Terminologibinding af SNOMED CT til FHIR ressourcer

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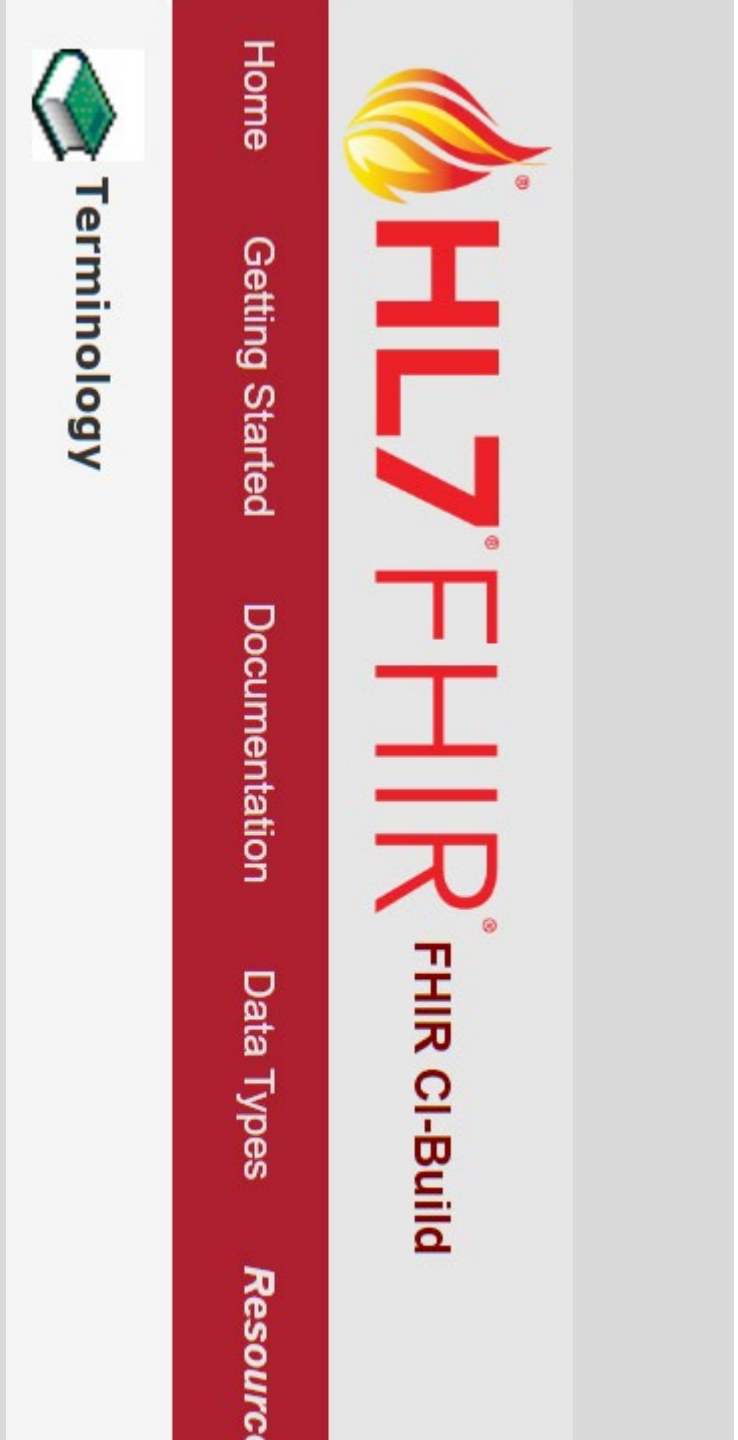
A norwegian case, and a danish -?

Partners in Norway

- E-helse direktoratet, NHRS
- Vestfold
- Styrmand a/s
- Conteir a/s

Agenda

- You know FHIR!
- You know what SNOMED CT is!
- What is TERMINOLOGI BINDING?
- What is the Snowstorm server?
- What is the Snomed CT URI specification?
- What is er post-coordination?
- What is semantic overlap?
- How can theses standards be engaged in an architecture that supports SEMANTIC INTEROPERABILITY?



Terminology binding

- Binding **to** datatypes: FHIR.code, FHIR.Coding or FHIR.CodeableConcept
- Binding **with**
  - Single concepts
    - SCT. Concept
    - SCT.Expression using **SCG syntax** Snomed compositional grammar (post-coordination)
  - Multiple concepts
    - SCT.Expression using the **ECL syntax** ExpressionConstraint Language
      - Direct: named valusets
      - Logical: dynamically defined valuesets

NB. Valuesets may include pre-, and post-coordinated concepts

FHIR valueSet

- A FHIR resource
- Used to limit input for components of other resources
- Essential for terminology binding

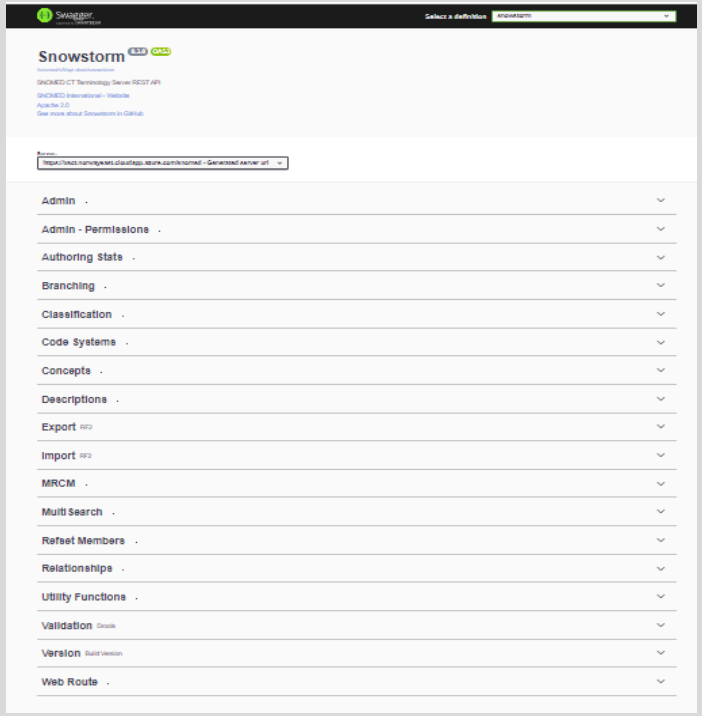
FSH ONLINE
Powered by SUSHI v3.3.2 and GoFSH v2.1.0

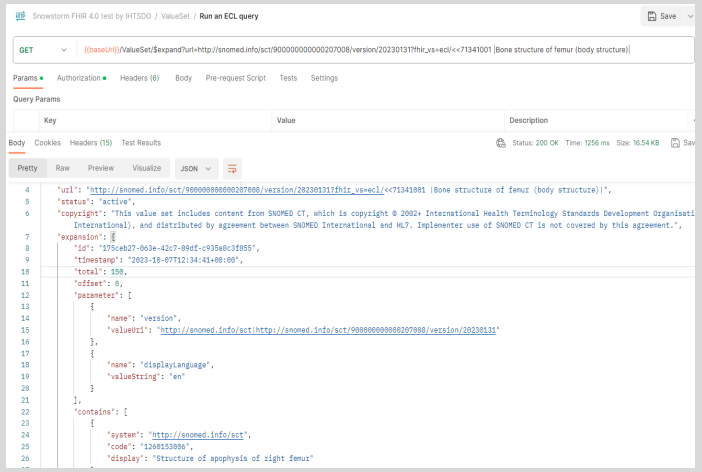
FSH Examples | Convert to JSON ▶ | ◀ Convert to FSH

FSH

```
// @Name: SNOMED Filtering
// @Description: Value set with includes and excludes
Alias: SCT = http://snomed.info/sct

ValueSet: HandednessVS
Id: handedness-vs
Title: "Handedness Value Set"
Description: "Indicates the dominant hand."
* ^copyright = "This value set includes content from SNOMED CT, which is copyright © 2002+ International Health Terminology Standards Development Organi
// Note the "concept is-a" filter is specific to SNOMED CT
// Note also that "concept is-a" will include #64940007 in the value set. If you want to only include its descendents, use "concept descendent-of" inste
// A list of filters is given here: https://www.hl7.org/fhir/valueset-filter-operator.html
// To find what filters are supported by a particular code system, go to that code system's page (see https://www.hl7.org/fhir/terminologies-systems.htm
* include codes from system SCT where concept is-a #64940007 "Handedness finding (finding)"
* exclude SCT#709880000 "Unknown handedness (finding)"
```





The Snowstorm server

- Terminology server provided as open source by IHTSDO
- Has an API for terminology specialists
- Has an API for FHIR (which is usefull for other but the FHIR model)
- Can be configured to resolve URIs
- Comes in many versions
- Version X 8.3 has the capacity for
  - Evaluation af Post-coordinations
  - Classification of post-coordinations
  - Generation of a «*human readable*» term for a post-coordination

URI in coding systems

- URI is an ISO standard
- The info suffix (snomed.info) points to ressources of the a type
- The return is an object
- The object can be a list of objects

- The conversion of objects into a string is called **serialization**
  - The FORMAT (XML, JSON, TURTLE)

The Snomed CT URI specification

- SNOMED CT is a clinical terminology with global scope
- To support unambiguous references to SNOMED CT resources, a standard approach to the identification of these resources is needed
- To identify, Snomed CT component and derivatives within a specific SNOMED CT edition at a given point in time
- Defines a standard format of URIs for identifying various SNOMED CT artefacts
- This becomes relevant when we, NOW, move from establishing the terminology (T-box) to Implementing Snomed CT
  - Terminology binding and validating data-instances (A-box content)

URIs for Language Syntaxes

Examples of language syntax URIs:

- **SCG** - SNOMED Compositional Grammar (with version option)
  - http://snomed.info/syntax/scg
  - http://snomed.info/syntax/scg/version/2.1
- **ECL** - Expression Constraint Language (with version option)
  - http://snomed.info/syntax/ecl
  - http://snomed.info/syntax/ecl/version/1.2

URI in FHIR resources

- ValueSet is a FHIR resource that is
  - Referenced by its relation to a CodeSystem
  - And the CodeSystem version

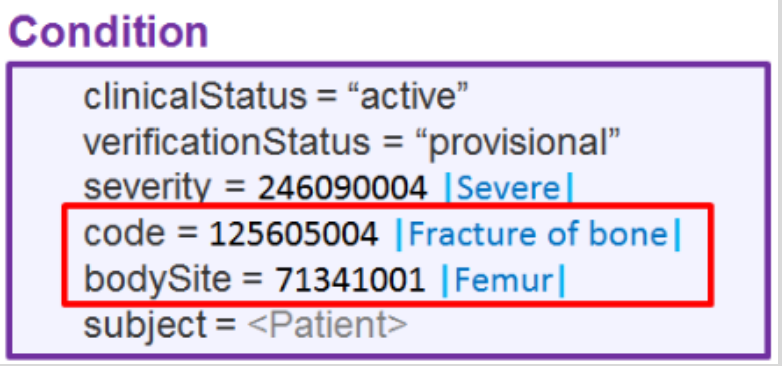
The Snowstorm server is offering ValueSet

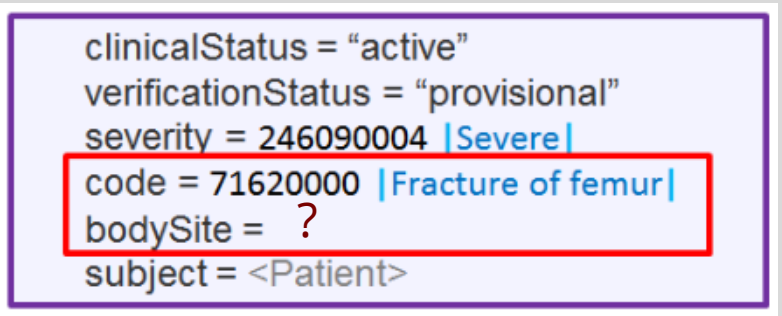
- EX

- ValusetCanonical is a valueset without a relationship to a CodeSystem

Vital signs


```
{
  "resourceType": "ValueSet",
  "id": "f17c2583-ee7b-4fe2-bbcf-fa8c1091933e",
  "url": "http://snomed.info/sct/51000202101/version/20230415?fhir_vs=ecl/^198541000202101{{ M mapTarget =\"Hjertefrekvens::Stilling::\" }}",
  "status": "active",
  "copyright": "This value set includes content from SNOMED CT, which is copyright © 2002+ International Health Terminology Standards Development Organisation (SNOMED International),
  "expansion": {
    "id": "b811c052-f920-43d2-846e-831c9e936791",
    "timestamp": "2023-10-07T22:48:02+00:00",
    "total": 4,
    "offset": 0,
    "parameter": [ {
      "name": "version",
      "valueUri": "http://snomed.info/sct|http://snomed.info/sct/51000202101/version/20230415"
    }, {
      "name": "displayLanguage",
      "valueString": "nb,no;q=0.9,en;q=0.8,en-GB;q=0.7,en-US;q=0.6,da;q=0.5"
    } ],
    "contains": [ {
      "system": "http://snomed.info/sct",
      "code": "4801000202104",
      "display": "Liggende flatt"
    }, {
      "system": "http://snomed.info/sct",
      "code": "272580008",
      "display": "Semi-recumbent position"
    }, {
      "system": "http://snomed.info/sct",
      "code": "33586001",
      "display": "sittestilling"
    }, {
      "system": "http://snomed.info/sct",
      "code": "10904000",
      "display": "oppreist stilling"
    } ]
  }
}
```





Semantic overlap

- When model and code has an overlap
- National (basic) Profiles may define bindings with overlaps
- Condition

Extension Profile define the constrains can specify «hard-coded» mutual constrains

URI for constraining valuset for FHIR.extendedCondition. bodySite

http://snomed.info/sct/**900000000000207008**/version/20230131/ecl/**<<71341001 |Bone structure of femur (body structure)|**

Resolving URL

{{baseUrl}}/ValueSet/$expand?url=http://snomed.info/sct/900000000000207008/version/20230131?fhir_vs=ecl/<<71341001 |Bone structure of femur (body structure)|

n=151

Invariants can mutualliy constain elements – dynamically

URI for constraining valueset for FHIR.Condition.bodySite:

http://snomed.info/sct/**900000000000207008**/version/20230131/ecl/ <<123037004 |Body structure (body structure)| :R363698007 |Finding site (attribute)|=<<71620000 |Fracture of femur|

Resolving URL

{{baseUrl}}/ValueSet/$expand?url=http://snomed.info/sct/900000000000207008/version/20230131?fhir_vs=ecl/<<123037004 |Body structure (body structure)| :R363698007 |Finding site (attribute)|=<<71620000 |Fracture of femur (disorder)|

n=41

Post-coordination


```
"contains": [
    {
        "system": "http://snomed.info/sct",
        "code": "462928007+70665002",
        "display": "|Neonatal physiologic monitoring system|+|Blood pressure cuff|"
    },
    {
        "system": "http://snomed.info/sct",
        "code": "8741000205104",
        "display": "Blood pressure cuff, ankle type"
    },
    {
        "system": "http://snomed.info/sct",
        "code": "720740000",
        "display": "Blood pressure cuff, adult thigh type"
    },
    {
        "system": "http://snomed.info/sct",
        "code": "720737000",
        "display": "Blood pressure cuff, adult size"
    },
    {
        "system": "http://snomed.info/sct",
        "code": "720736009",
        "display": "Blood pressure cuff, paediatric size"
    },
    {
        "system": "http://snomed.info/sct",
        "code": "70665002",
        "display": "Blood pressure cuff"
```


- Combines more than one Snomed CT identifier
- Follows a syntax: Snomed Compositional Grammar (SCG)
- Is restricted by RULES defined in the MACHIN READABLE CONCEPT MODEL (MRCM)
- Can be classified
- An open source tool is available
- Ex
- http://snomed.info/syntax/scg/70665002 |Blood pressure cuff, device (physical object)| + 462928007 |Neonatal physiologic monitoring system (physical object)|
- URI for a set combining pre- and, post-coordinated concepts
- http://snomed.info/syntax/ecl/<<70665002
- Resolving URL
- {{baseUrl}}/ValueSet/$expand?url=http://snomed.info/xsct/11000003104?fhir_vs=ecl/<<70665002

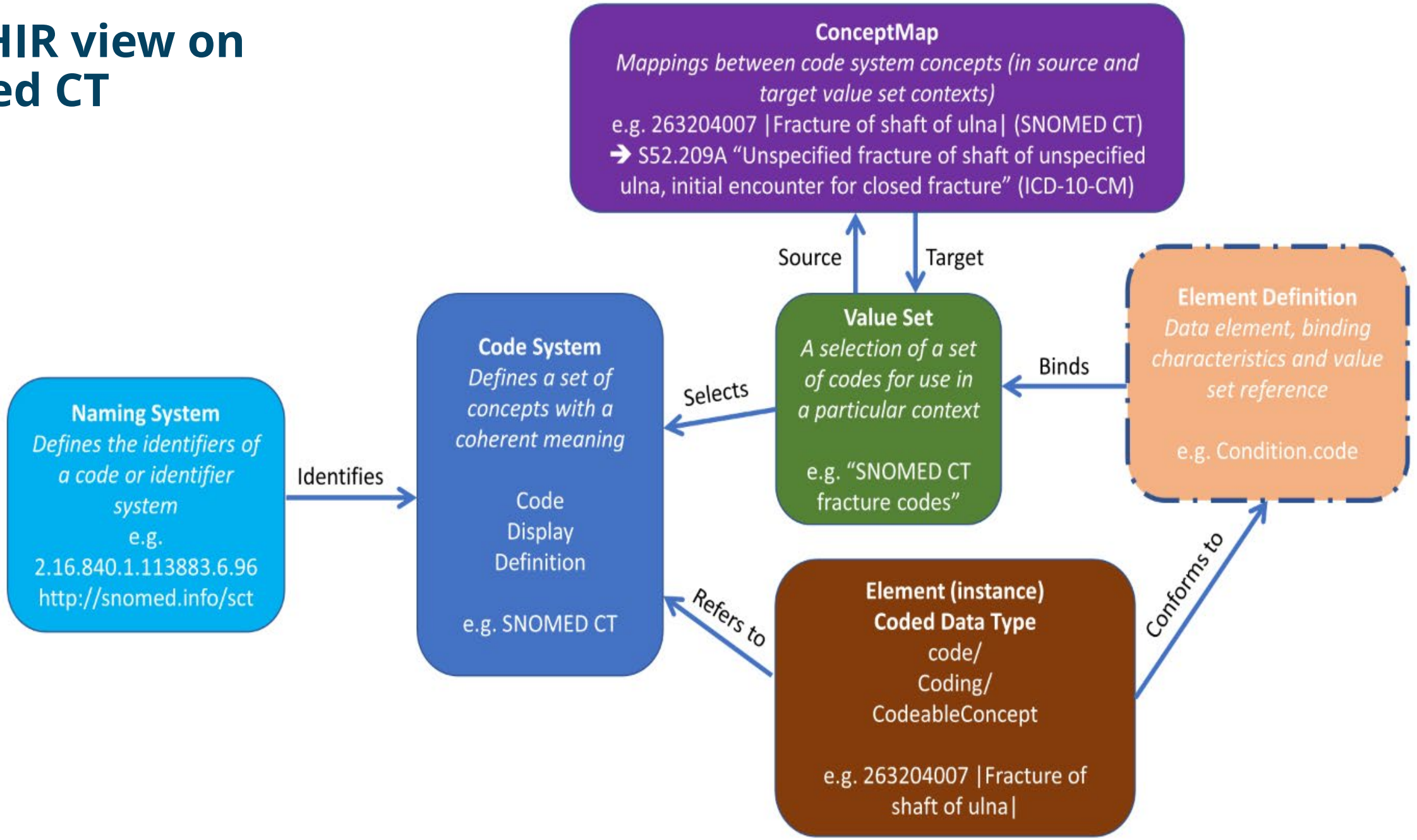
Emergency Non-thoracoscopic percutaneous pleural puncture procedure of Right pleura along Upper surface of third rib in Midclavicular line


```
{
        "code": "264955004:260870009=25876001{363704007=44788007,405814001=279013009,405814001=367995006}",
        "property": [
          {
            "code": "alternateIdentifier",
            "valueString": "652301000003162"
          },
          {
            "code": "humanReadableClassifiableForm",
            "valueString": "===264955004 |Non-thoracoscopic percutaneous pleural puncture procedure|:{260870009 |Priority|=25876001 |Emergency|}{363704007 |Procedure site|=44788007 |Right pleura structure|,405814001 |Procedure site - Indirect|=279013009 |Midclavicular line|,405814001 |Procedure site - Indirect|=367995006 |Structure of upper border of third rib|}"
          }        ]
    }
```

Closure by suture of Surgical incision wound of Skin structure of left axilla with Nylon suture, monofilament


```
{
        "code": "18557009:{424226004=463862001}{363700003=609343002,363704007=76
4473004}",
        "property": [
          {
            "code": "alternateIdentifier",
            "valueString": "652321000003169"
          },
          {
            "code": "humanReadableClassifiableForm",
            "valueString": "=== 18557009 |Closure by suture| : { 424226004 |Using device|
= 463862001 |Nylon suture, monofilament| } { 363700003 |Direct morphology| = 60934300
2 |Surgical incision wound|, 363704007 |Procedure site| = 764473004 |Skin structure of left
 axilla| }"
          }
        ]
    }
```

The FHIR view on Snomed CT

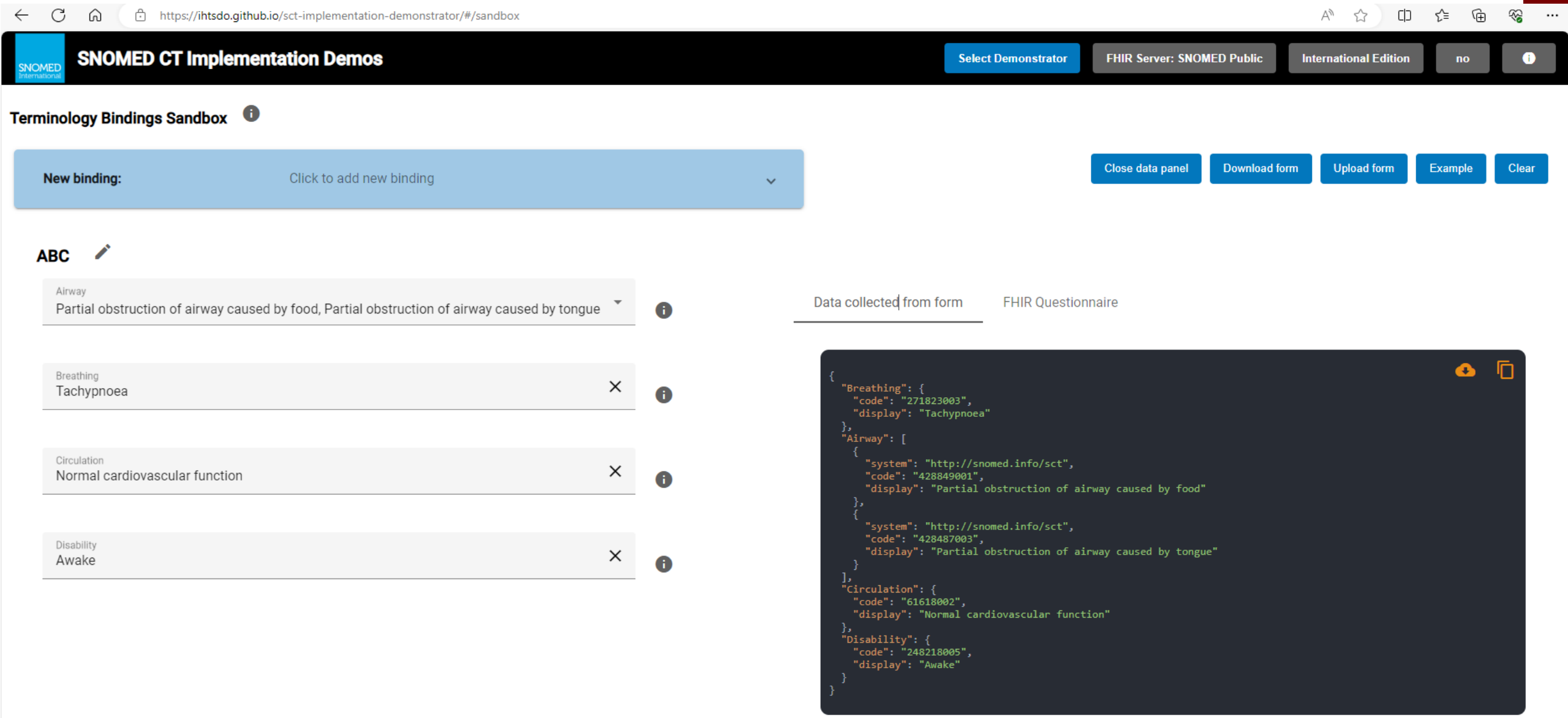


Examples

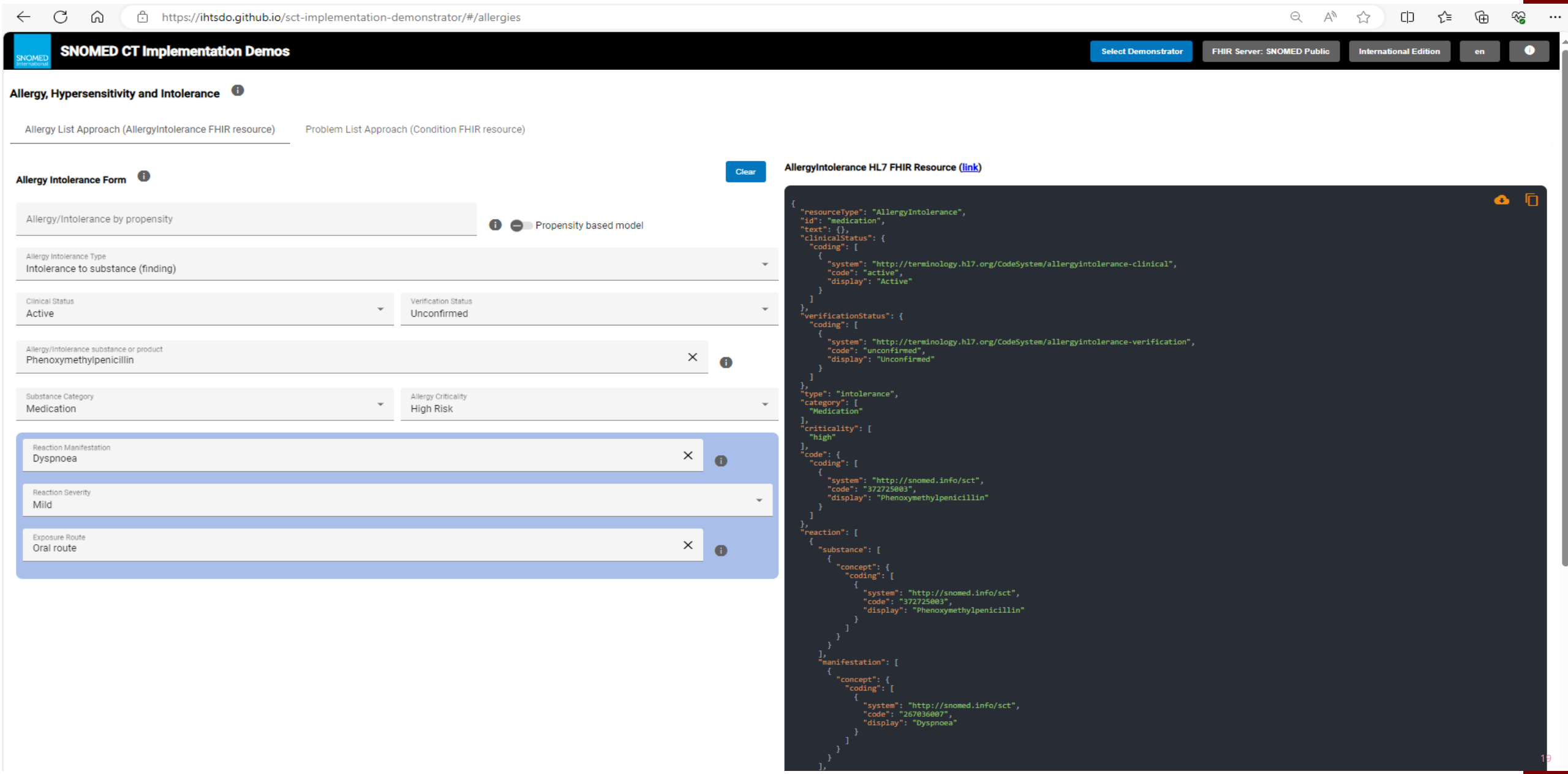
- Valuset intensional encoded by ECL version 2.0 against the norwegian edition version 20230415
- http://snomed.info/sct/51000202101/version/20230515/ecl/^19854100020210 1{{M mapTarget=\"Puls::Rytme::\"}}/syntaxVersion/2.0

- Valuset intensional encoded by ECL version 2.0 against the international edition version 20230131
- http://snomed.info/sct/**900000000000207008** /version/20230131/ecl/^**447562003** {{M mapTarget=\"Q79.8\"}}/syntaxVersion/2.0

Try this!


https://ihtsdo.github.io/sct-implementation-demonstrator/#/sandbox
SNOMED CT Implementation Demos
Select Demonstrator
FHIR Server: SNOMED Public
International Edition
no
Terminology Bindings Sandbox
New binding:
Click to add new binding
Close data panel
Download form
Upload form
Example
Clear
ABC
Airway
Partial obstruction of airway caused by food, Partial obstruction of airway caused by tongue
Breathing
Tachypnoea
Circulation
Normal cardiovascular function
Disability
Awake
Data collected from form
FHIR Questionnaire
{
"Breathing": {
"code": "271823003",
"display": "Tachypnoea"
},
"Airway": [
{
"system": "http://snomed.info/sct",
"code": "428849001",
"display": "Partial obstruction of airway caused by food"
},
{
"system": "http://snomed.info/sct",
"code": "428487003",
"display": "Partial obstruction of airway caused by tongue"
}
],
"Circulation": {
"code": "61618002",
"display": "Normal cardiovascular function"
},
"Disability": {
"code": "248218005",
"display": "Awake"
}
}

...and THIS!


https://ihtsdo.github.io/sct-implementation-demonstrator/#/allergies
SNOMED CT Implementation Demos
Select Demonstrator
FHIR Server: SNOMED Public
International Edition
en
Allergy, Hypersensitivity and Intolerance
Allergy List Approach (AllergyIntolerance FHIR resource)
Problem List Approach (Condition FHIR resource)
Allergy Intolerance Form
Clear
Allergy/Intolerance by propensity
Propensity based model
Allergy Intolerance Type
Intolerance to substance (finding)
Clinical Status
Active
Verification Status
Unconfirmed
Allergy/Intolerance substance or product
Phenoxymethylpenicillin
Substance Category
Medication
Allergy Criticality
High Risk
Reaction Manifestation
Dyspnoea
Reaction Severity
Mild
Exposure Route
Oral route
AllergyIntolerance HL7 FHIR Resource (link)
{
"resourceType": "AllergyIntolerance",
"id": "medication",
"text": {},
"clinicalStatus": {
"coding": [
{
"system": "http://terminology.hl7.org/CodeSystem/allergyintolerance-clinical",
"code": "active",
"display": "Active"
}
]
},
"verificationStatus": {
"coding": [
{
"system": "http://terminology.hl7.org/CodeSystem/allergyintolerance-verification",
"code": "unconfirmed",
"display": "Unconfirmed"
}
]
},
"type": "intolerance",
"category": [
"Medication"
],
"criticality": [
"high"
],
"code": {
"coding": [
{
"system": "http://snomed.info/sct",
"code": "372725003",
"display": "Phenoxymethylpenicillin"
}
]
},
"reaction": [
{
"substance": [
{
"concept": {
"coding": [
{
"system": "http://snomed.info/sct",
"code": "372725003",
"display": "Phenoxymethylpenicillin"
}
]
}
}
],
"manifestation": [
{
"concept": {
"coding": [
{
"system": "http://snomed.info/sct",
"code": "267036007",
"display": "Dyspnoea"
}
]
}
}
],