

SNOMED CT April 2016 LOINC - SNOMED CT Cooperative Project Alpha (phase 3) Edition - RF2 Release notes



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Approvals

Final Version	Date	Approver	Comments
1.0		Ian Green	Final Version

Draft Amendment History

Version	Date	Editor	Comments
0.01		Suzanne Santamaria	First draft for comments
0.02		Ian Green	Revised/Additional updates

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Table of Contents

- 1 Introduction
 - 1.1 Background
 - 1.2 Purpose
 - 1.3 Scope
 - 1.4 Audience
- 2 Feedback for the Alpha release
 - Desired feedback:
- 3 Content Development Activity
 - Overview:
 - Content usage:
 - Content detail:
 - LOINC Term to SNOMED CT Expression Reference Set
 - LOINC Part to SNOMED CT Map Reference Set
 - Mapping and Modeling Guidelines Used
 - Quality Assurance
 - Classifying Expressions with SNOMED CT
 - Next Steps
 - Acknowledgements
 - References:

1 Introduction

1.1 Background

A cooperative agreement [3] was signed between the Regenstrief Institute (RII) and the IHTSDO in July 2013. The agreement details how SNOMED CT and LOINC will be linked through:

1. a map of LOINC Terms to post-coordinated SNOMED CT expressions
2. a map of LOINC Parts to SNOMED CT concepts
3. a map between LOINC Terms and existing pre-coordinated SNOMED CT concepts
4. LOINC Answer sets mapped to SNOMED CT codes
5. addition of new content in either terminology

See Figure 1 for an illustration of these connections. This Alpha Release includes artifacts related to items 1, 2, and 5 above.

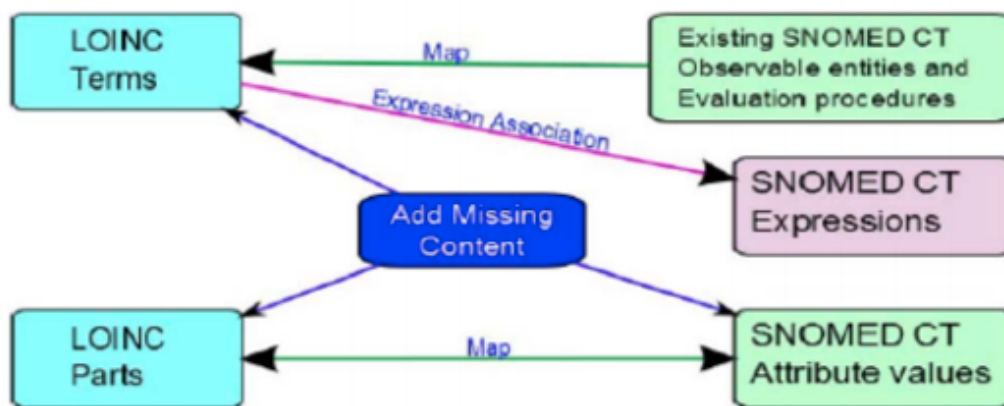


Figure 1. Diagram showing an overview of maps, Expression Associations and content additions that form part of the Cooperative Works of the Agreement [3].

1.2 Purpose

This document is intended to give a brief description, background context and explanatory notes on the official IHTSDO RF2 release format of the LOINC - SNOMED CT Cooperative Project Alpha Release - phase 3. This is the format intended to be continually distributed for implementation.

This is not a detailed technical document about the release file formats or on implementing LOINC and SNOMED CT together. See [“Guidelines for using SNOMED CT and LOINC together - Phase 2 Draft”](#) [1] for information about implementation of LOINC and SNOMED CT together.

All content will be released in parallel by IHTSDO and the Regenstrief Institute through their distribution channels, e.g. IHTSDO Confluence site, LOINC website.

Two other file formats are available for review of content in the Alpha Release. Information about these files is provided in separate documents [2].

- OWL file: for reviewing and classifying the content with an ontology reasoner using an ontology viewing/editing software such as Protege. A hierarchy is created between some LOINC Terms after classification. This is not an official release format for IHTSDO. It does not contain metadata such as refset identifier and correlation designation.
- Excel spreadsheet: for reviewing the map of LOINC Terms to SNOMED CT expressions in a human-readable tabular format. This is not an official release format for IHTSDO. The map from LOINC Parts to SNOMED CT is not included as the Parts are not publicly released by the Regenstrief Institute.

1.3 Scope

This document is written for the purpose described above and is not intended to provide details of the technical specifications for SNOMED CT or encompass every change made during the release.

1.4 Audience

The audience includes National Release Centers, vendors of electronic health records, terminology developers and managers who wish to partake in the review of the LOINC - SNOMED CT Cooperative project edition Alpha release.

2 Feedback for the Alpha release

Desired feedback:

Feedback is requested on this Alpha release to inform future development and determine fitness for purpose. Feedback on the formatting of expressions, maps and reference sets is expected; feedback on the content of the expressions or mapping themselves is also welcome.

Please provide feedback by 31 May, 2016 at <https://jira.ihtsdotools.org/projects/LOINC>.

3 Content Development Activity

Overview:

This Alpha release contains two content files: a LOINC Term to SNOMED CT Expression Reference Set and a LOINC Part to SNOMED CT Reference Set. This Alpha release is RF2 compliant and it contains a full release file, a snapshot file and a delta file. The Alpha content is released under the 715515008 | LOINC - SNOMED CT Cooperation Project module (core metadata concept) with concept identifiers from the 20160131 version of the IHTSDO International release of SNOMED CT and Version 2.54 of LOINC released December 2016.

This release includes a majority (around 75%) of the Top 2000 LOINC Lab Observations and LOINC Parts needed to represent these LOINC Terms. Some LOINC Terms on the Top 2000 list were excluded from the scope of the Alpha release for various reasons:

- We have not yet mapped all the LOINC Parts associated with the Top 2000 LOINC Terms to SNOMED CT concepts (or have not created the SNOMED CT concepts). The main reason for this exclusion is the requirement for further clarification with the Substance Project, RII, and Observable Model Redesign Project.
- There are Terms being discussed internally for modelling reconsiderations and possible modification (e.g. susceptibility testing and genetic testing)
- Panels are not in the scope of the Cooperative Agreement
- Veterinary specific terms are not considered in the scope of SNOMED CT and this project

Over 1500 concepts were added to SNOMED CT to produce this Alpha release.

This Alpha release does not represent a set of data ready for clinical use within a system. It has been made available at this time for review and evaluation purposes only.

USE WITHIN A CLINICAL SYSTEM CANNOT BE SUPPORTED AT THIS TIME

Alpha release status means that:

- The release format specification of the product is public but not fixed.
- The method of product content preparation may be public (but is not required to be) but is not fixed.
- Quality or safety assurance of the product may be ill defined and/or incomplete.
- So far as is possible within internal resourcing constraints, IHTSDO undertakes to support the product and maintain it in synchronization with the primary release data as required.
- Trial implementation is encouraged to evaluate utility and safety.
- Trial implementation is at the user's own risk, where such risk is permitted by other governance processes.
- Trial implementations may have to change if and when the product design changes in the light of experience and release of the baseline.

Content usage:

The main purposes for the mapping are to (a) link the laboratory coverage of LOINC with the SNOMED CT concept model to provide a consistent model rather than having divergent representation of similar concepts, (b) limit duplication of effort related to overlapping areas, and (c) focus resources on common and collaborative effort rather than the competing activities of the past. In practical terms there are a variety of ways to deploy and benefit from the resulting products. These are explored in the current draft of the document "Guidance on Use of SNOMED CT and LOINC Together." It is available on Confluence at <http://snomed.org/snomedlinc>.

Content detail:

LOINC Term to SNOMED CT Expression Reference Set

- The LOINC Term to SNOMED CT Expression Reference Set contains 13756 active LOINC Terms associated with post-coordinated SNOMED CT expressions. This refset includes around 75% of the LOINC Terms from the Top 2000 Laboratory LOINC list.
- All of the LOINC Terms are subclasses of 363787002 | Observable entity (observable entity) in SNOMED CT and the

expressions follow the draft SNOMED CT Observables model in a flattened form (no nesting of attributes as in previous Alpha releases of this project) [4,5].

- See Table 1 for an example from the refset and see Figure 2 for a diagram of the Observables model used in this work.
- Section "Mapping and Modeling Guidelines Used" contains general rules on the mapping and exceptions.
- The majority of the expressions included are fully defined and are an exact match with a LOINC Term, with a few exceptions.
- The expressions are represented in the stated form with no hierarchy included.
- There are some known potential content issues in this reference set which are under discussion with the Observables and Investigation Modeling Project Group.

A.

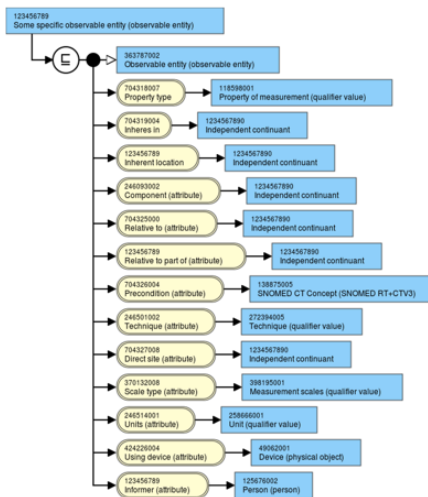
id	mapTarget	expression
7f26012e-5a23-4cdb-b5d3-dbe1ef97dbf5	27182-5 Calcium:ACnc:Pt:Bld:Ord	363787002 Observable entity :704319004 Inheres in =87612001 Blood ,704327008 Direct site =119297000 Blood specimen ,370134009 Time aspect =123029007 Single point in time ,246093002 Component =5540006 Calcium ,370132008 Scale =117363000 value ,704318007 Property type =118569000 Arbitrary concentration

B.

id	mapTarget	expression
7f26012e-5a23-4cdb-b5d3-dbe1ef97dbf5	27182-5	363787002:704319004=87612001,704327008=119297000,370134009=123029007,246093002=

Table 1. Example from the LOINC Term to SNOMED CT Expression Reference Set. This shows a LOINC term "Calcium:ACnc:Pt:Bld:Ord" (LOINC code 27182-5) with an equivalent post-coordinated expression. Note that "A" includes text labels for demonstration purposes; the actual refset will not contain the text descriptions (shown in "B"). For brevity, not all fields in the LOINC Term to SNOMED CT Expression Reference Set are included in this table.

A.



B.

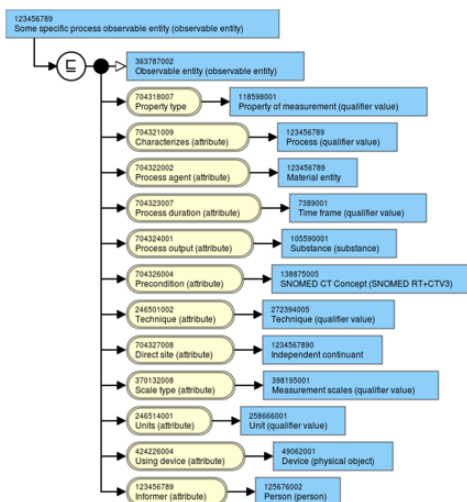


Figure 2. Flattened Observables model showing the relationship of SNOMED CT attributes (in yellow) and values (in blue) used in creating the post-coordinated expressions in the LOINC Term to SNOMED CT Expression Refset. "A" shows the model for quality observables and "B" shows the model for process observables.

LOINC Part to SNOMED CT Map Reference Set

- The LOINC Part to SNOMED CT Reference Set consists of 4070 LOINC Parts (LP) mapped to one or more SNOMED CT concepts.
- While the majority of the maps are one to one, occasionally one LP maps to more than one SNOMED CT concept or a combination of LPs map to one SNOMED CT concept or combination of SNOMED CT concepts. Additionally, a concept may be used as a value in more than one attribute.
- See section "Mapping and Modeling Guidelines Used" for general rules on the mapping and exceptions.
- See Table 2 for examples of Part maps.

A.

id	mapTarget	referencedComponentId	attributeId	correlationId
9e9be8d3-a438-4708-8d15-73bf002b37aa	LP15257-6 Calcium	5540006 Calcium (substance)	246093002 Component (attribute)	447559001 Broad to narrow map from SNOMED CT source code to target code (foundation metadata concept)
4da50a7e-d2b5-415e-805c-a6772f71b3d0	LP15257-6 Calcium	5540006 Calcium (substance)	704324001 Process output (attribute)	447559001 Broad to narrow map from SNOMED CT source code to target code (foundation metadata concept)

B.

id	mapTarget	referencedComponentId	attributeId	correlationId
e8001e5d-95fd-4e6b-a750-7cacad50d99bb	LP15257-6	5540006	246093002	447559001
fcab2a6d-ca5b-4288-9051-e6c656ec7c5c	LP15257-6	5540006	704324001	447559001

Table 2. Example of one LOINC Part mapped to a SNOMED CT concept to be used with two different attributes. LP15257-6 is a component part type in LOINC. The attributeId column indicates for which attribute in SNOMED CT this concept would be a value; in this case the concept is used as value for two different SNOMED CT attributes. Note that A includes text labels for demonstration purposes; the actual refset will not contain the text descriptions (shown in B). For brevity, not all fields in the LOINC Part to SNOMED CT Complex Map Reference Set are included in this table.

Mapping and Modeling Guidelines Used

When preparing this content we utilized the draft flattened Observables model (see Figure 2) and followed these guidelines:

- Mapping is performed from LOINC to SNOMED CT
- In general, we mapped from LOINC axis to SNOMED CT attribute as such:
 - LOINC Component Component attribute in SNOMED CT for quality observables (or Process output attribute in process observables such as excretions)
 - LOINC Components containing divisors Component + Relative to attributes in SNOMED CT
 - LOINC Components containing challenges Component + Precondition attributes in SNOMED CT
 - LOINC Components containing adjustments Component + Technique attributes in SNOMED CT
 - Sometimes a new SNOMED CT concept containing a combination of techniques was needed
 - LOINC Property Property attribute in SNOMED CT
 - LOINC Scale Scale attribute in SNOMED CT
 - LOINC System Direct site + Inheres In in SNOMED CT
 - Direct site is the equivalent of system in LOINC. Used for all specimen types except XXX.
 - Inheres in applies to all specimen types except "specimen" and XXX and Body fluid
 - Direct site and Inheres in
 - The Direct site is the direct object of the observation action; the site or specimen where the observation takes place. This may be different from the value of Inheres in, since the property being observed may be inferred from a specimen or from a remote site. The intended object of the observation is the entity in which the observed property inheres; or the independent continuant which is ideally intended to be observed.
 - Example:
 - Serum specimen being used to determine body plasma sodium concentration. The concentration inheres in the plasma, but is being measured in a serum specimen.
 - LOINC Time
 - LOINC Part Pt Time aspect attribute = Single point in time in SNOMED CT
 - LOINC X hrs = Process duration attribute in SNOMED CT
 - Exception: Where LOINC System = urine AND Time = 24 hrs AND Property is not one of MRat, SRat, VRat, and NRat, the Term is mapped as such:
 - Specimen = Change map from Urine 24 hour urine sample
 - Time = Change map from 24hrs Single point in time
 - Inheres in is not affected
 - LOINC Method Technique attribute in SNOMED CT
- An expression only needs to include the attributes necessary to specify the LOINC Term. It does not need to use every attribute in the Observables model.
- We mapped from one LOINC Part to one SNOMED CT concept where possible. In some cases a one to one map was not possible:
 - LOINC Part mapped to more than one SNOMED CT concept
 - LOINC System Parts are mapped using two attribute-value pairs in SNOMED CT: Direct site and Inheres in
 - Example: LOINC Part "Ser/Plas" is mapped to SNOMED CT Direct site=Acellular blood (serum or plasma) specimen and Inheres in=Plasma
 - LOINC Parts for cells (e.g. Basophils) are often mapped to two concepts in SNOMED CT: an individual X cell concept and a population of X cells in portion of fluid concept. The property type and scale of the associated LOINC Term will determine which map is appropriate for that LOINC Term.
 - Some LOINC Component Parts (generally substances) are mapped using the Component and/or Process output attribute in SNOMED CT depending on the time aspect and property of a LOINC Term. When the Property type is MRat, SRat, VRat, and NRat, and Time = 24 hrs, then the Process output attribute carries the SNOMED CT concept equivalent to the LOINC Component. Otherwise, the Component attribute carries the SNOMED CT concept equivalent to the LOINC Component. A LOINC Term will generally only include a value for Component OR for Process Output, but not both. The Part map may include a value for Component and Process Output.
 - Example: Creatinine is used as a value of the Component attribute in LOINC Term Creatinine/Calcium [Mass Ratio] in Urine. Creatinine is used as a value of the Process output attribute in LOINC Term Creatinine [Mass/volume] in 24 hour Urine.
 - LOINC Divisor Parts are mapped to two attribute-value pairs in SNOMED CT: Relative to and Units
 - LOINC Part 100 Leukocytes is mapped to SNOMED CT Relative to=Population of all leukocytes in portion of fluid and Units=Percentage
 - LOINC Part is not mapped to an equivalent SNOMED CT concept
 - LOINC Part that is not universal and reproducible is mapped to a more general concept in SNOMED CT.
 - Example, the LOINC Part "Leukocyte other" is mapped to "Leukocyte (cell)" and "Population of leukocytes in portion of fluid" in SNOMED CT because the meaning of "Leukocyte other" cannot be specified.
 - LOINC Part mapped to a different attribute in SNOMED CT concept
 - Example: The LOINC Component Part "Color" is mapped to the Property attribute with a value of "Color" in SNOMED CT
 - Two LOINC Parts are combined to map to two SNOMED CT concepts

- LOINC Component Part Crystals.unidentified and LOINC Method Microscopy.light map to SNOMED CT Component=Crystal and Technique=Detecting by light microscopy without classifying
- Our goal is to create maps that are exact matches between LOINC Parts and SNOMED CT concepts. Where this is not possible, the map is given a designation other than "Exact match."
 - Example, the LOINC Part "Leukocyte other" is mapped to "Leukocyte (cell)" and "Population of leukocytes in portion of fluid" with a correlation of "SNOMED CT Broader."
- Our goal is to create SNOMED CT expressions that are exact matches to LOINC Terms and mark these as fully defined. Where this is not possible, the map is marked as primitive and/or a designation other than "Exact match" is utilized.
 - Example, the LOINC Term "Leukocytes other [#./volume] in Body fluid" is mapped to an expression that has Component=Population of leukocytes in portion of fluid along with other attribute-value pairs. The map is given a correlation of "LOINC narrower" and a designation of "Primitive."
- Additional information is designated for each map:
 - content origin (LOINC or SNOMED CT or both)
 - correlation (exact, narrower, broader)
 - attribute (where a Part is used in an expression)
 - IHTSDO refset identifier
 - IHTSDO module identifier
 - effective time of map
 - map status for active vs inactive
 - unique identifier of map row (GUID)
- Some SNOMED CT Concepts included in the file do not specifically map to a LOINC Part or Terms, e.g. grouping concepts, concepts used in the Observables modeling, some technique concepts.
- Active, discouraged and trial LOINC Terms are included in the mapping as some implementers are using these LOINC Terms. Deprecated LOINC Terms and Parts are not included in the mapping.
- Some naming conventions in SNOMED CT concepts are not consistent
 - Example: "Immunoglobulin G antibody to Yersinia" vs "Immunoglobulin A antibody to Yersinia species"

Quality Assurance

The files associated with this Alpha release were reviewed by a number of individuals including Terminologists at IHTSDO, Regenstrief Institute, Kaiser Permanente, University of Nebraska, Linköping University and Mapping Specialists from the IHTSDO Mapping Service Team. Quality assurance reviews were performed both manually and with some automated processes. Feedback received from reviewers (internal and external) on the previous Alpha releases were considered and changes were implemented in this release where applicable. There are several known issues that are currently under review. Changes will be implemented when a resolution becomes available. Known issues include:[1]

- Proper representation of LOINC Terms using "total," e.g. Total cholesterol. In this Alpha release, expressions for these Terms are marked as primitive rather than fully defined.
- Some of the values of SNOMED attributes are Observable entity concepts, when in fact they should be drawn from other hierarchies, e.g. "Color (observable entity)" is used as a value of for the Property type attribute when a concept "Color (property) (qualifier value)" should be used instead.

Classifying Expressions with SNOMED CT

If reviewers are familiar with classifying in ontologies and would like to classify the expressions with all or a portion of SNOMED CT, send us an email at LOINC-SNOMEDProject@ihtsdo.org with a subject line of "Alpha Release."

Next Steps

Next steps in the project include:

- Evaluate feedback received on this Alpha Release
- Prepare Beta release
- Finish the map of LOINC Parts to SNOMED CT concepts. Additional SNOMED CT concepts will need to be created to finish the map.
- Use the above map to create more expressions for LOINC Terms.
- Resolve and/or note content and modeling known and upcoming issues.
- Implement the SNOMED CT Observables model to define existing pre-coordinated SNOMED CT concepts

Acknowledgements

We would like to acknowledge Méliissa Mary for her thorough review, analysis, and feedback on two previous versions of the file releases as well as for her presentation of her findings to the IHTSDO Content COmmittee in April, 2015.

We would like to acknowledge Bruce Goldberg and Michael Smith of Kaiser Permanente for their valuable assistance in early mapping in this project and for reviewing many versions of the expressions map before publication.

References:

1. "Guidelines for using SNOMED CT and LOINC together - Phase 2 Draft:" <http://snomed.org/snomedloinc>
 2. Alpha release files of LOINC - SNOMED CT Cooperation Project, including additional file formats (OWL, Excel) are available at: [https://mlds.ihtsdotools.org/#/ihtsdoReleases/ihtsdoRelease/50041\[2\]](https://mlds.ihtsdotools.org/#/ihtsdoReleases/ihtsdoRelease/50041[2])
 - a.
 - b. COOPERATION AGREEMENT dated July 2013 Between The International Health Terminology Standards Development Organisation (IHTSDO) and The Regenstrief Institute, Incorporated (RII): <http://www.ihtsdo.org/about-ihtsdo/partnerships/loinc>
 - c. Draft SNOMED CT Observables Model described in a PowerPoint presentation titled "Observables model in the context of the concept model." <https://confluence.ihtsdotools.org/x/spEeAQ>
 - i. Note that viewing this presentation requires being a member of Observable and Investigation Model Project on Confluence. If you are not yet a user of this project on Confluence, please request addition through the site.
 - d. Observables and investigation procedures redesign Inception/Elaboration document: <https://confluence.ihtsdotools.org/x/yY5UAQ>
 - i. Note that viewing this presentation requires being a member of Observable and Investigation Model Project on Confluence. If you are not yet a user of this project on Confluence, please request addition through the site.
 - e. Information about Expressions can be found in the "SNOMED CT Technical Implementation Guide:" http://ihtsdo.org/fileadmin/user_upload/doc/
 - f. The International Health Terminology Standards Organization (IHTSDO): <http://www.ihtsdo.org/>
 - g. IHTSDO Confluence: <https://confluence.ihtsdotools.org/>
 - h. Logical Identifiers Names and Codes (LOINC): <http://loinc.org/>
 - i. Area to submit feedback on the LOINC - SNOMED CT Alpha release: <https://jira.ihtsdotools.org/projects/LOINC>
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