SNOMED International

Leading healthcare terminology, worldwide

Developer Training Terminology Services

Germany - Online

Wednesday, 10th May 2023

https://confluence.ihtsdotools.org/display/DEV/Germany

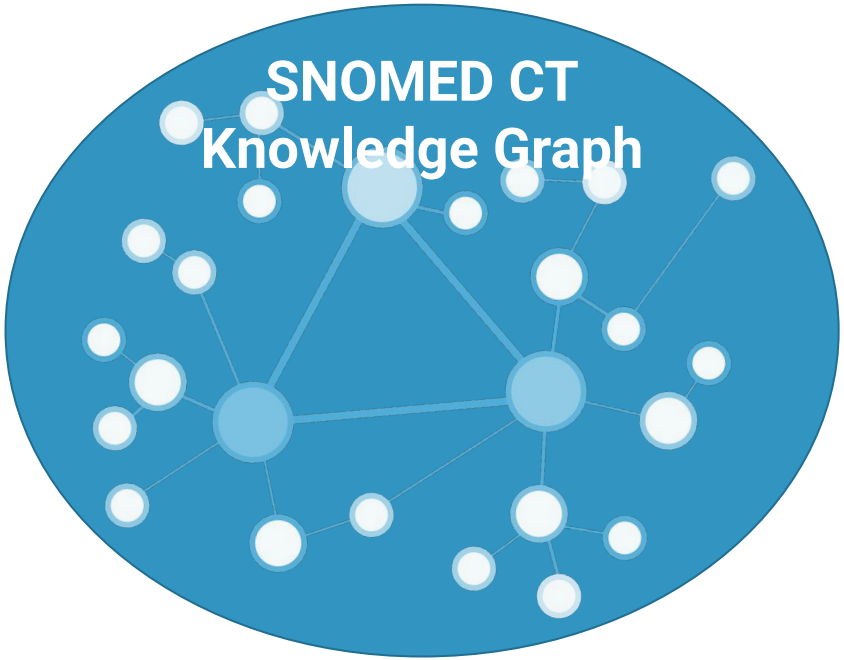
Agenda - Part 2

Using a SNOMED-enabled terminology server

- Components and derivatives
- Practical session (working with the FHIR API)
  - Search and display
  - Lookup Content in SNOMED subsets
  - Use Maps
- Analytics demo
- Practical session (working with the FHIR API)
  - Querying SNOMED CT using the Expression Constraint Language (ECL)


SNOMED
International
Components and
Derivatives

Components



Concepts

Descriptions

Relationships

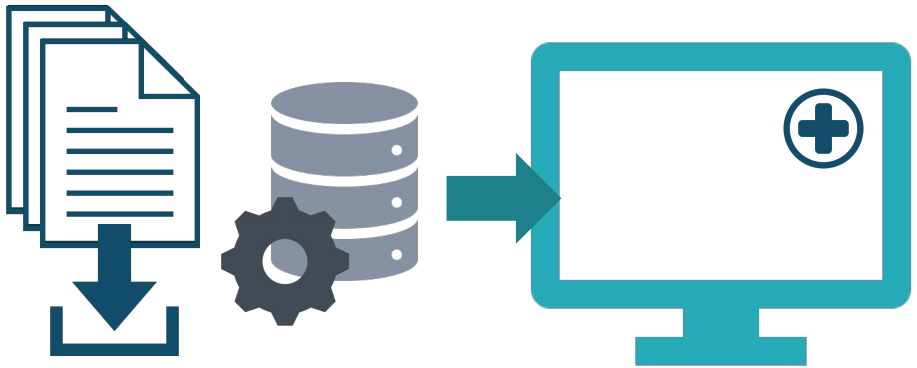
Components

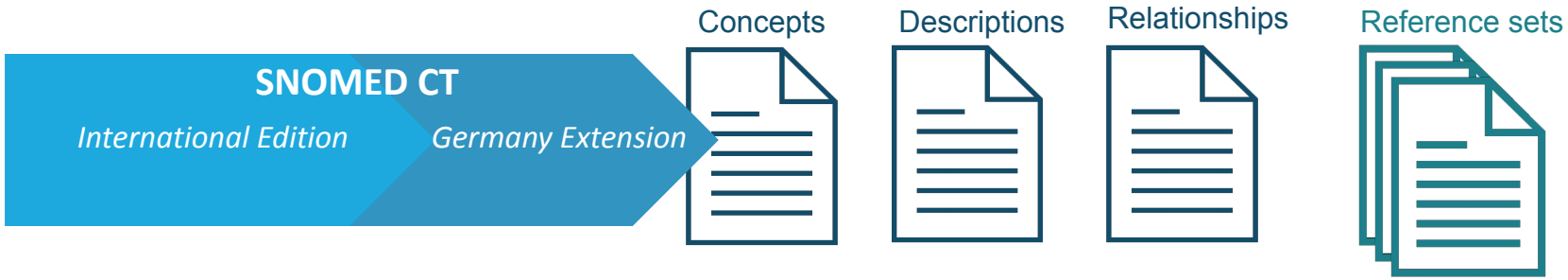
Reference Sets

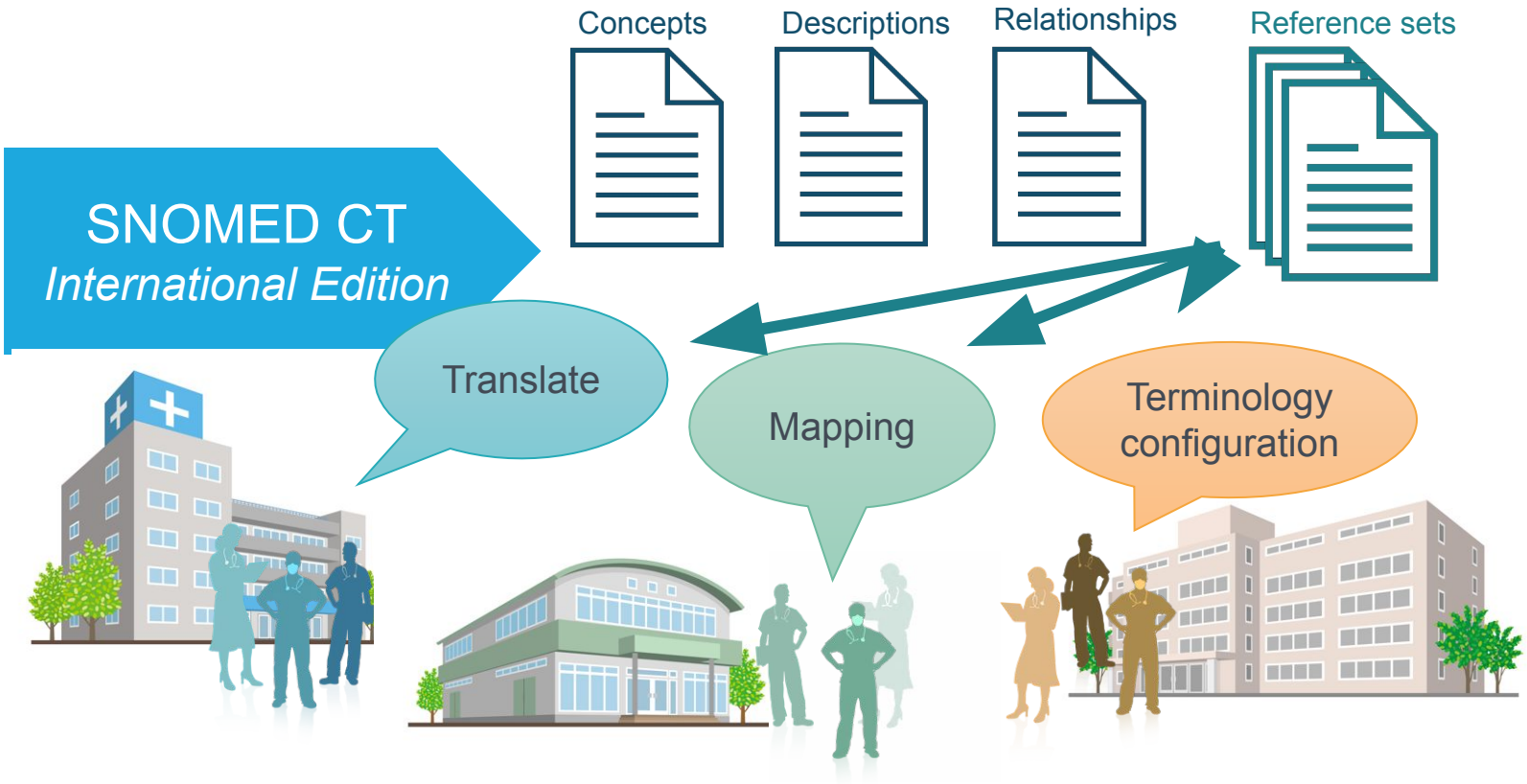
Derivatives

SNOMED CT

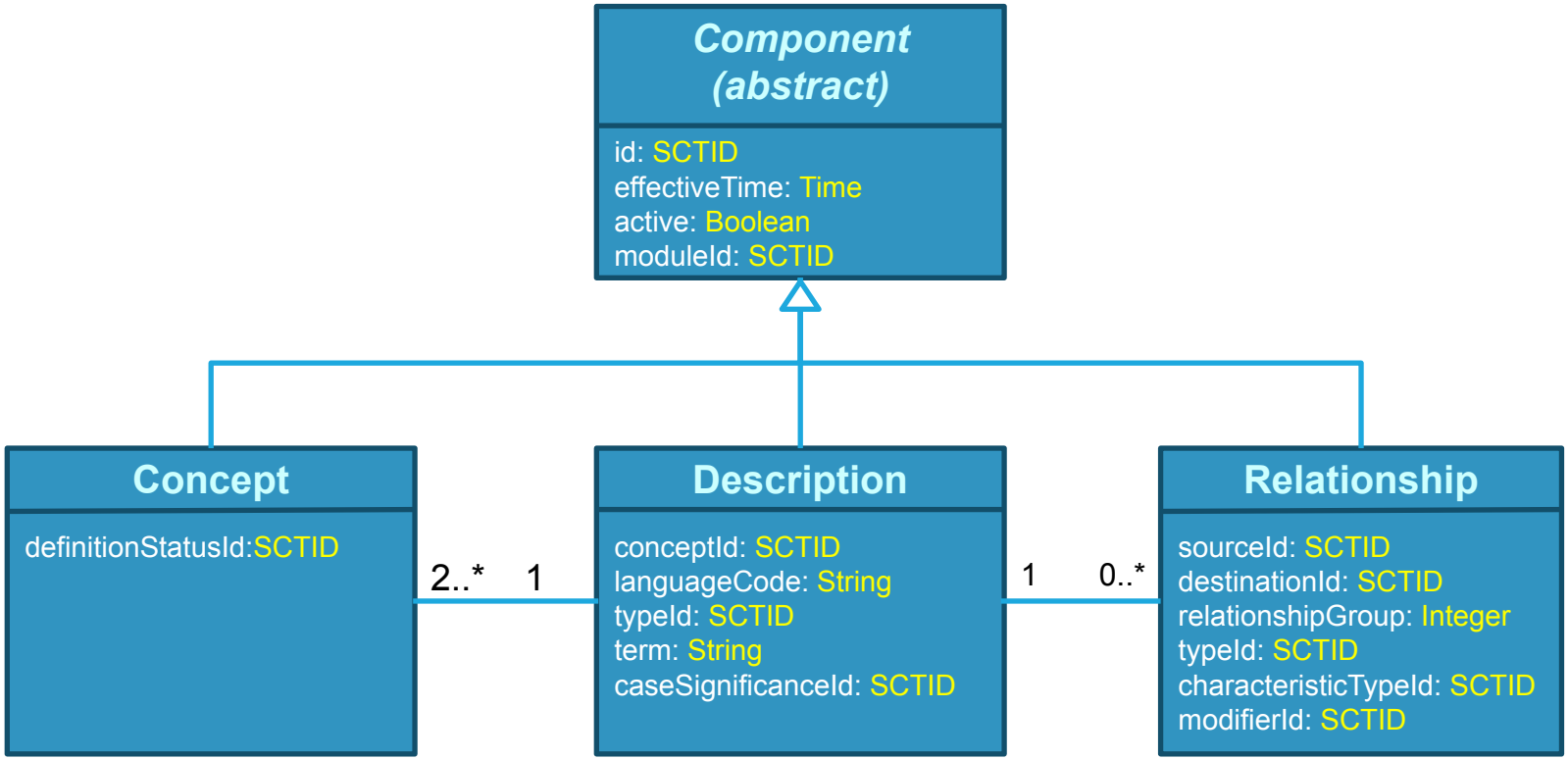
International Edition *Germany Extension*



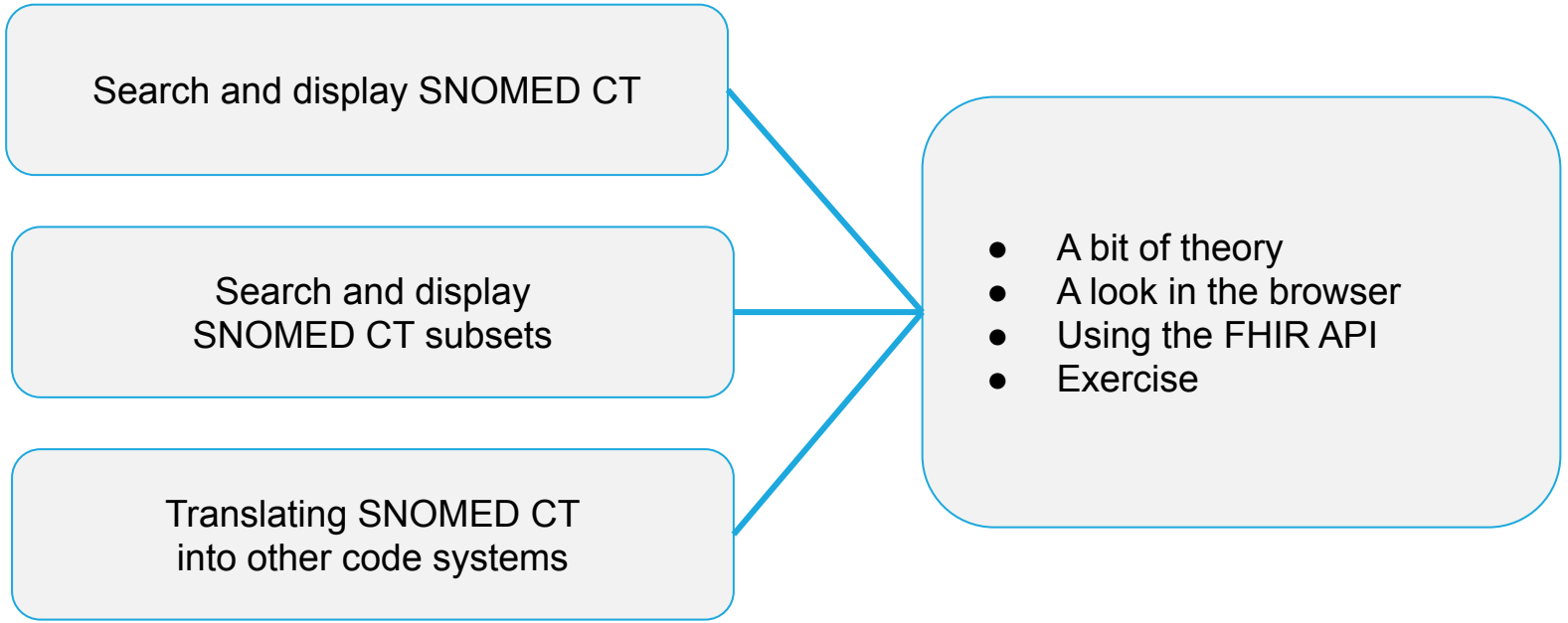

SNOMED CT
International Edition
Germany Extension
Concepts
Descriptions
Relationships
Reference sets


Concepts
Descriptions
Relationships
Reference sets
SNOMED CT
International Edition
Translate
Mapping
Terminology configuration

Logical Model of SNOMED CT Components



Accessing SNOMED CT Components and Derivatives




SNOMED
International
Search and Display

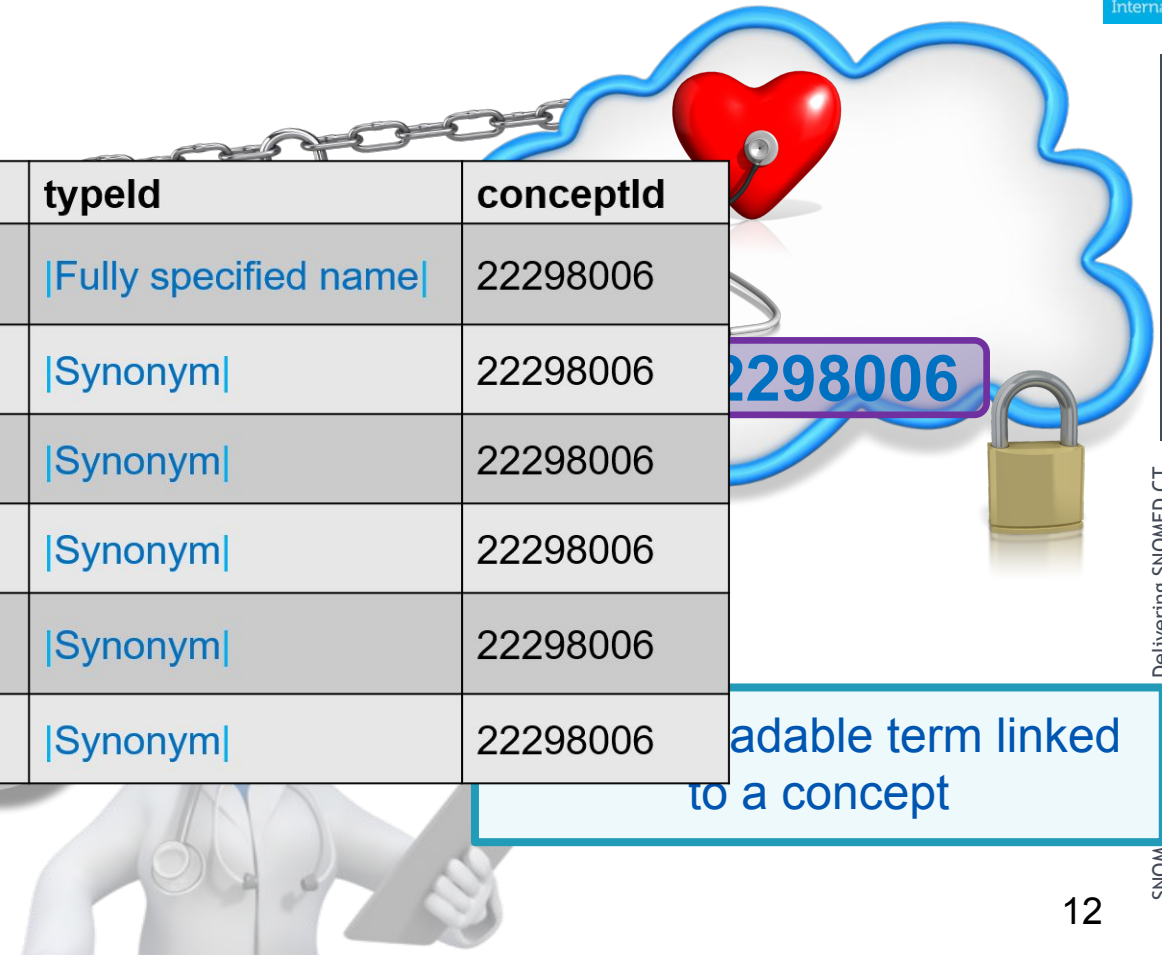
Concept

A clinical idea with a unique identifier

id	effective Time	active	moduleId	definitionStatusId
22298006	20020131	1	900000000000207008	900000000000073002

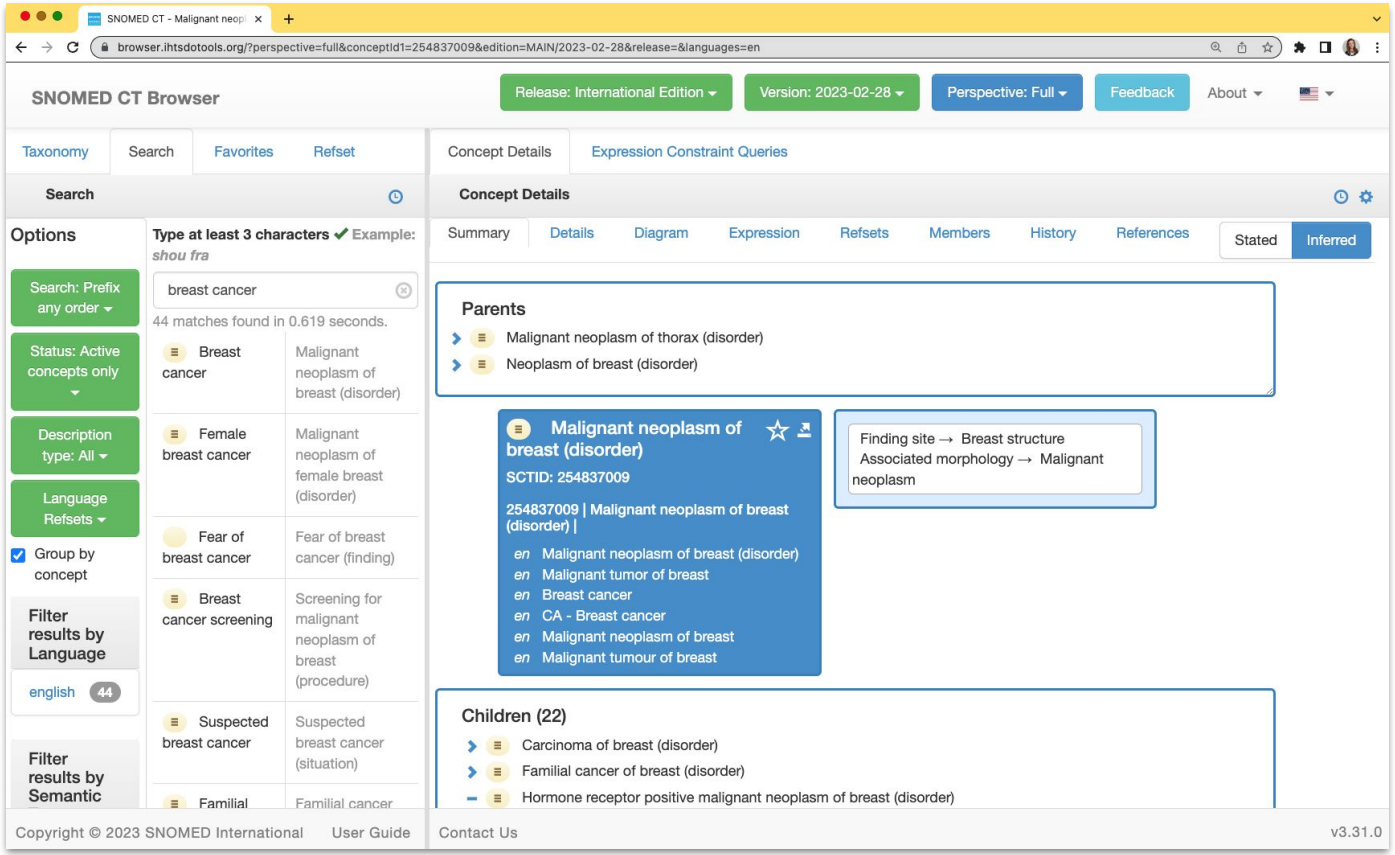
Description

id	term	typeId	conceptId
751689013	Myocardial infarction disorder)	|Fully specified name|	22298006
37436014	Myocardial infarction	|Synonym|	22298006
37442013	Cardiac infarction	|Synonym|	22298006
37333015	Heart attack	|Synonym|	22298006
1784872019	MI - Myocardial infarction	|Synonym|	22298006
1784873012	Myocardial infarct	|Synonym|	22298006



adable term linked to a concept

Exploring Concepts and Descriptions in the Browser



Introduction to HL7 FHIR
Terminology Module

The FHIR **Terminology Module** is the part of the HL7 FHIR API specification for interacting with terminologies and classifications.

The main Terminology **Resources** are:

- **CodeSystem**
  - e.g. “SNOMED CT International Edition”, “LOINC” or “ICD-10”
- **ValueSet**
  - e.g. “Nursing Activities Subset” or “Clinical Procedures”
- **ConceptMap**
  - e.g. “SNOMED CT to ICD-10 Map” or “SNOMED CT to MedDRA Map”

Introduction to HL7 FHIR
Terminology Operations

A brief summary of the main **Operations** that can be performed on the **Resources**:

- CodeSystem
  - **$lookup** - view the details of a single code / concept
  - **$validate-code** - check that a code (and term) is within a specific CodeSystem
  - **$subsumes** - test if there is an ancestor / descendant relationship between a pair of codes
- ValueSet
  - **$expand** - list all, or search within, the codes in a ValueSet
  - **$validate-code** - check that a code (and term) is within a specific ValueSet
- ConceptMap
  - **$translate** - translate a code from one CodeSystem to a code within another CodeSystem

Technical Terms in SNOMED CT and FHIR

Relevant to search & display

SNOMED CT technical terms and their equivalents in FHIR:

SNOMED CT Term	HL7 FHIR Term
SNOMED CT Version	CodeSystem
Concept / Concept ID	Code
Description	Designation

SNOMED Concept Lookup with FHIR

Using **CodeSystem $lookup** operation

https://www.hl7.org/fhir/codesystem-operation-lookup.html

HTTP GET [base]/CodeSystem/$lookup
?system=http://snomed.info/sct
&code=22298006

- Here the ***system*** parameter uses the URI for SNOMED CT
- The ***code*** parameter is a SNOMED CT concept id
- When no ***version*** parameter is set a terminology server should use the International Edition

Caution: *Snowstorm goes beyond the FHIR specification for this operation and will automatically select the edition that contains the requested code.*

SNOMED Concept Lookup with FHIR

Using **CodeSystem $lookup** with a specific Edition

HTTP GET [base]/CodeSystem/$lookup
?system=http://snomed.info/sct
&version=http://snomed.info/sct/11000234105
&code=22298006

- This example adds the ***version*** parameter with URI for **SNOMED CT Austrian Edition**
  - 11000234105 is the Austrian module identifier
- In the response we can see many descriptions from the International and Belgian Editions (see *valueString*)

SNOMED Concept Search with FHIR

Using **ValueSet $expand** operation

https://www.hl7.org/fhir/valueset-operation-expand.html

HTTP GET [base]/ValueSet/$expand
?url=**http://snomed.info/sct/11000234105?fhir_vs**
&displayLanguage=de
&filter=plaz

- Here the ***url*** parameter is the implicit value set of all SNOMED CT concepts in the Austrian Edition
  - https://www.hl7.org/fhir/snomedct.html#implicit

- The ***displayLanguage*** parameter switches both the search and display language
- The ***filter*** parameter is the user search term

SNOMED Concept Search with FHIR

Using **ValueSet $expand** operation … continued

Additional Options

- **displayLanguage** parameter can be an ordered list of languages or language-dialects
  - Example: de,en-gb

Snowstorm Search Behaviour

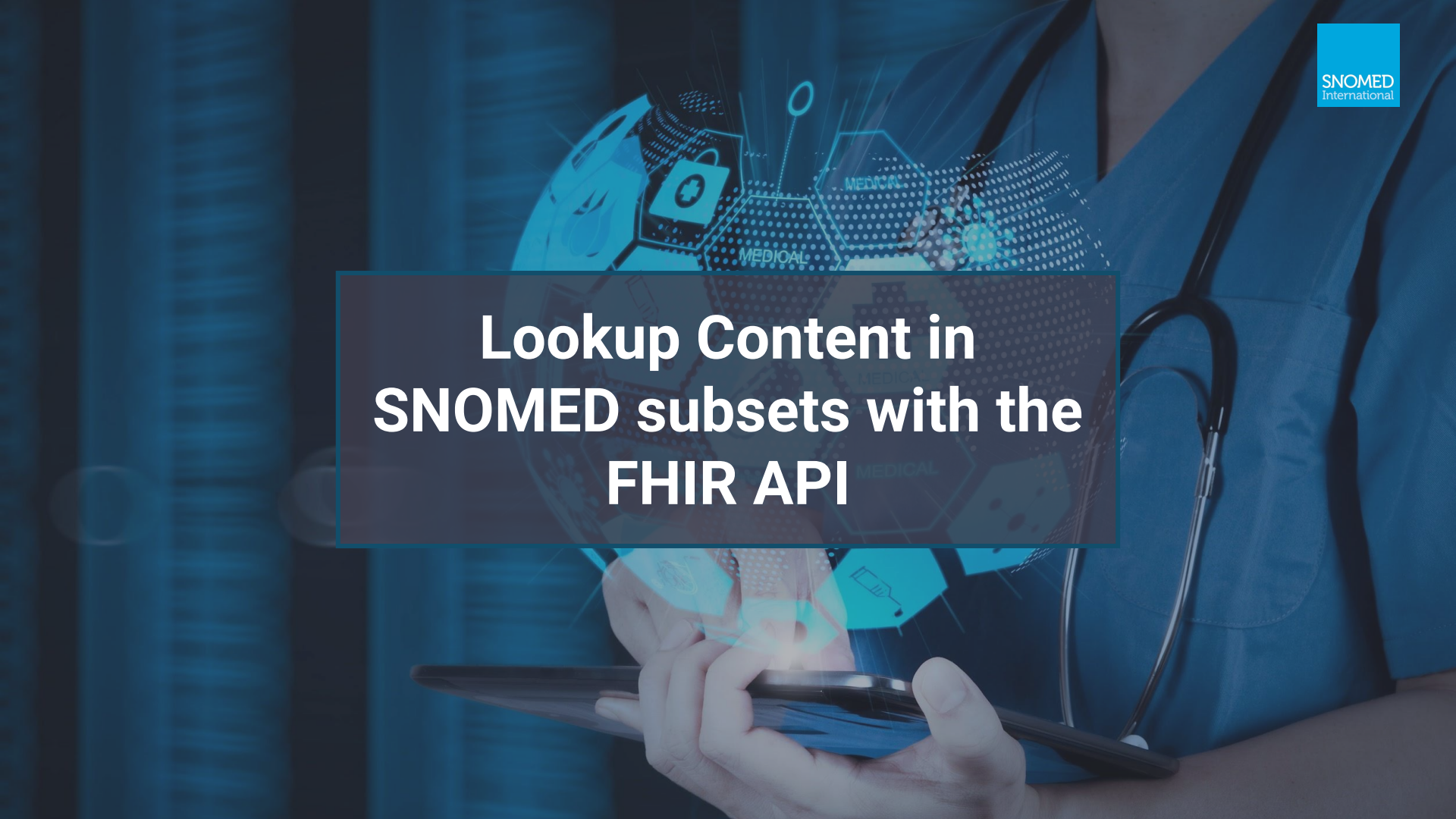
- All descriptions within the requested language/dialect are used to find concepts
- Concepts are sorted by the shortest term that matched the user search
- The “display” term in the response is the preferred term in the requested language/dialect
- *The available dialect aliases are in Snowstorm configuration under “search.dialect.config”*

Exercise

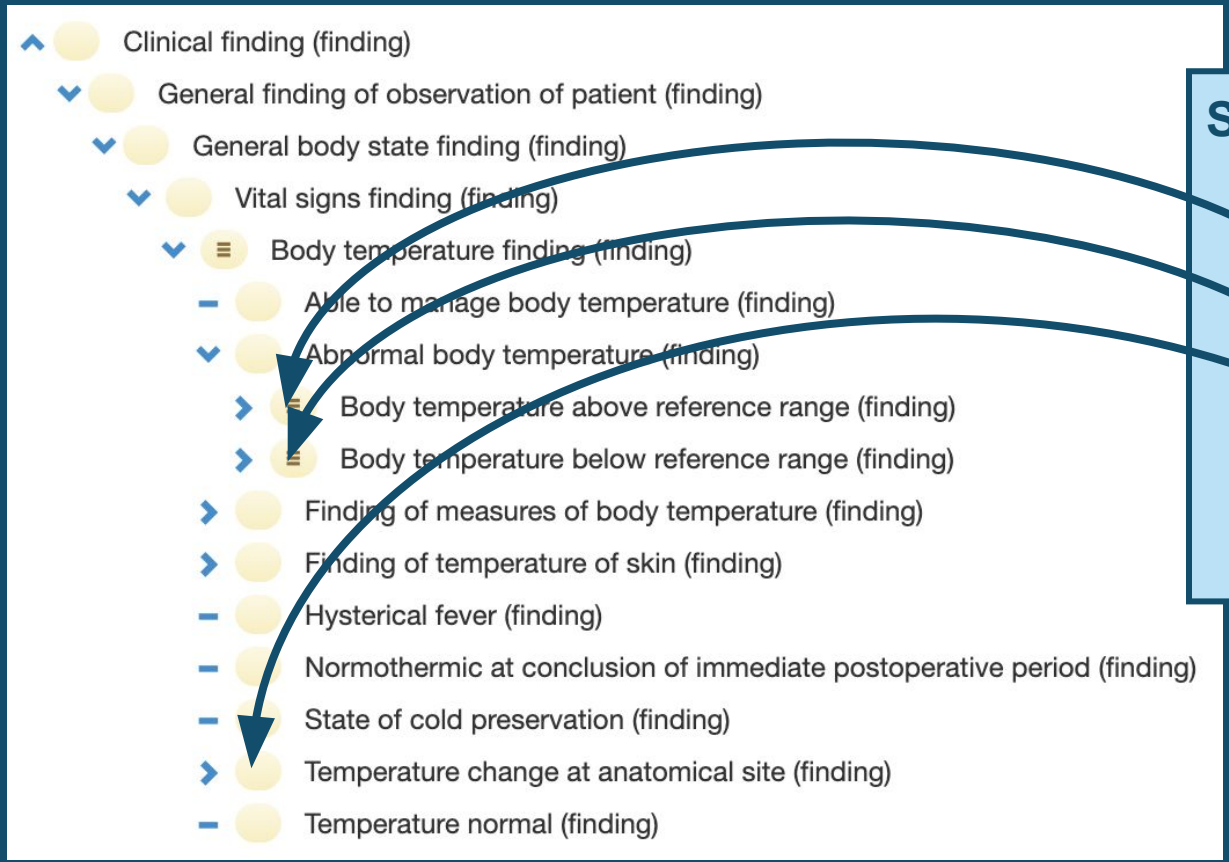
Use the FHIR API to:

- Lookup the code “80146002”
  - How many designations / descriptions does it have?

- Filter the set of all concepts to find the code for “Myocardial infarction”
  - What other terms / languages can be used to find this concept using FHIR?
  - Why does the “display” term in the response sometimes not match the search term?


SNOMED
International
Lookup Content in SNOMED subsets with the FHIR API

SNOMED CT (Versioned Edition)



Subset

50177009

846676008

87273009

SNOMED CT (Versioned Edition)

All surgical procedures

All disorders with a morphology of inflammation

Subset

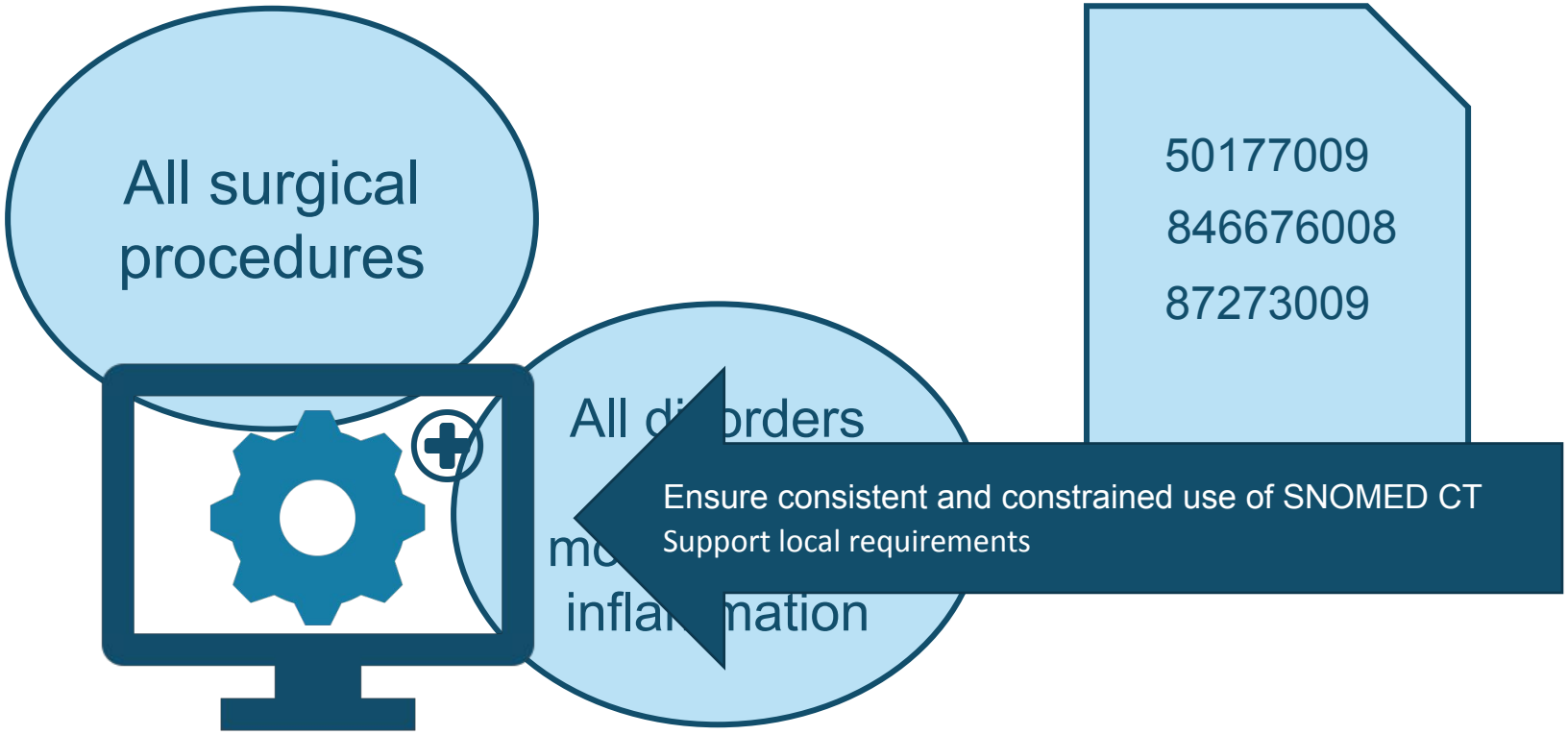
50177009

846676008

87273009

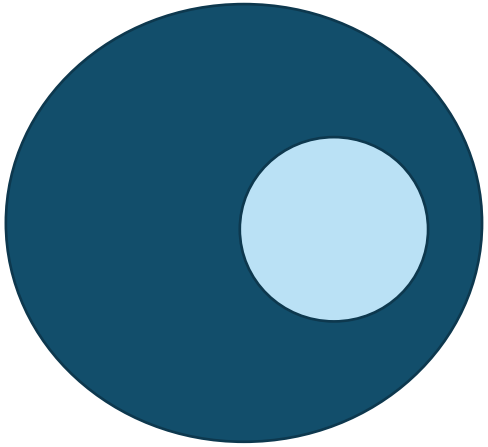
SNOMED International

SNOMED CT Subsets

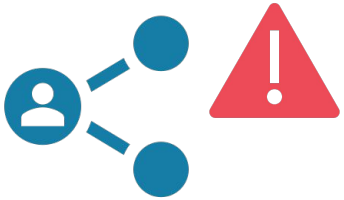


Subset Use Cases

Constrain search and data entry



Specify value sets used for communication, reporting and decision support



Specify groups used for retrieval and analytics

Subsets in SNOMED CT

A simple list of identifiers can represent a subset

A subset needs to be identified and named

Subsets may be represented as a reference set

- The subset is identified by the refsetId
- The refsetId refers to a concept
- Descriptions of that concept name the reference set
- A supertype of that concept refers to the reference set type (|simple type reference set|)

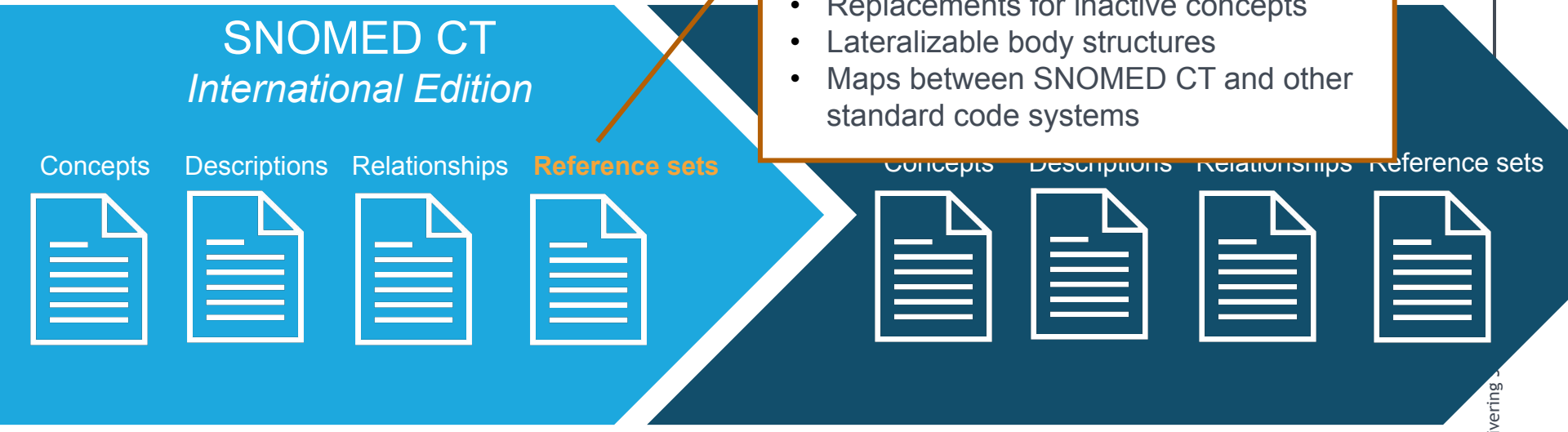
Distribution Format - Reference Sets

Standard file format for distributing sets of references to SNOMED CT components

Reference sets

Different reference set types

Refset Use Cases



Examples

- Term preferences (UK and US language)
- Replacements for inactive concepts
- Lateralizable body structures
- Maps between SNOMED CT and other standard code systems

Simple Type Refset Example

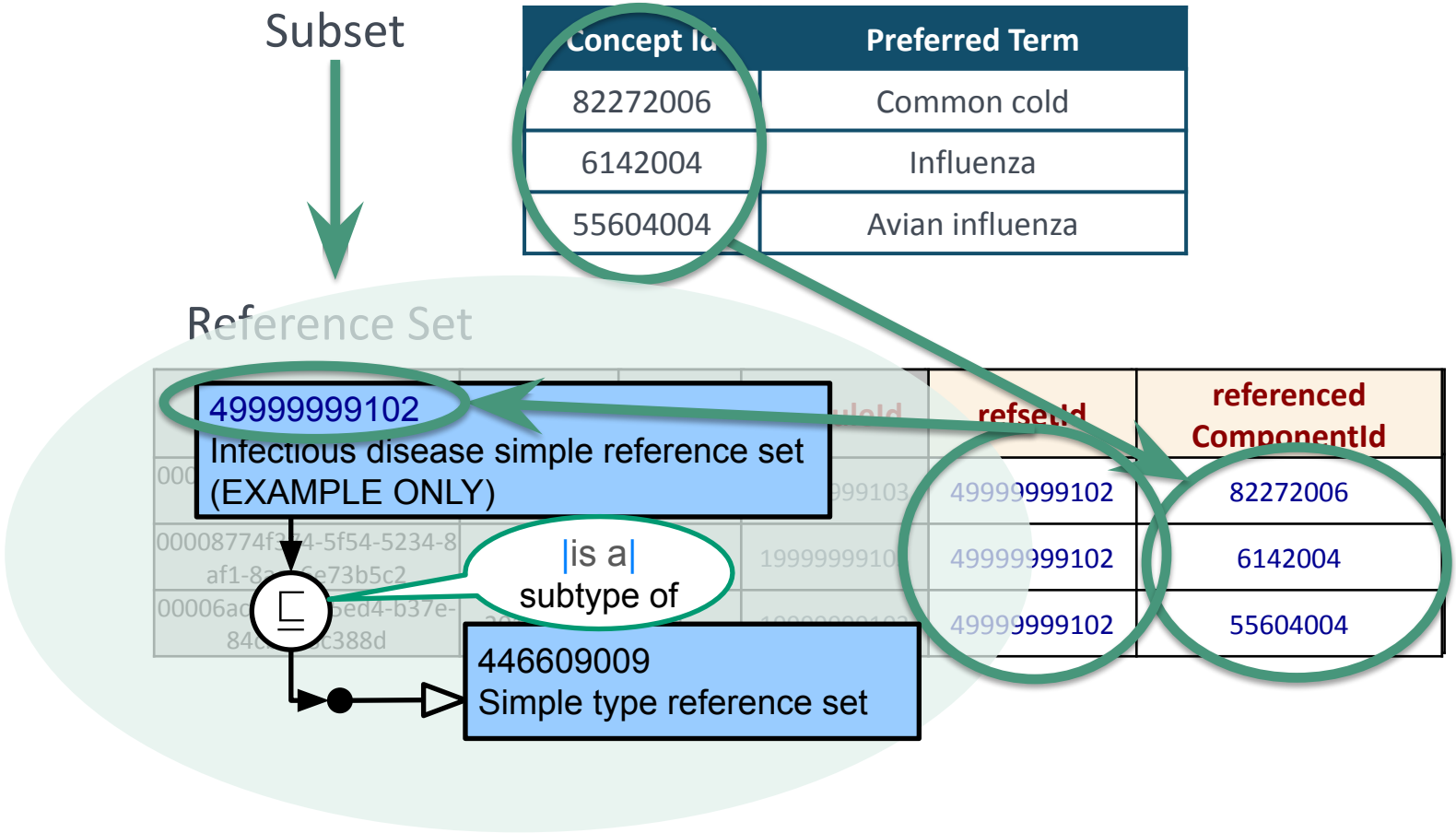
|Simple type reference set|

Identification, versioning and modularization information	**id**	**UUID**
	effectiveTime	**Time**
	active	**Boolean**
	moduleId	**SCTID**
An identifier of the reference set	**refsetId**	**SCTID**
References a subset member	**referencedComponentId**	**SCTID**

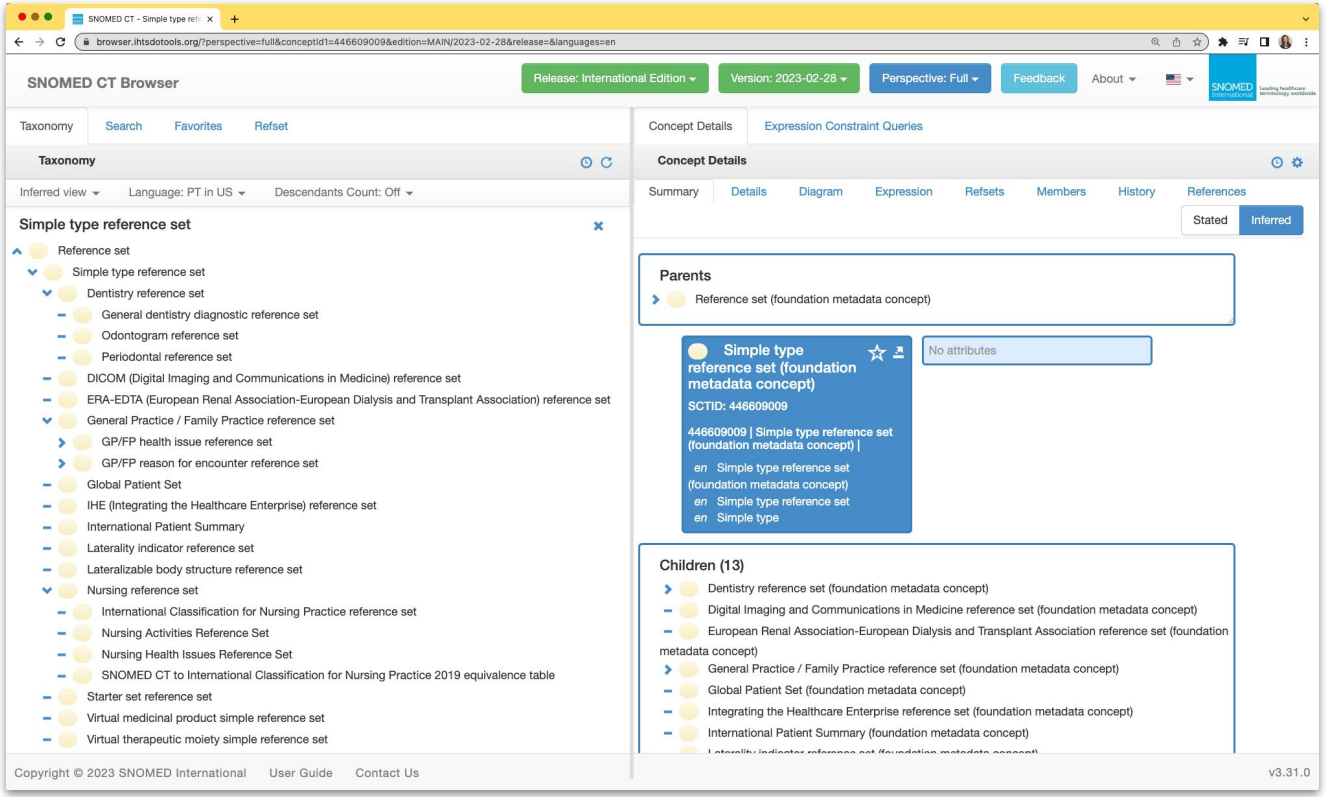
The **refsetId** refers to a concept which is a descendant of the concept 446609009 |Simple type reference set|

The **referencedComponentId** refers to a component which is a member of the subset

Simple Type Refset Example



Browser


SNOMED CT - Simple type ref
browser.ihtsdotools.org/?perspective=full&conceptId1=446609009&edition=MAIN/2023-02-28&release=&languages=en
SNOMED CT Browser
Release: International Edition
Version: 2023-02-28
Perspective: Full
Feedback
About
Taxonomy
Search
Favorites
Refset
Concept Details
Expression Constraint Queries
Taxonomy
Inferred view
Language: PT in US
Descendants Count: Off
Simple type reference set
Reference set
Simple type reference set
Dentistry reference set
General dentistry diagnostic reference set
Odontogram reference set
Periodontal reference set
DICOM (Digital Imaging and Communications in Medicine) reference set
ERA-EDTA (European Renal Association-European Dialysis and Transplant Association) reference set
General Practice / Family Practice reference set
GP/FP health issue reference set
GP/FP reason for encounter reference set
Global Patient Set
IHE (Integrating the Healthcare Enterprise) reference set
International Patient Summary
Laterality indicator reference set
Lateralizable body structure reference set
Nursing reference set
International Classification for Nursing Practice reference set
Nursing Activities Reference Set
Nursing Health Issues Reference Set
SNOMED CT to International Classification for Nursing Practice 2019 equivalence table
Starter set reference set
Virtual medicinal product simple reference set
Virtual therapeutic moiety simple reference set
Concept Details
Summary
Details
Diagram
Expression
Refsets
Members
History
References
Stated
Inferred
Parents
Reference set (foundation metadata concept)
Simple type reference set (foundation metadata concept)
SCTID: 446609009
446609009 | Simple type reference set (foundation metadata concept) |
en Simple type reference set (foundation metadata concept)
en Simple type reference set
en Simple type
No attributes
Children (13)
Dentistry reference set (foundation metadata concept)
Digital Imaging and Communications in Medicine reference set (foundation metadata concept)
European Renal Association-European Dialysis and Transplant Association reference set (foundation metadata concept)
General Practice / Family Practice reference set (foundation metadata concept)
Global Patient Set (foundation metadata concept)
Integrating the Healthcare Enterprise reference set (foundation metadata concept)
International Patient Summary (foundation metadata concept)
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v3.31.0

Technical Terms in SNOMED CT and FHIR
Relevant to subsets

Subset is the generic term, simply meaning a smaller set of things.

SNOMED CT technical terms and their equivalents in FHIR:

SNOMED CT Term	HL7 FHIR Term
Simple Reference set / Refset	ValueSet

Search within Refsets with FHIR

Using **ValueSet $expand** operation

https://www.hl7.org/fhir/valueset-operation-expand.html

HTTP GET [base]/ValueSet/$expand
?url=http://snomed.info/sct/11000234105?fhir_vs=**refset/733990004**
&displayLanguage=de,en
&filter=foot

- The ***url*** is an implicit value set containing the “Nursing Activities” refset from the International Edition
- ***displayLanguage*** includes the user’s preferred language and fallback options
- ***filter*** is a search term

Search within Subsets with FHIR

Using **ValueSet $expand** operation

Snowstorm Search Behaviour Continued

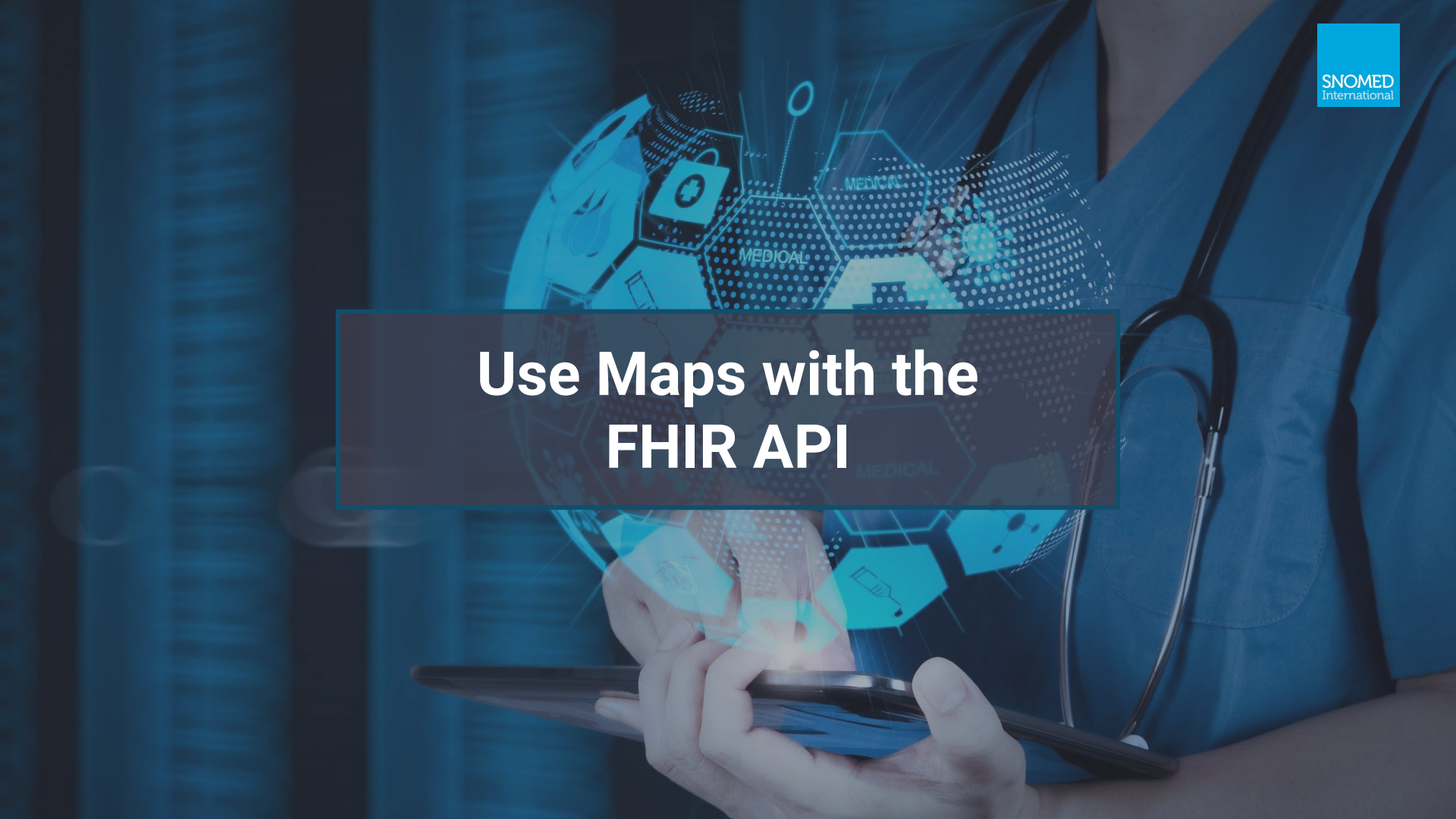
- Search terms may use multiple word prefixes, in any order
  - For example to find the concept "**Intrauterine Schwangerschaft im pränatalen Ultraschall**"
    A good search term could be: "**int sch ult**"
  - Users who learn this type less and find faster
  - This is also a great way to avoid spelling mismatch issues

Exercise

Use the FHIR API to

1. Count the total number of codes in the **Nursing Activities Reference Set**

2. Filter the **Nursing Activities Reference Set** by “breastfeeding”


SNOMED
International
Use Maps with the
FHIR API

Background

Link SNOMED CT to other code systems

Integrating local codes and SNOMED CT

- Using a library of clinical phrases as an interface terminology
- Communication of clinical data between organizations
- Migration to SNOMED CT

Integrating statistical classification systems and SNOMED CT

- Statistical analysis of SNOMED CT encoded data
- Meaning-based analysis of statistical data

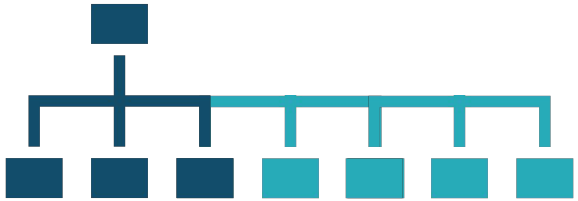
SNOMED CT to ICD-O simple map reference set

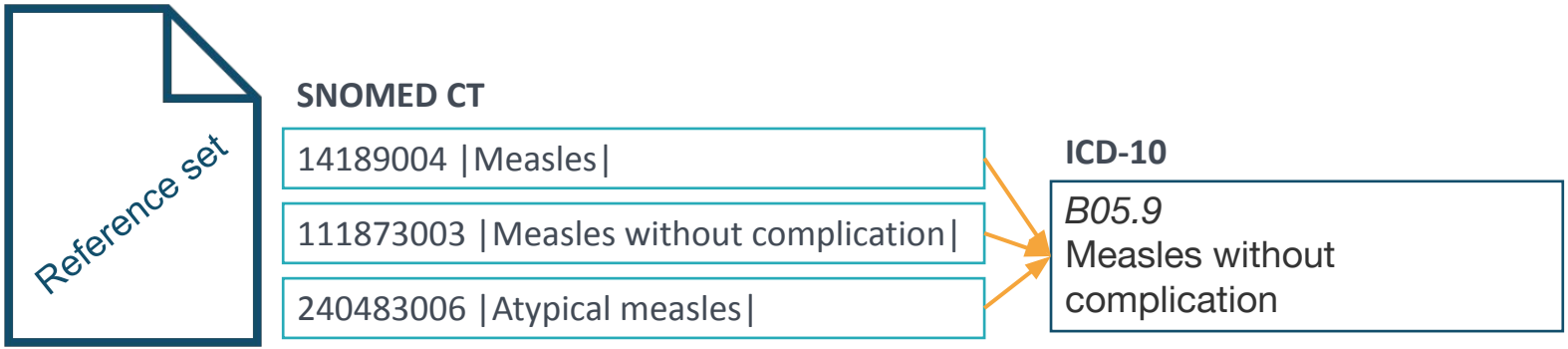
...	refsetId	referencedComponentId	mapTarget
...	446608001	2142002	8721/3
...	446608001	2227007	8370/3
...	446608001	21326004	8045/3
...	446608001	27313007	8857/0
...	446608001	32913002	8510/3
...	446608001	41607009	8312/3

|SNOMED CT to ICD-O simple map reference set|

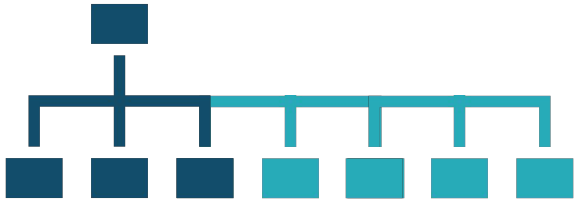
...	refsetId	referencedComponentId	mapTarget
...	|SNOMED CT to ICD-O simple map reference set |	|Nodular melanoma (morphologic abnormality)|	Nodular melanoma
...	|SNOMED CT to ICD-O simple map reference set |	|Adrenal cortical carcinoma (morphologic abnormality)|	Adrenal cortical carcinoma
...	|SNOMED CT to ICD-O simple map reference set |	|Combined small cell carcinoma (morphologic abnormality)|	Combined small cell carcinoma
...	|SNOMED CT to ICD-O simple map reference set |	|Spindle cell lipoma (morphologic abnormality)|	Spindle cell lipoma
...	|SNOMED CT to ICD-O simple map reference set |	|Medullary carcinoma (morphologic abnormality)|	Medullary carcinoma, NOS
...	|SNOMED CT to ICD-O simple map reference set |	|Renal cell carcinoma (morphologic abnormality)|	Renal cell carcinoma, NOS

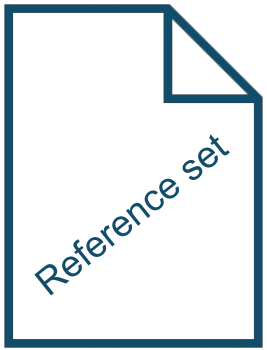
|SNOMED CT to ICD-10 extended map|





|SNOMED CT to ICD-10 extended map|





SNOMED CT

10674911000119108
|Otitis media caused by Influenza A virus|

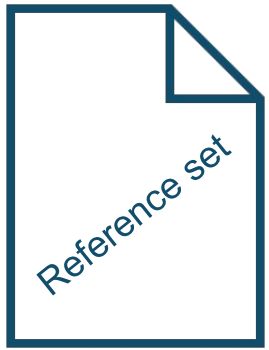
ICD-10

J10.8
Influenza with other manifestations, seasonal influenza virus identified

H67.1 Otitis media in viral diseases classified elsewhere

Map advice:
THIS CODE MAY BE USED IN THE PRIMARY POSITION WHEN THE MANIFESTATION IS THE PRIMARY FOCUS OF CARE

|SNOMED CT to ICD-10 extended map|



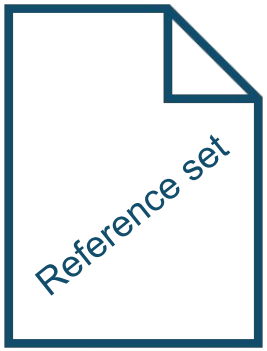
SNOMED CT

8619003 |Infertile|

ICD-10

N97.9 Female infertility, unspecified

N46 Male infertility



SNOMED CT

ICD-10

10674911000119108
|Otitis media caused by Influenza A virus|

J10.8
Influenza with other manifestations, seasonal influenza virus identified

H67.1 Otitis media in viral diseases classified elsewhere

10674911000119108
|Otitis media caused by Influenza A virus|

J10.8
Influenza with other manifestations, seasonal influenza virus identified

H67.1 Otitis media in viral diseases classified elsewhere

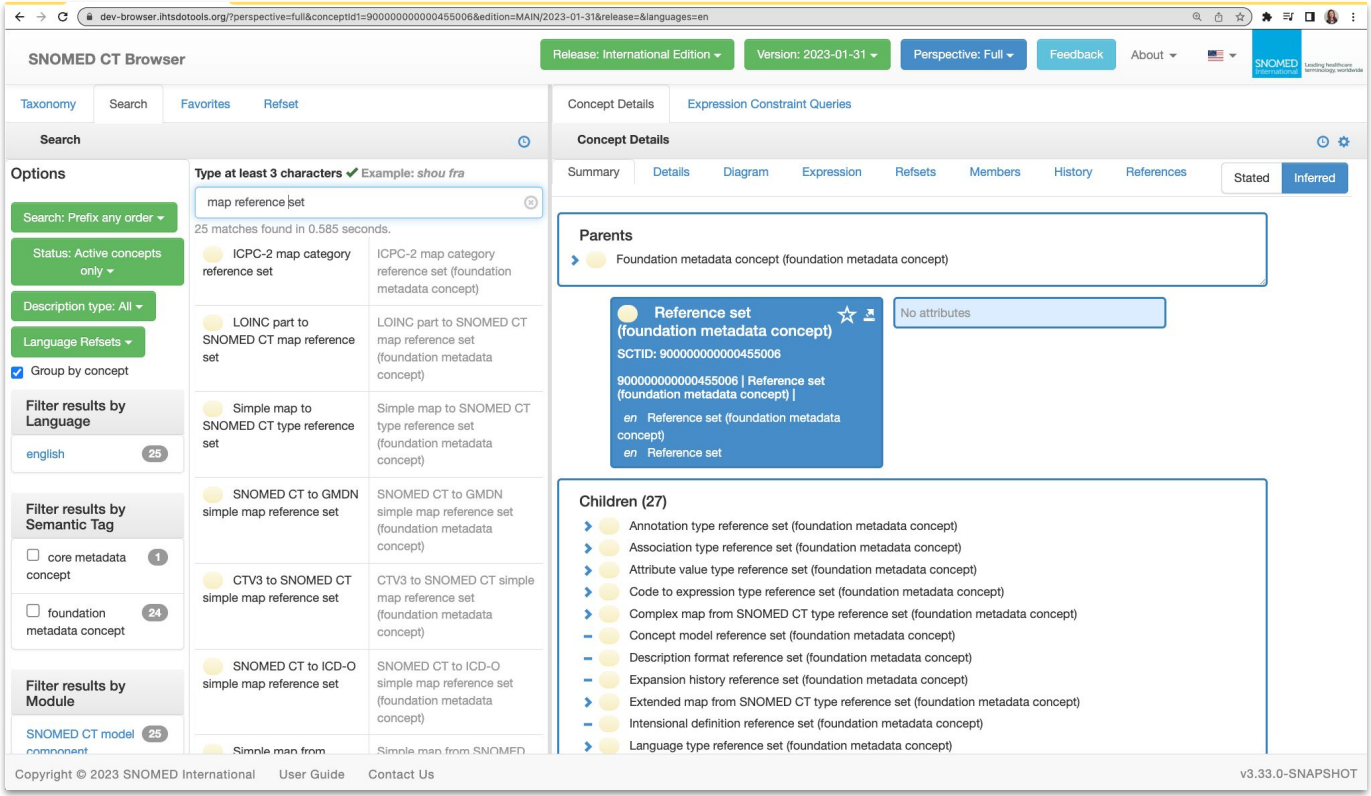
Map advice:
THIS CODE….

8619003 |Infertile|

N97.9 Female infertility, unspecified

N46 Male infertility

Browser


dev-browser.ihtsdotools.org/?perspective=full&conceptId1=900000000000455006&edition=MAIN/2023-01-31&release=&languages=en
SNOMED CT Browser
Release: International Edition
Version: 2023-01-31
Perspective: Full
Feedback
About
Taxonomy
Search
Favorites
Refset
Concept Details
Expression Constraint Queries
Search
Concept Details
Options
Type at least 3 characters ✔ Example: shou fra
map reference set
25 matches found in 0.585 seconds.
Search: Prefix any order
Status: Active concepts only
Description type: All
Language Refsets
Group by concept
Filter results by Language
english 25
Filter results by Semantic Tag
core metadata concept 1
foundation metadata concept 24
Filter results by Module
SNOMED CT model component 25
ICPC-2 map category reference set
ICPC-2 map category reference set (foundation metadata concept)
LOINC part to SNOMED CT map reference set
LOINC part to SNOMED CT map reference set (foundation metadata concept)
Simple map to SNOMED CT type reference set
Simple map to SNOMED CT type reference set (foundation metadata concept)
SNOMED CT to GMDN simple map reference set
SNOMED CT to GMDN simple map reference set (foundation metadata concept)
CTV3 to SNOMED CT simple map reference set
CTV3 to SNOMED CT simple map reference set (foundation metadata concept)
SNOMED CT to ICD-O simple map reference set
SNOMED CT to ICD-O simple map reference set (foundation metadata concept)
Summary
Details
Diagram
Expression
Refsets
Members
History
References
Stated
Inferred
Parents
Foundation metadata concept (foundation metadata concept)
Reference set (foundation metadata concept)
SCTID: 900000000000455006
900000000000455006 | Reference set (foundation metadata concept) |
en Reference set (foundation metadata concept)
en Reference set
No attributes
Children (27)
Annotation type reference set (foundation metadata concept)
Association type reference set (foundation metadata concept)
Attribute value type reference set (foundation metadata concept)
Code to expression type reference set (foundation metadata concept)
Complex map from SNOMED CT type reference set (foundation metadata concept)
Concept model reference set (foundation metadata concept)
Description format reference set (foundation metadata concept)
Expansion history reference set (foundation metadata concept)
Extended map from SNOMED CT type reference set (foundation metadata concept)
Intensional definition reference set (foundation metadata concept)
Language type reference set (foundation metadata concept)
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Map to other CodeSystems with FHIR

Using **ConceptMap $translate** operation

https://www.hl7.org/fhir/conceptmap-operation-translate.html

HTTP GET [base]/ConceptMap/$translate
?code=254153009
&system=http://snomed.info/sct
&version=http://snomed.info/sct/11000234105
&targetsystem=**http://hl7.org/fhir/sid/icd-10**

- ***code*** is the concept to translate
- ***system*** is the source CodeSystem, in this case SNOMED CT
- ***version*** selects the latest available version of the SNOMED CT Austrian Edition
- **targetsystem** is the uri of the CodeSystem to translate the code to, ICD-10

Exercise

Use the FHIR API to

1. Translate the SNOMED CT concept 74400008 |Appendicitis| to ICD-10

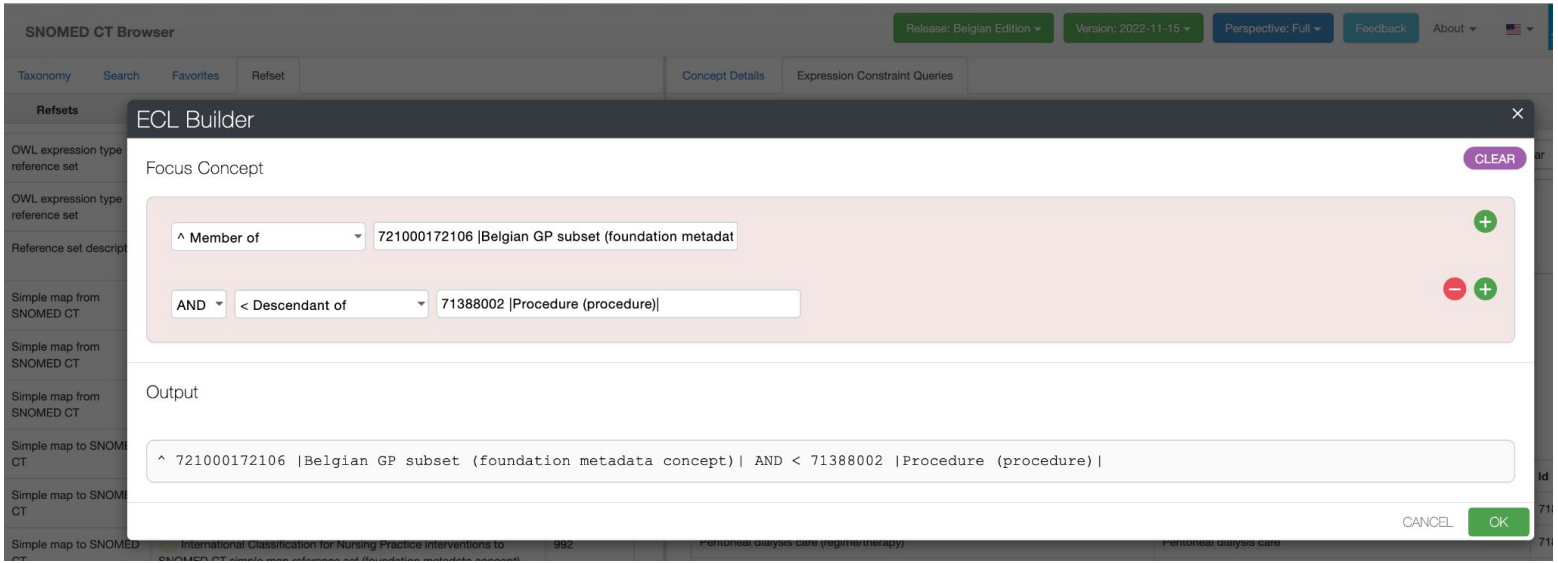
2. Translate 9977002 |Blister of ankle with infection| to ICD-10
    - How many possible ICD-10 codes are there?


SNOMED
International
Data Analytics
with SNOMED CT


SNOMED
International
Query SNOMED CT with the FHIR API

Browser

ECL Builder



Search using ECL with FHIR

Using **ValueSet $expand** operation

https://www.hl7.org/fhir/valueset-operation-expand.html

HTTP GET [base]/ValueSet/$expand
?url=http://snomed.info/sct/11000234105?fhir_vs=**ecl/<71388002**
&displayLanguage=de,en
&filter=virus

- This ***url*** is another type of “implicit ValueSet”, using the ECL query language
- It selects all concepts of type “71388002 |Procedure|”
  in the SNOMED CT Austrian Edition

Search using ECL with FHIR

$expand combining a Refset and ECL constraint

HTTP GET [base]/ValueSet/$expand
?url=http://snomed.info/sct/11000234105?fhir_vs=**ecl/^733990004 AND <71388002**

- This example uses ECL to combine a **refset** and a **hierarchical** constraint
- It filters the “733990004 |Nursing Activities Reference Set|”
  by concepts of type “71388002 |Procedure|”
  in the SNOMED CT Austrian Edition
- ***Note: URLs containing ECL may require URL encoding, particularly the ^ char (%5E)***

Search using ECL with FHIR

$expand with a more complex ECL example

This is the ECL to select any **surgical procedure** with a **procedure site** of some **heart structure**

< 387713003 |**Surgical procedure** (procedure)| :
<< 363704007 |**Procedure site** (attribute)| = << 80891009 |**Heart structure** (body structure)|

HTTP GET [base]/ValueSet/$expand
?url=http://snomed.info/sct/11000234105?fhir_vs=**ecl/< 387713003 |Surgical procedure (procedure)| : << 363704007 |Procedure site (attribute)| = << 80891009 |Heart structure (body structure)|**
&filter=transplant

The FHIR example is filtered by the term “transplant”.
.. there are many options for flexible or context based search!

Exercise

Use FHIR to:

1. Search for all **Disorders** within the **Nursing Activities Reference Set**

2. Search for **Disorders** within the **Nursing Activities Reference Set** that have “brain” in the name

3. List the concepts in SNOMED CT the that have an active ingredient of **Antigen of Measles morbillivirus**, without using a term filter
    - This one is harder, use an ECL refinement, see http://snomed.org/ecl

Wrap-up

Links to Further Information

SNOMED CT Starter Guide

- http://snomed.org/sg
  Extensions & Customization

SNOMED CT Release File Specifications

- Reference Set Release Files Specification
  http://snomed.org/rfs-refsetspec

SNOMED CT Terminology Services Guide

- Working with metadata
  http://snomed.org/tsg-metadata

SNOMED CT Record Services Guide

- http://snomed.org/rsg-comm
  Using Reference Sets to represent allowable value sets

Links to Further Information

SNOMED International Training & Terminology Services Certification Course

- https://courses.ihtsdotools.org/

SNOMED International Implementation Support

- http://snomed.org/support

Open Source Repositories

- https://github.com/IHTSDO

Getting in touch

- Technical: techsupport@snomed.org
- General: info@snomed.org

Links to Further Information

Mapping

- https://mapping.ihtsdotools.org
- https://snap.snomedtools.org/

SNOMED CT Browser

- https://browser.ihtsdotools.org

Enabling Data Analytics with SNOMED CT

- https://www.youtube.com/watch?v=9aSp31dJ0_E&t=9s

Reference set & translation tool

- https://refset.ihtsdotools.org

Release service

- MLDS - https://mlds.ihtsdotools.org/

SNOMED International Tools and Resources

- Mapping - https://mapping.ihtsdotools.org & https://snap.snomedtools.org/
- SNOMED CT Browser - https://browser.ihtsdotools.org
- MRCM Browser (relevant to writing ECL) - https://browser.ihtsdotools.org/mrcm
- Health Data Analytics Demonstrator - https://youtu.be/hmB3VMu_74w
- Reference set & translation tool - https://refset.ihtsdotools.org
- Release service
- MLDS - https://mlds.ihtsdotools.org/de

Questions?

SNOMED International

THANK YOU

SNOMED International

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