

The hierarchical crosswalk between LOINC and SNOMED CT Laboratory Procedures

**Polina Talapova MD¹, Eduard Korchmar¹, Timur Vakhitov¹, Aleksander
Davydov MD¹**

¹Odysseus Data Services, Cambridge, MA, USA

The LOINC-SNOMED hierarchical crosswalk has been designed and implemented by members of the Odysseus Vocabulary team to carry out the mission of the OHDSI international community to improve the global health by empowering researchers to generate evidence promoting better healthcare decisions worldwide. Since 2009, in the OMOP CDM, SNOMED CT and LOINC have been being used as Gold Standard ontologies for the harmonization of disparate representations of Observations and Measurements in longitudinal patient assets. In 2013, Regenstrief Institute and SNOMED International have formed a long-term collaborative relationship to develop common coded content to support order entry and result reporting in Healthcare [1]. Since then, the collaboration has provided LOINC/SNOMED CT Expression Association and Map Sets Files with “one-to-one” or “one-to-many” mappings of LOINC Parts as well as some LOINC Laboratory Tests to SNOMED Attributes. However, until recently, active LOINC Terms and fully defined SNOMED Expressions were not connected.

CHALLENGE

Nowadays, the necessity to provide the hierarchical crosswalk between LOINC and SNOMED is exacerbated by increasingly frequent requests of OHDSI community members to find out what concept has to be chosen if semantically the same LOINC and SNOMED Standard concepts are available or how to find all LOINC concepts indicating the measurement of a specific substance together with

SNOMED [2,3,4]. Moreover, a comprehensive and precise concept set is known to be a half the battle with cohort definition at the beginning of a study and getting reliable results of it at the end. So, how can we simplify the process of concept set creation as well as increase its semantic coverage for patient data? Answering this question, we would like to provide the public with the already available in OMOP CDM hierarchical crosswalk between LOINC and SNOMED and propose the possible ways of its extension.

SOLUTION

We present an approach that allows building the hierarchical crosswalk automatically using a structured query language (SQL) in the following sequence:

1. Formation of the pool of attributes for fully-defined SNOMED Expressions of the Measurement Domain.
2. Connection of SNOMED attributes to LOINC laboratory procedures using LOINC Parts and modified LOINC/SNOMED CT Collaborative Files.
3. Multi-axial matching of sharable attributes in different combinations for LOINC and SNOMED (see Figure 1).

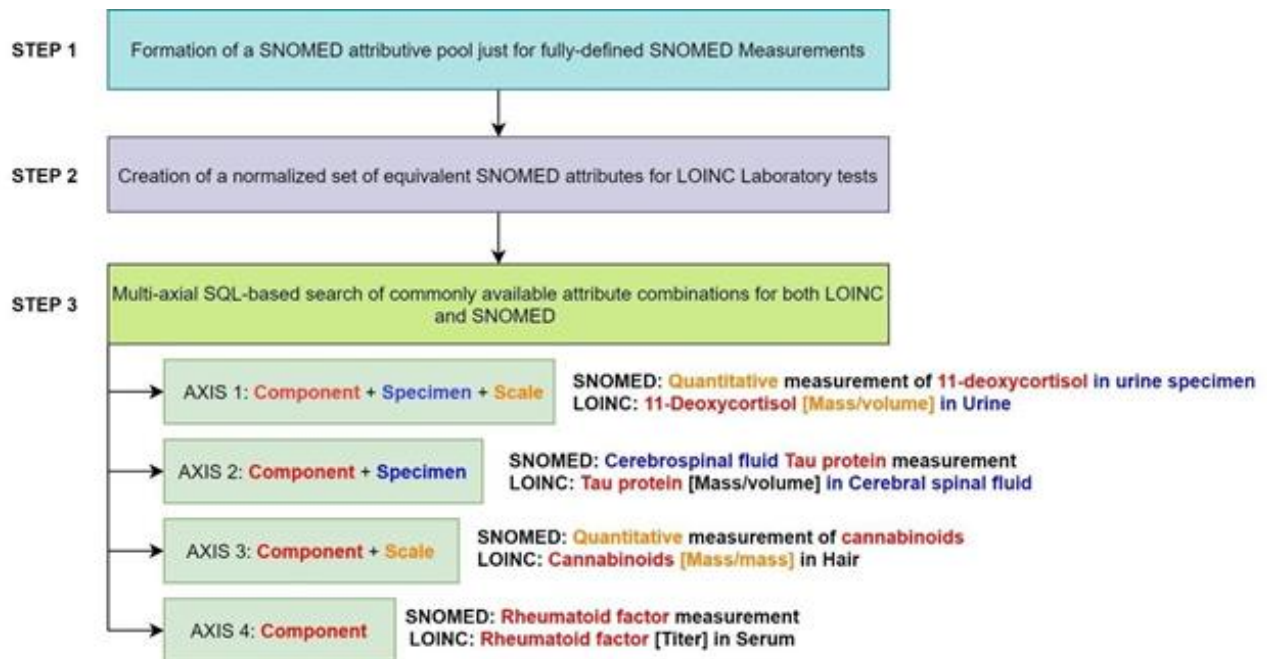


Figure 1. The methodology of an automated hierarchical crosswalk between LOINC Laboratory tests and SNOMED CT Measurements.

The SQL script for the crosswalk creation is available in the OHDSI GitHub Repository as the part of the LOINC load stage (steps 17-22) [5].

RESULTS

We have obtained more than 16578 hierarchical links between LOINC Laboratory Tests and SNOMED Measurements. Currently, the hierarchical links are represented by “Is a” relationships (with reverse of “Subsumes”) which semantically embed LOINC Laboratory tests as a descendant “under” SNOMED Measurements in the OMOP Hierarchy of Measurements (see tables 1 and 2).

Table 1. The extract from the hierarchical crosswalk for more granular LOINC Laboratory tests, which are connected to a generic SNOMED Measurement through the “Is a” relationship.

loinc_code	loinc_name ▲	relationship_id	snomed_code	snomed_name
41651-1	Glucose [Mass/volume] in Arterial blood	Is a	33747003	Glucose measurement, blood
2339-0	Glucose [Mass/volume] in Blood	Is a	33747003	Glucose measurement, blood
49134-0	Glucose [Mass/volume] in Blood --2 hours post dose glucose	Is a	33747003	Glucose measurement, blood
6689-4	Glucose [Mass/volume] in Blood --2 hours post meal	Is a	33747003	Glucose measurement, blood
87422-2	Glucose [Mass/volume] in Blood --post meal	Is a	33747003	Glucose measurement, blood
88365-2	Glucose [Mass/volume] in Blood --pre-meal	Is a	33747003	Glucose measurement, blood
32016-8	Glucose [Mass/volume] in Capillary blood	Is a	33747003	Glucose measurement, blood
40858-3	Glucose [Mass/volume] in Capillary blood --baseline	Is a	33747003	Glucose measurement, blood
41653-7	Glucose [Mass/volume] in Capillary blood by Glucometer	Is a	33747003	Glucose measurement, blood
2345-7	Glucose [Mass/volume] in Serum or Plasma	Is a	33747003	Glucose measurement, blood
40024-2	Glucose [Mass/volume] in Serum or Plasma --1 day post XXX challenge	Is a	33747003	Glucose measurement, blood
1500-8	Glucose [Mass/volume] in Serum or Plasma --1 hour post 0.05-0.15 U insulin/kg IV post 12H CFst	Is a	33747003	Glucose measurement, blood
1499-3	Glucose [Mass/volume] in Serum or Plasma --1 hour post 0.5 g/kg glucose IV	Is a	33747003	Glucose measurement, blood

Table 2. The extract from the hierarchical crosswalk for the generic SNOMED Measurement, which is connected to more granular LOINC Laboratory tests through a “Subsumes” relationship.

snomed_code	snomed_name ▲	relationship_id	loinc_code	loinc_name
33747003	Glucose measurement, blood	Subsumes	41652-9	Glucose [Mass/volume] in Venous blood
33747003	Glucose measurement, blood	Subsumes	41653-7	Glucose [Mass/volume] in Capillary blood by Glucometer
33747003	Glucose measurement, blood	Subsumes	44919-9	Glucose [Moles/volume] in Serum or Plasma --1.5 hours post meal
33747003	Glucose measurement, blood	Subsumes	45052-8	Glucose [Moles/volume] in Serum or Plasma --12 AM specimen
33747003	Glucose measurement, blood	Subsumes	45053-6	Glucose [Moles/volume] in Serum or Plasma --8 AM specimen
33747003	Glucose measurement, blood	Subsumes	45054-4	Glucose [Moles/volume] in Serum or Plasma --12 PM specimen
33747003	Glucose measurement, blood	Subsumes	45055-1	Glucose [Moles/volume] in Serum or Plasma --4 PM specimen
33747003	Glucose measurement, blood	Subsumes	45056-9	Glucose [Moles/volume] in Serum or Plasma --8 PM specimen
33747003	Glucose measurement, blood	Subsumes	45298-7	Glucose [Moles/volume] in Serum or Plasma --2.5 hours post 50 g lactose PO
33747003	Glucose measurement, blood	Subsumes	45299-5	Glucose [Moles/volume] in Serum or Plasma --45 minutes post dose lactose PO
33747003	Glucose measurement, blood	Subsumes	47622-6	Glucose [Moles/volume] in Serum or Plasma --pre dose glucose
33747003	Glucose measurement, blood	Subsumes	47859-4	Glucose [Moles/volume] in Serum or Plasma --5 minutes post dose glucose
33747003	Glucose measurement, blood	Subsumes	48109-3	Glucose [Moles/volume] in Serum or Plasma --15 minutes pre dose glucose

PERSPECTIVES

As far SNOMED and LOINC put on hold the collaborative work, the hierarchy can be extended through the creation of hierarchical mappings for those LOINC Parts and SNOMED Attributes which do not exist yet, which can be incorporated into existing SQL-script. However, this approach looks time-consuming. Thus, we plan to review the status of Classification concepts of LOINC Hierarchy, which, becoming standard and being integrated into the LOINC-SNOMED Hierarchy as descendants of generic SNOMED concepts can bring along all related Standard Measurements.

CONCLUSION

The hierarchical crosswalk between LOINC and SNOMED CT for Laboratory Procedures already facilitates the process of concept set creation and therefore cohort definition for OHDSI researchers in Atlas. And this positive effect can be enhanced via further hierarchical expansion.

References

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