preceded by
p	m	o	F	D	s	e	S	d	f	O	M	P

Figure 1: Allen's basic relations and converse relations (<https://www.ics.uci.edu/~alspaugh/clis/shr/allen.html#Allen1983-mkti>)

- **We define co-occurrence as the situation in which time interval a (e.g. a CLP) is wholly present during time interval b (or conversely time interval b is wholly present during time interval a).**

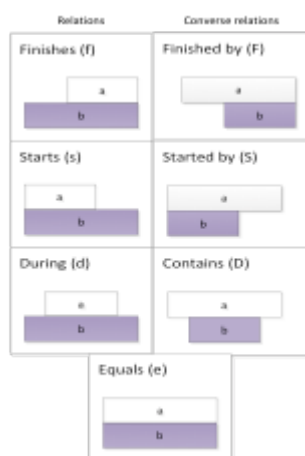


Figure 2: Allen's basic and converse relations compatible with co-occurrence

As it would undoubtedly be difficult to distinguish among these various temporal relations in a clinical setting, we can represent the relationship between a and b in Allen's syntax as $a(fsdeFSD)b$ which indicates the disjunction of all the patterns depicted in figure 2 above.

Thus, in deciding whether CLP_a and CLP_b are co-occurrent, the question becomes can either life phase persist after the other has resolved. If the answer is no, then CLP_a and CLP_b are co-occurrent. As an example, consider the conjunction of coronary artery embolus and myocardial infarction. Clearly the embolus may resolve after treatment but the infarcted myocardial tissue will not and thus coronary artery embolus and myocardial infarction are not considered to be necessarily co-occurrent. On the other hand, consider the conjunction of intestinal obstruction and volvulus. The intestinal obstruction would no longer exist once the volvulus is reduced and thus volvulus and intestinal obstruction are necessarily co-occurrent.

In terms of simple co-occurrence, two life phases may be necessarily co-occurrent but clinically related by an association in which neither condition causes the other. These types of clinical associations often are related by a common predisposition and therefore simple co-occurrence would be most appropriate for representing overlap syndromes (e.g. asthma with COPD) as well as to associate two CLPs (CLP_a and CLP_b) in which after reviewing the current literature one is still unsure of whether a causal chain exists between CLP_a and CLP_b. (especially relevant for genetic mutations and associated phenotypes).

[i]Allen, James F. "Maintaining knowledge about temporal intervals". Communications of the ACM 26(11) pp. 832-843, Nov. 1983.

Causality

We consider the notion of causality as a primitive predicate, which is essential for medical reasoning and decision-making. Whether y follows x incidentally or because it is caused by x is seen as fundamentally different. Causal relationships between disorders are represented using the due to role. A causal relationship should be considered as any point in a causal chain between X and Y and for which X is not merely a risk factor for Y and for which X is temporally separated by Y by an interval where it is reasonable to believe that the association between X and Y is not just coincidental.

Risk factors vs. cause*

- A cause is an event, condition, or characteristic without which the disease would not have occurred.
- A risk factor is a surrogate or marker for an underlying cause (e.g. education and income status are risk factors but not causes of ischemic heart disease)

*http://sphweb.bumc.bu.edu/otlt/MPH-Modules/EP/EP713_Causality/EP713_Causality3.html

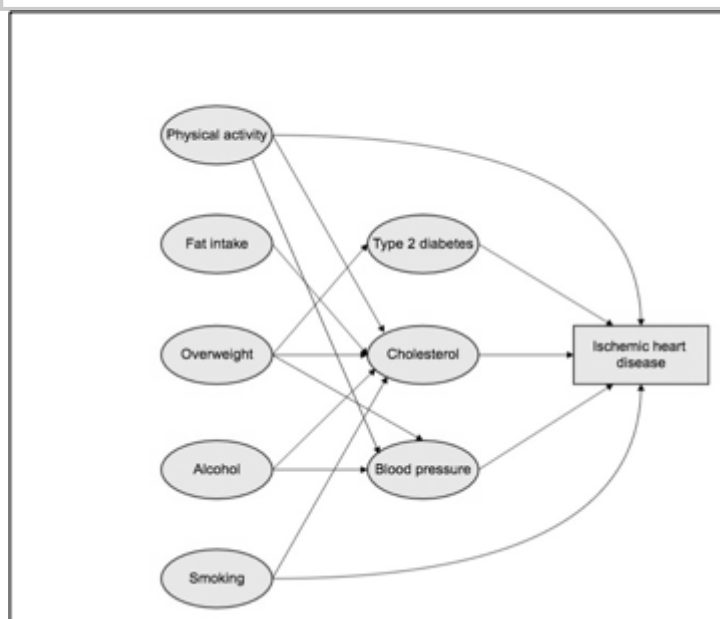


Figure 3: Example of causal chain for ischemic heart disease adapted from The Global Health Risks Report, WHO 2004

- **Due to** may be thought of as a differentia to distinguish between simple co-occurrence and co-occurrent and due to. It may be used when co-occurrence or temporally following is uncertain in lieu of additional temporal patterns such as during and after currently not represented in SNOMED CT.

Causality and co-occurrence

When considering disorders that may co-occur and where one is causally related to the other, the following Allen's temporal sequences apply. In this case *b* is considered the causal condition and *a* the resultant condition and thus the converse relations shown in figure 2 in which *a* is present before *b* are invalid.



Figure 4: Allen's relations compatible with co-occurrence and causality

The modeling of disorders that are both co-occurrent and causally related results in the unusual circumstance in which a condition appears to be both a supertype and the value of the due to role (figure 5). This can be explained by noting that there are 2 separate life phases containing the causal condition, the first which precedes the combined life phase and a second in which it is present together with the life phase including the resultant condition. Thus the combined life phase is considered to be due to the first life phase in which the causative condition exists prior to and independent of the life phase in which it is part of the combined life phase. On the other hand, the ramifications of embedding the due to role within the relationship group representing the resultant condition requires further investigation.

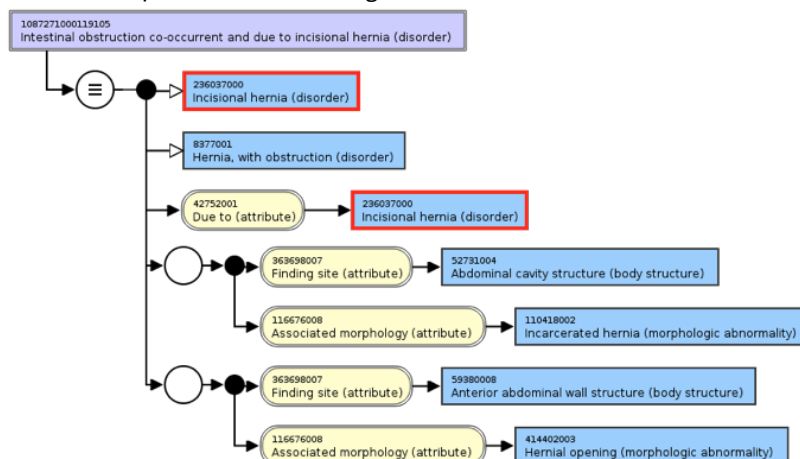


Figure 5: Example of combined disorder illustrating both co-occurrence and a causal relationship

Use of the *associated with* attribute

In general, associated with should be avoided due to the ambiguity which it conveys and the difficulty in applying this role consistently. There is only one situation when associated with could possibly be considered appropriate*.

General grouping concepts which aggregate more specific associations

For example, 6211002 | polyarthritis associated with* another disorder (disorder) | subsumes two children

- 201972000 | allergic arthritis of multiple sites (disorder) | modeled with *due to* 419076005 | allergic reaction (disorder) |
- 422565003 | post-infective polyarthritis (disorder) | modeled with *after* 40733004 | infectious disease (disorder) |


*Consideration might be given to renaming *associated with* in this case to something more descriptive such as *causally or temporally related to*.

Appendix C: Principles for Accepting Content in the International Release

The statement of scope for the International Release is that it includes content necessary for international conformance and interoperability. Content that is within the scope of the International Release is restricted to the International Release and may not be modified or replaced by an extension, unless explicitly permitted by SNOMED International. Affirmative answers to the following questions are criteria for inclusion in the International Release:

- Is it useful in more than one national healthcare system?
- Does it need to be understandable in electronic health applications in more than one national healthcare system?
- Can it be used in electronic health applications beyond a patient's national healthcare system, i.e. if a patient were to travel or relocate to a different country?

Use of proprietary names and works

 This section considers scope as it relates to the incorporation of proprietary names (e.g. names of clinical forms or tools, and drugs) into *SNOMED CT*. The section is divided into two sub-sections. The first one covers SNOMED International itself. The second one covers third parties (e.g. SNOMED International Affiliates) who implement *SNOMED CT* in electronic health applications (Note: there is some overlap between these sections).

Clinical form or tool

In this section, we refer to the *owner* of a clinical form or tool. This term loosely refers to the person or organization who owns the intellectual property rights of the form or tool. This may be the individual or group who originally created the form or tool, the organization that employed the creators, or a commercial organization to whom the creators assigned their intellectual property rights.

SNOMED International

Names

Incorporating the name of a clinical form or tool (e.g. the *XYZ Test*), or the name of the score generated by a form or tool (e.g. the *XYZ Test Score*) into *SNOMED CT* does not require a license from the owner. It is possible that the owner holds a trademark (which may be registered or unregistered) representing the name or score, but simply incorporating that word into *SNOMED CT* does not infringe on the trademark.

This also applies to brand name drugs. SNOMED International does not need to obtain the permission of the trademark owner simply to include a reference to the brand name drug in *SNOMED CT*.

Questions

A clinical form or tool, including the wording of the individual questions within the form or tool, is generally a literary work and qualifies for copyright protection. The copying of all or any substantial part of a literary work, without a license from the owner, infringes on the copyright.

It is possible, though unlikely, that incorporating the wording of an individual question from a clinical form or tool may infringe on the copyright. However, it is much more likely that SNOMED International would systematically include all of the questions from the form or tool in *SNOMED CT*. Except in the case of the simplest of forms, that is likely to infringe on the copyright, without permission from the owner.

Answers

Certain questions may have a range of pre-determined answers. This could be as simple as *Yes/No* or a number within a specific range, but may also be more substantial (e.g. *needs help cutting, spreading butter, etc., or requires modified diet*).

Incorporating very simple answers into *SNOMED CT* does not require permission. However, incorporating more substantial text into *SNOMED CT* generally infringes on the copyright. This usually does not apply to individual answers, but it almost always applies when entire sets of answers are incorporated.

Scores

The principles that apply to individual answers also apply to the overall score generated by a clinical form or tool.

The incorporation of numbers does not infringe on the copyright. However, when each possible score has an associated textual description and all possible scores and descriptions are incorporated into *SNOMED CT*, a license is required.

Concepts representing questions, answers, or scores

A *concept* may be introduced into *SNOMED CT* that represents the text of questions, answers, or scores. For example, a form may include a question about a person's ability to dress and a range of possible answers. *SNOMED CT* may incorporate neither the text of the question nor any of the possible answers, but instead may incorporate a concept such as *ability to dress*. Similarly, if the form contains 20 questions, *SNOMED CT* may want introduce 20 concepts, for *XYZTest_Result1*, *XYZTest_Result2* and so on, to *XYZTest_Result20*.

The incorporation of a single concept into *SNOMED CT*, based on a question, answer, or score on a clinical form is highly unlikely to infringe on the copyright. However, if *SNOMED CT* systematically introduces a concept for every single question on a clinical form, it is likely to infringe on the copyright.

These concepts (e.g. *ability to dress*) may already exist in *SNOMED CT*, or they may be added in other contexts (This does not apply to concepts that represent specific questions within a form). This is unlikely to result in a copyright infringement.

Implementation of SNOMED CT

Names

The use of the name of a clinical form or tool or of a brand name drug will usually not infringe on the copyright. However, caution should be exercised by implementers who wish to use trademarks in a *commercial* context, i.e. a system that enables drugs to be purchased electronically. SNOMED International does not advise implementers on this matter, but recommends that implementers, who are in any doubt, contact the trademark owner.

In general, implementers should make no greater use of a trademark than is necessary. For example, displaying a graphical mark (e.g. a logo) on a screen or in printed material should be avoided.

Questions, answers, and scores

Implementers should manage questions, answers, and scores in the same way as SNOMED International (see above). When the incorporation of content from a clinical form or tool infringes on the copyright, the system the reproduces (by display or print) the content also usually infringes. This means that the license to incorporate content by SNOMED International should also cover the system implementer.

Preexisting terms

As noted above, terms in a clinical form may already exist within *SNOMED CT*, even though they have not been copied from the form. This is not copyright infringement by SNOMED International. If, however, a system implementer chooses to arrange a collection of these pre-existing terms in a way that reproduces all or a substantial part of a clinical form (e.g. by populating a drop-down box with all of the possible answers to a specific question on the form), that may infringe on the copyright.

Form structure

A system may reproduce the structure and layout of a clinical form on a screen display or printed output (e.g. to make the system more accessible to users who are familiar with a paper-based form). This may infringe on the copyright, unless the structure or layout is very minimal (e.g. a bulleted list). An implementer who wishes to emulate the *look and feel* of a clinical form should seek a license from the owner.

Algorithms or logic

System implementers may use the algorithm or logic inherent in a clinical form or tool (e.g. the method by which an overall score is calculated). For example, a clinical form may instruct the user to perform a mathematical operation on the individual answers to produce the overall score, and the same operation may be carried out by the system. The use of the algorithm or logic is an infringement. SNOMED International avoids such use and encourages system implementers to contact the owner to discuss possible infringement.

Management of non-human content

Non-human content may be included in a request for new content via the SNOMED International Request System (SIRS) or may be identified in the International Release. Careful consideration is required to differentiate content that belongs in the International Release versus an extension. The basic principle is that content used in human medicine should be in the core. Content that is strictly non-human may be managed in an extension.

Examples of non-human content,

- Egg-related coelomitis (disorder)
- Dehorning (procedure)
- Bone structure of wing (body structure)

Types of content that should be in the core include the following:

- **Diseases and findings.** Anything that can occur in both humans and animals should be in the core.
- **Material entities.** Every substance that can cause adverse effects should be in the core (with the understanding that poisonings and adverse effects in humans may be caused by virtually any substance). Some material entities may be of interest only in a non-human or veterinary context. These entities may be added to, or left in, a veterinary extension.
- **Organisms.** Most organisms should be in the core, with some exceptions. There are over 20,000 organism codes in the Veterinary Extension maintained by the Veterinary Terminology Services Laboratory (VTSL) at Virginia Tech University. Generally, these are not transferred to the core, except when used in public health or human medicine or when requested by more than one SNOMED International member country.

Organisms that are not used in human medicine can be added to the Veterinary Extension. It is publicly available to SNOMED International member countries and to Affiliate Licensees. To access to the Veterinary Extension, see <http://vtsl.vetmed.vet.edu> | <http://vtsl.vetmed.vet.edu/> or contact VTSL at vtsl.extension@gmail.com

Principles for determining National Extension content

A National Extension includes content outside of the scope of the International Release, but necessary for national conformance and interoperability. Each member-state determines the application and interpretation of this scope and whether or not concepts should be added to their extension.

Criteria to determine if concepts should be included in a National Extension include affirmative answers to the following:

- Is the concept outside of the scope of the International Release, but necessary for national conformance and interoperability?
- Is it useful throughout the national healthcare system?
- Does it need to be understandable throughout the national healthcare system?
- Does it need to be shared in a reproducible manner within the national healthcare system?

If so, then the concept may be eligible for the National Extension.

Appendix D: Historical Notes

Added or changed

Domain change for measurement/evaluation attributes. Six attributes were approved for Measurement procedure only. The domain for these attributes was expanded to Evaluation procedure.

Dose form values. Type of drug preparation (product) and its subtypes were moved to the Qualifier value hierarchy. Type of drug preparation (qualifier value) better represents these concepts because they are not products.

Finding to Event. A number of concepts moved. The attributes used to define those concepts were retained in the Clinical finding hierarchy.

Route of Administration. Allows a procedure to be more fully modeled, so that its definition includes the route of administration of a given substance.

Situation with explicit context (situation). Previously named Context-dependent category.

Summary of historical domain relationships

Domain	Historical Relationship
Ambiguous component	Possibly equivalent to
Component moved elsewhere	Moved to
Duplicate component	Same as
Erroneous component	Replaced by Was a
Limited component	Was a
Outdated component	Replaced by Was a
Pending move	Moved to
Non-conformance to editorial policy	None required

No longer valid

Access for Endoscopic route of access. Information that was previously captured by Access, Endoscopic approach-access (qualifier value) is adequately captured with Using Access Device, Endoscope, device (physical object).

Has Definitional Manifestation. Not being used in an understandable, reproducible and useful way.

Inactivated

Approach. Use for non-surgical procedures not reproducible.

Episodicity no longer modeled in active content. Was used not to specify the first episode of a disorder for a patient but rather, the first time a patient presented to the healthcare provider for a disorder.

Onset and Course. Could not be used reproducibly. Onset easily confused with Course.






Using (replaced with Using Device). Allowed values that included descendants of Physical force (physical force) which are not actually devices. The Device attributes clarify the inconsistency that existed over when to use Using vs. Access Instrument vs Access, particularly for Endoscopic procedure.

Other

Surgical and related procedure domains in *Clinical Terms Version 3*. Generated from the OPCS4-based Chapter 7 of Read Version 2 by the addition of new *concepts* during the Clinical Terms Project (CTP) and subsequent refinement.

Appendix E: Editorial Guide: Style and Terms

To provide consistency and clarity, there has been an effort to use certain styles and specific terms within the Guide. Although this has been the intent, it is the content of the Guide that has been the focus. Consequently, authors may find instances where alternative styles or terms are used.

Style	
Type	Notes
Italics	<ul style="list-style-type: none"> To emphasize a word in a sentence or phrase To indicate the name of something
Upper case first letter	<ul style="list-style-type: none"> To emphasize a word in a sentence or phrase not necessarily at the beginning
Periods	Not used in: <ul style="list-style-type: none"> Lists when items contained therein are not sentences At the end of sentences within tables
Examples	<ul style="list-style-type: none"> Presented as: <ul style="list-style-type: none"> For example, <ul style="list-style-type: none"> <i>text of example</i> When possible, examples from the <i>SNOMED CT</i> browser are provided. When examples from the browser aren't available, i.e do not yet exist, they are obtained from other sources
Macros: Note, Tip, Warning <ul style="list-style-type: none"> General <ul style="list-style-type: none"> For example, <i>For more information, Modeling, Exception</i> Specific <ul style="list-style-type: none"> For example, <i>Concepts, URLs</i> Optional Title - added to each 	General <div style="border: 1px solid #ffc107; padding: 5px; margin-bottom: 5px;">  For more information Contains general information or additional resource (may be link). </div> <div style="border: 1px solid #28a745; padding: 5px; margin-bottom: 5px;">  Modeling Contains modeling information. </div> <div style="border: 1px solid #dc3545; padding: 5px; margin-bottom: 5px;">  Exception or Inactivation or Under Revision Contains information about content exceptions, inactivation, or under revision </div> Specific <div style="border: 1px solid #ffc107; padding: 5px; margin-bottom: 5px;">  Concepts Some concepts, for example, those in the Qualifier value hierarchy, support the definition of other concepts. </div> <div style="border: 1px solid #dc3545; padding: 5px;">  URLs URLs that point to definition sources are unacceptable. </div>

Style	
Tables <ul style="list-style-type: none"> • Heading row - light green fill; bold font • Sub-heading row - light blue fill • Column heading - light blue fill • Other cells - may have pink fill for emphasis • Footing row - light yellow fill 	<p>Note: Tables generated from the <i>Human Readable Concept Model</i> have unique formatting</p>
Text formats <ul style="list-style-type: none"> • "Quotation marks" • Bold font • All CAPS 	<ul style="list-style-type: none"> • Minimally used
Page headings	<ul style="list-style-type: none"> • Section headings - Heading 3 • Subsection headings - Bold paragraph

Terms

Terms	
Used in Guide	Synonym / Other
Attribute	Concept Model Attribute; Relationship type
Authoring platform	SCA tool
Child	Subtype, Subtype child
Classifier	Description logic (DL) classifier; Logic reasoner
Descendant	Child and Subtype child/children
Domain	Concept model domain
Electronic health application	Software application; Clinical information systems
Electronic health record or EHR	Electronic medical record; Electronic record; Electronic patient record
Extension	<i>SNOMED CT</i> extension, Member/Affiliate-Added Terminology
Grouping concept/Grouper	NA
Inactivate/Inactivation	Retire *
International Release	Core
Modeler/Modeling	Author/Authoring, Editor/Editing
Parent	Supertype, Supertype parent
Precoordinated	Precoordinated expression
Postcoordinated	Postcoordinated expression
Qualifier	Qualifying characteristic
Range	Concept model range, Allowable value
Relationship group	Role group *
Root concept	Top-level concept
Semantic tag	Semantic type, Hierarchy tag
Situation with Explicit Context	Context-dependent Category

Terms	
Sufficiently defined	Fully defined*
Supercategory	??
*Strikethrough = No longer used	