

An integrated Expression Repository EHR system

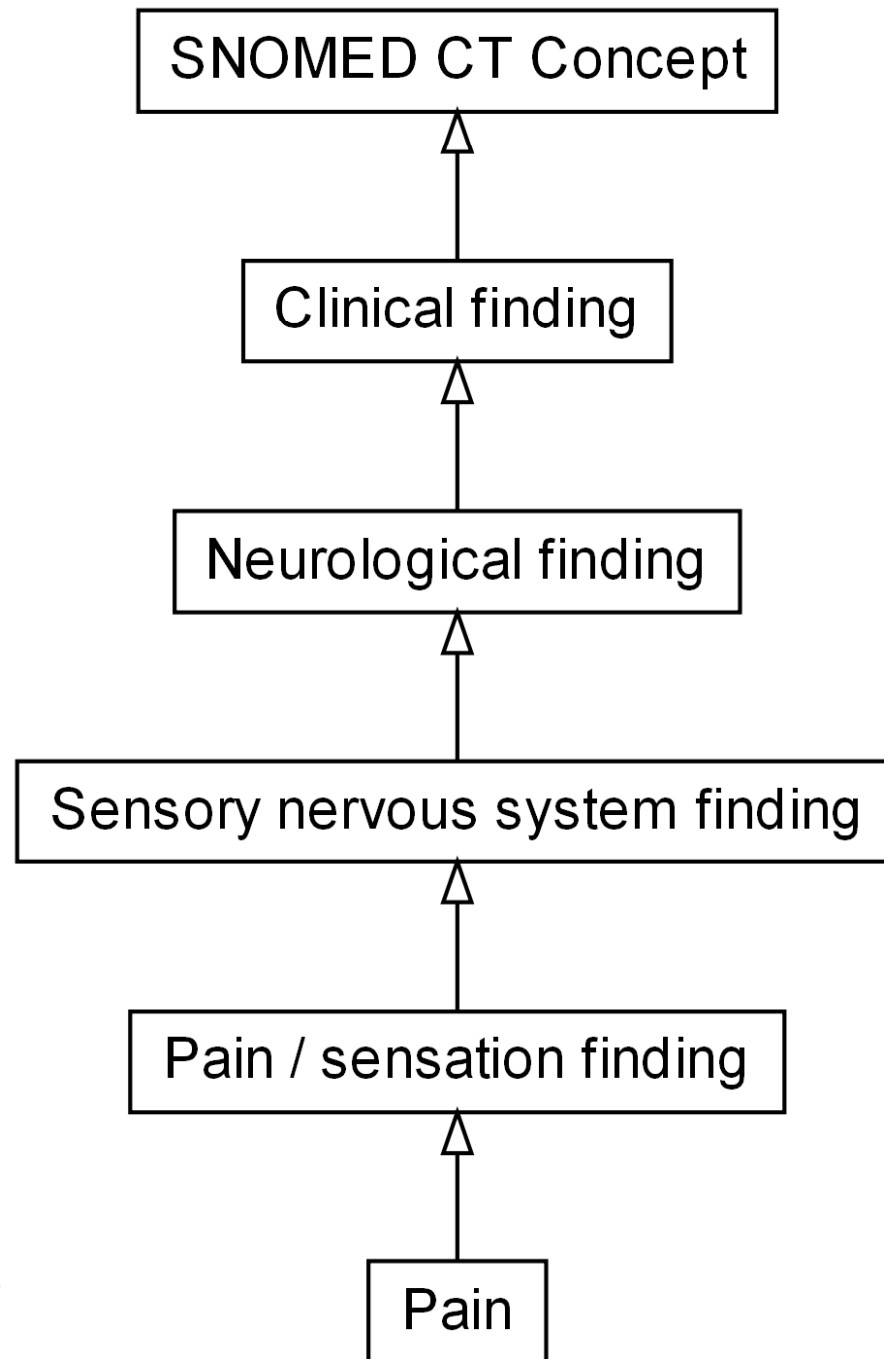
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Project goals

- Develop and test a system for storing and querying pre- and post-coordinated SNOMED CT expressions in an Electronic Health Record (EHR) system
- SNOMED CT is used as a reference terminology
- SNOMED CT allows abstraction of EHR data for transfer to quality databases

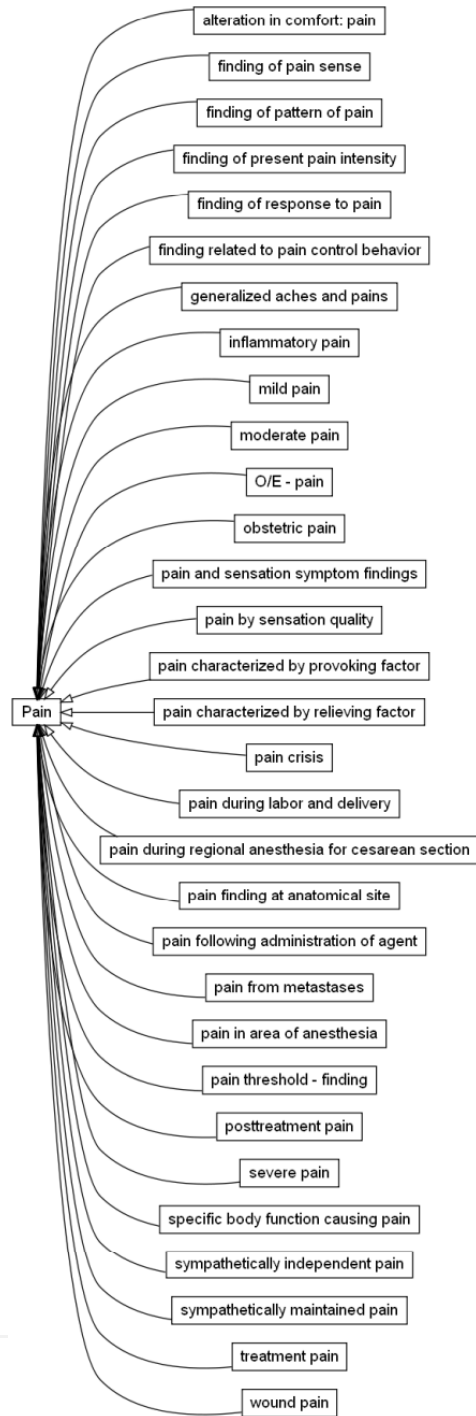
Pre- and post-coordination

Pre-coordination: Pain



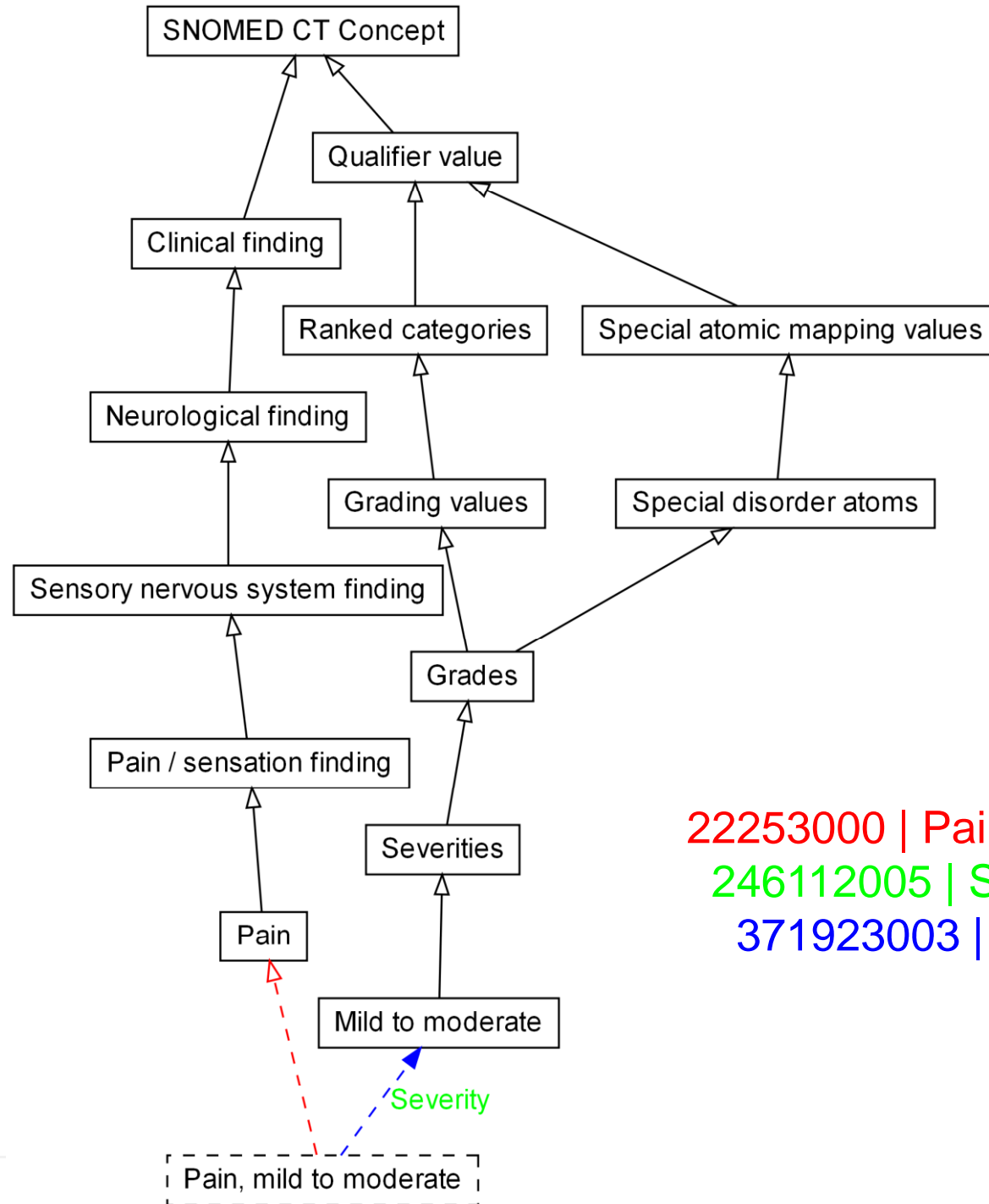
22253000 | Pain |

Pre-coordination: Pain



- 31 children
- 787 decedents

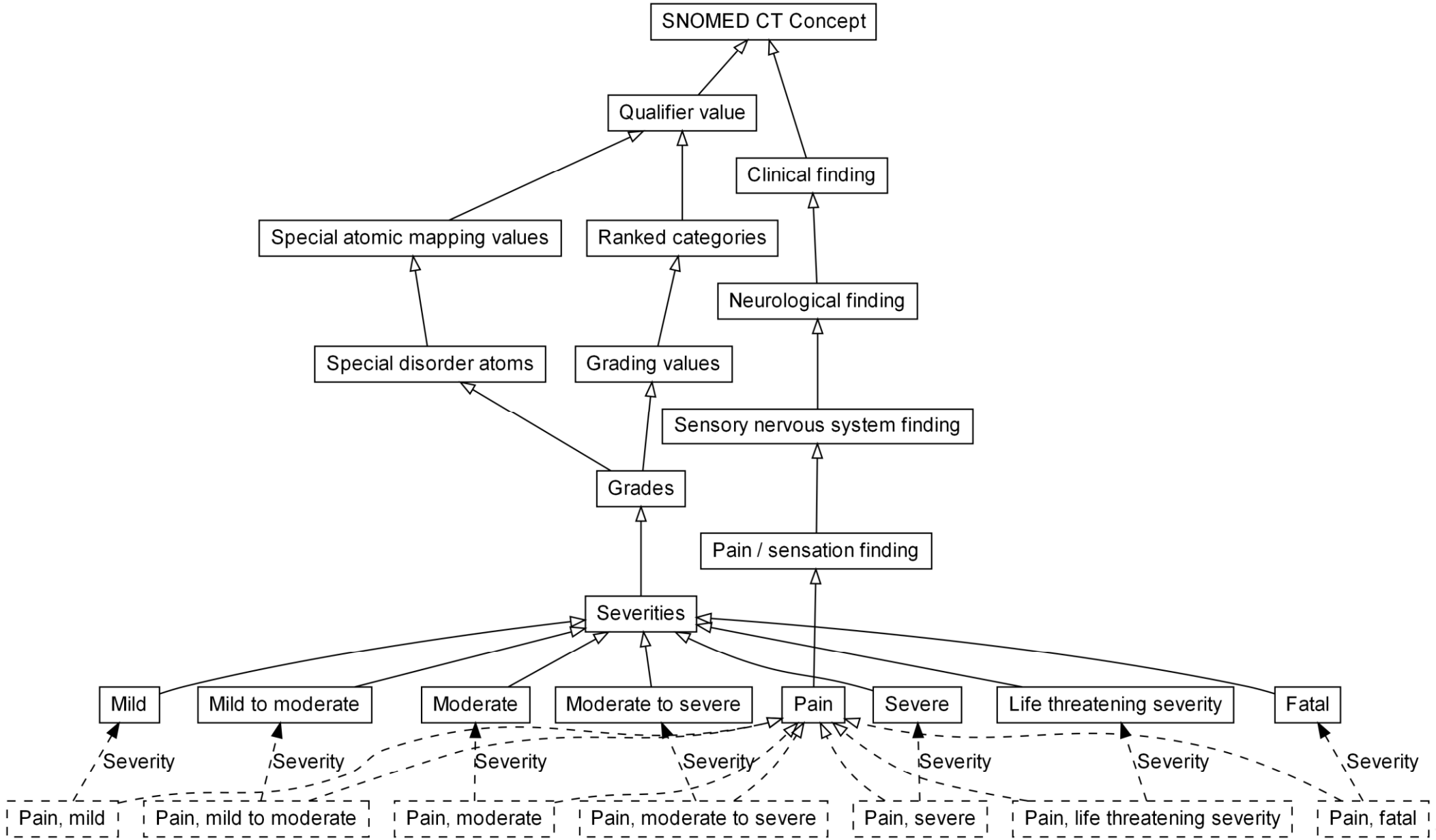
Post-coordination: Pain, Severity



22253000 | Pain | :
246112005 | Severity | =
371923003 | Mild to moderate |

Pain, mild to moderate

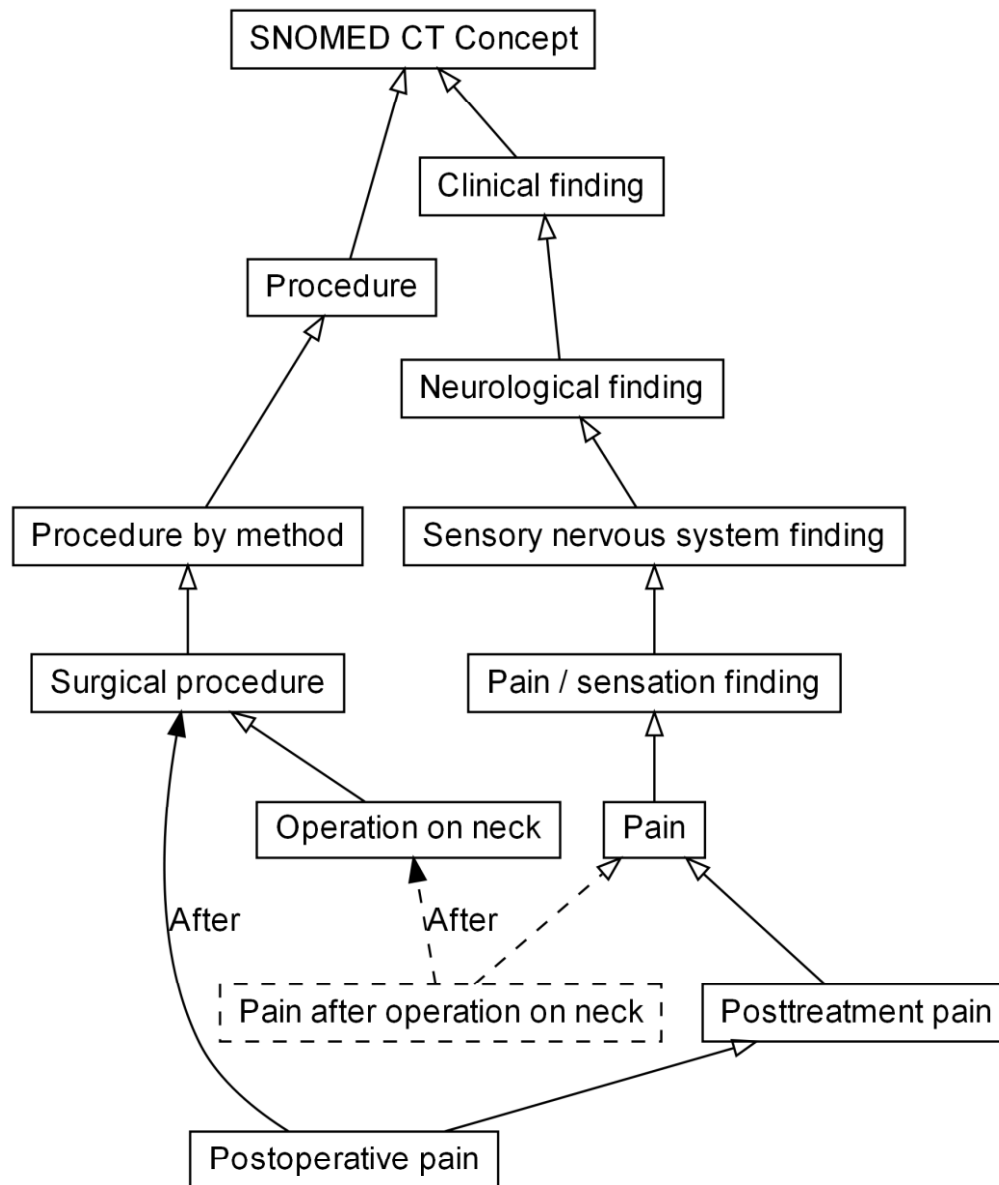
Post-coordination: Pain, All 7 Severities



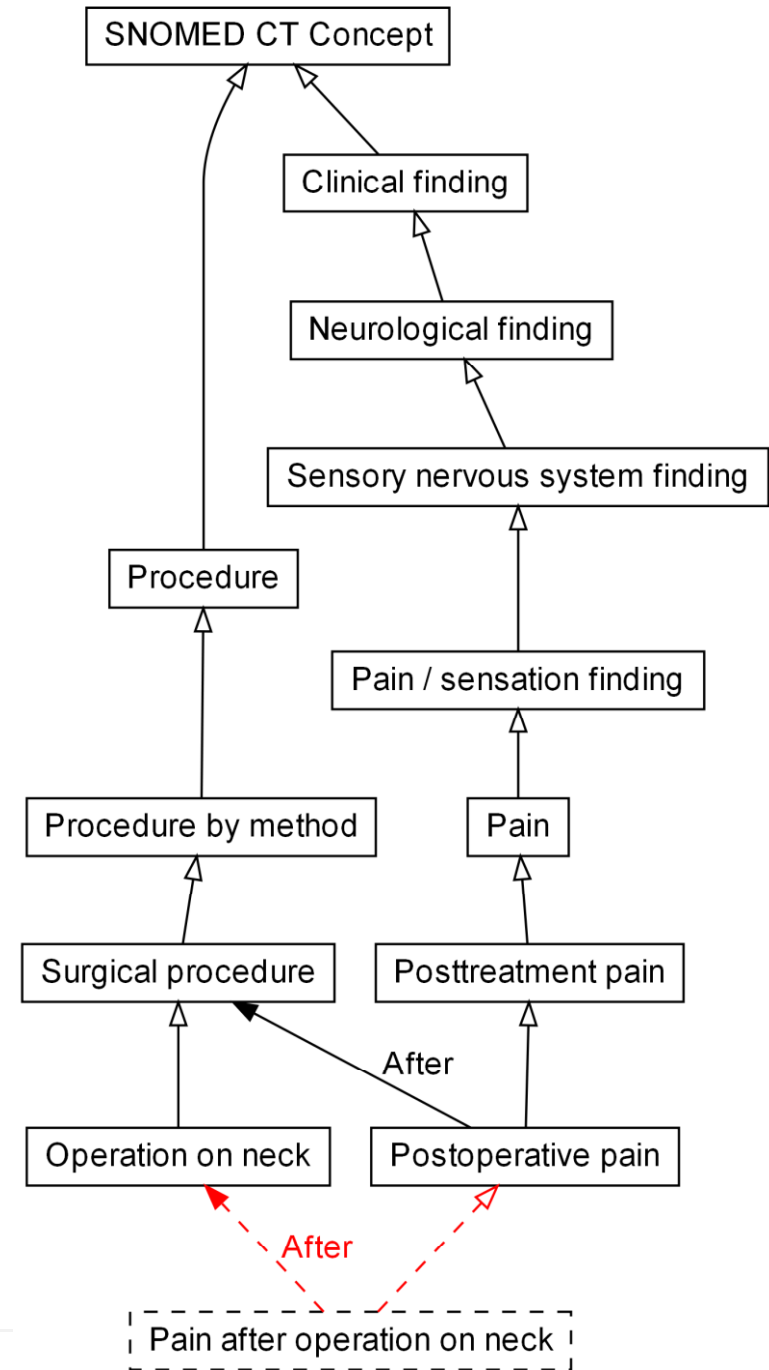
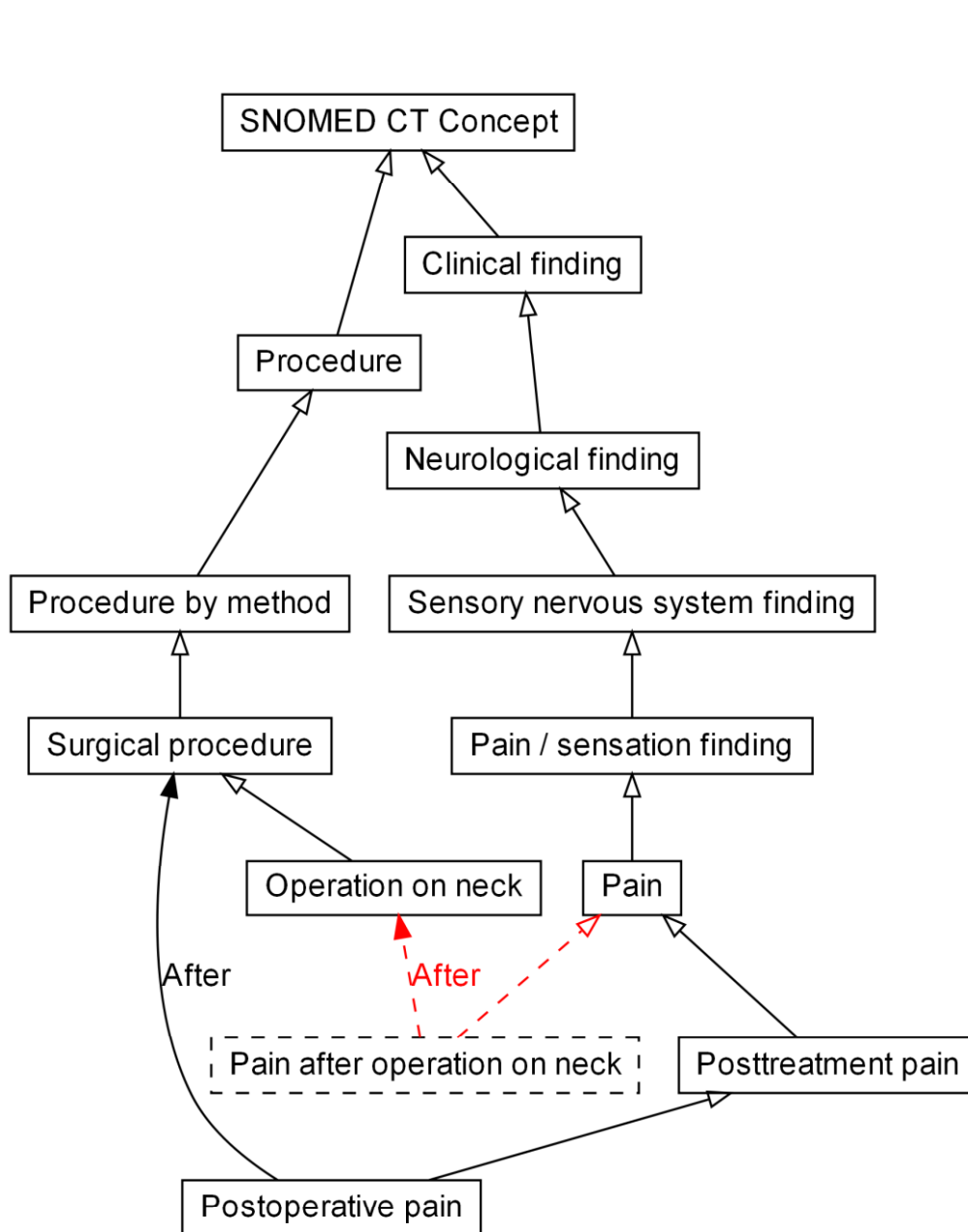
Post-coordination: Pain, all defining attributes

- Finding site, 26 000
- Associated morphology, 4 500
- Causative agent, 78 000
- Due to, 100 000
- After, 150 000
- Severity, 7
- Clinical course, 31
- Episodicity, 5
- Interprets, 26 000
- Has interpretation, 190
- Pathological process, 3
- Has definitional manifestation, 100 000
- Occurrence, 12
- Finding method, 53 000
- Finding informer, 4
- $5,5 * 10^{44}$ possibilities
- *Approximately* $4,9 * 10^{24}$ sensible possibilities
- 787 pre-coordinated decendents

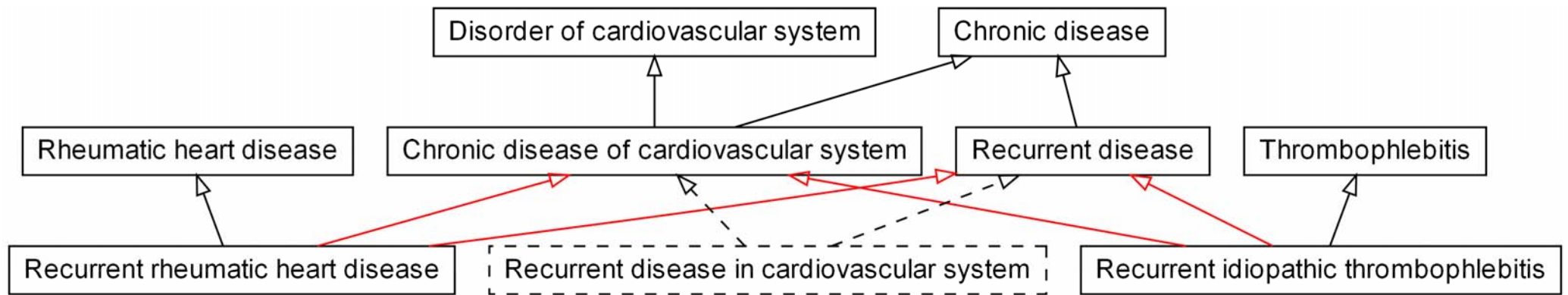
Post-coordination: Pain after operation on neck



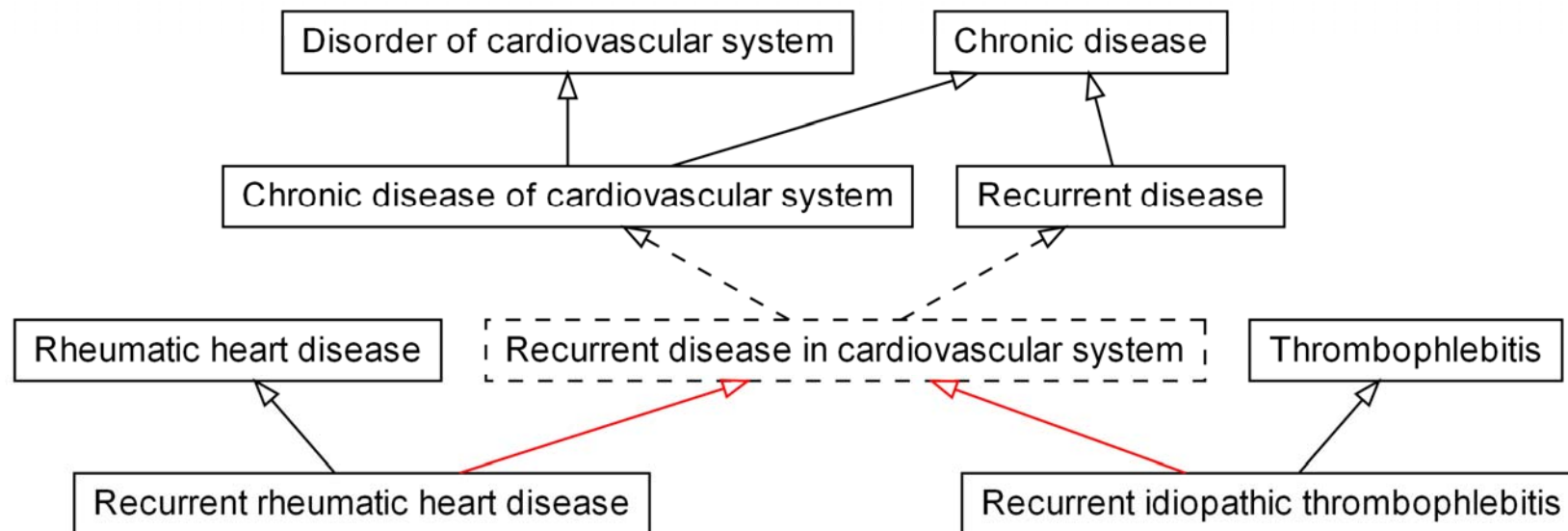
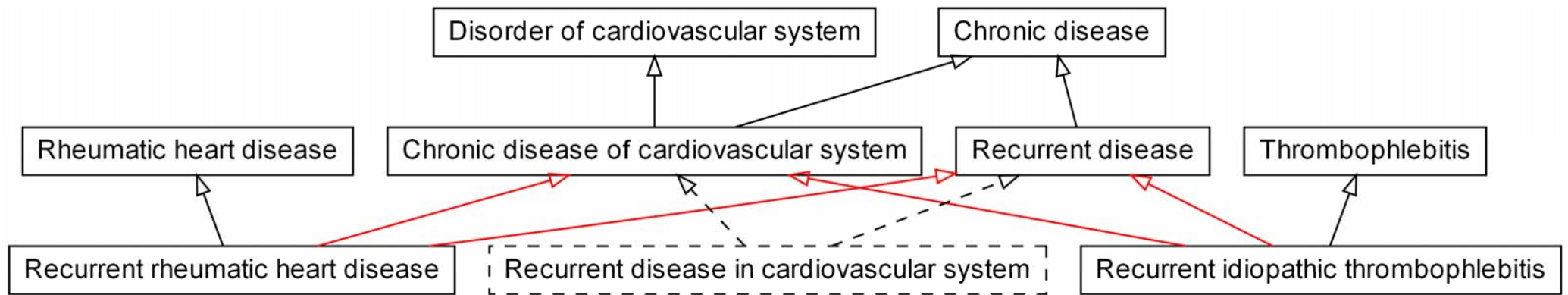
Post-coordination: Pain after operation on neck



Post-coordination: Recurrent disease of cardiovascular system



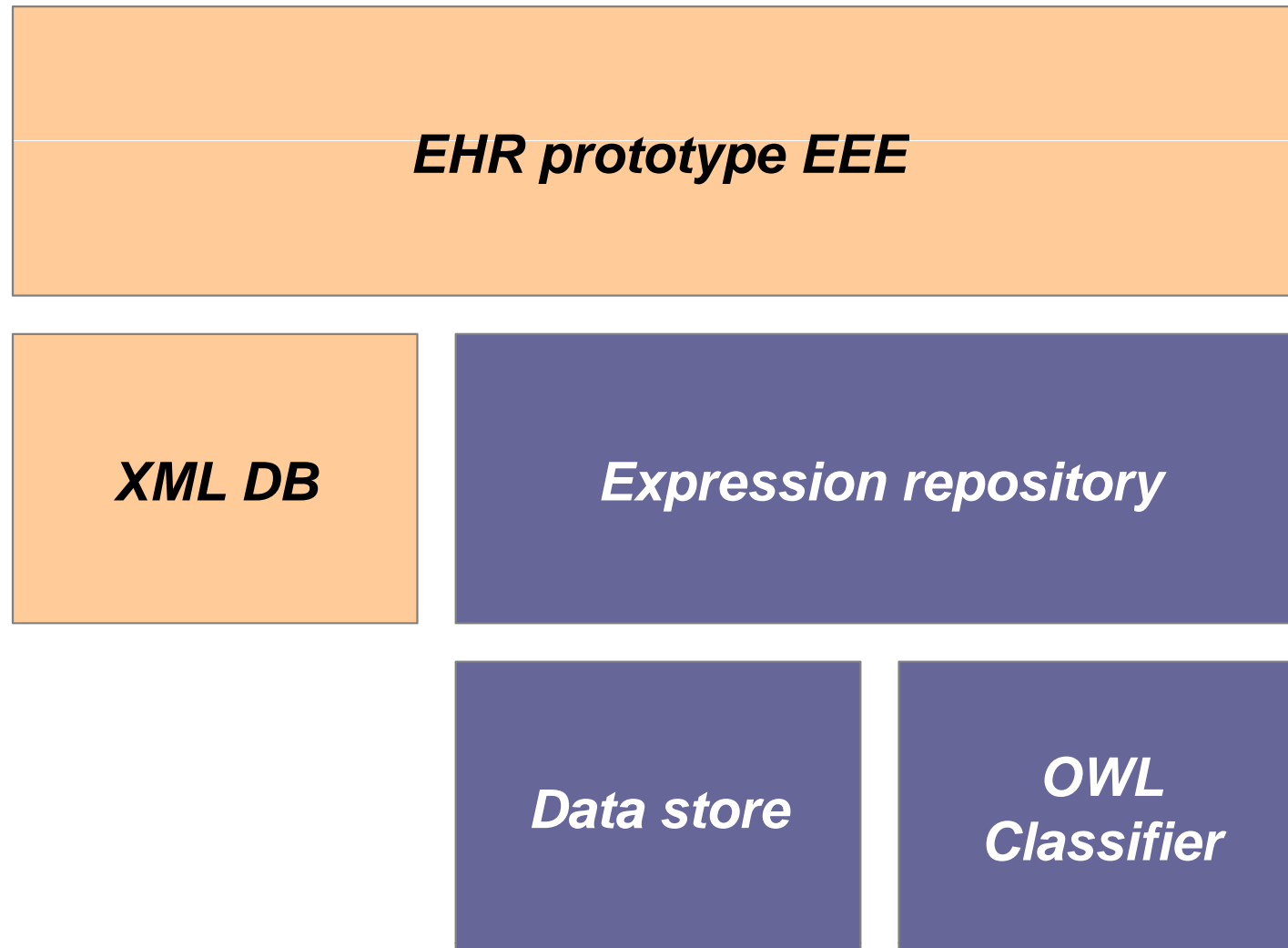
Post-coordination: Recurrent disease of cardiovascular system



Rationale for an expression repository

- Classifiers typically does not handle changes between releases and over time
- Each addition of a new post-coordinated expression creates a new version
- Unnecessary to classify each time an expression is submitted
 - Classifications of equivalent expressions can be reused
- Expressions might contain more characters than current systems can handle
- Fully defined post-coordinated expressions decrease the maintenance cost compared to extensions with pre-coordinated concepts

Expression repository architecture



Expression repository

- Classifier used to classify new post-coordinated expressions
 - OWL API-compliant classifiers (Snorocket, ELK, ...)
 - SNOMED CT expressions are translated to OWL
 - Result of classification fed to data store
- SNOMED CT query results aggregated from data store

Equivalent expressions

- Structural equivalent expressions
 - are only stored once in the repository
 - the equivalence can never be lost
- Semantic, but not structural, equivalent expressions
 - are stored individually
 - are linked to each other
 - have shared rows in the transitive closure table
 - the equivalence might be lost due to updates in new releases

85919009|Disorder of intestine|:

{ 363698007|Finding site|=66754008|Appendix structure|,
116676008|Associated morphology|=23583003|Inflammation|}

85919009|Disorder of intestine|:

{ 116676008|Associated morphology|=23583003|Inflammation|,
363698007|Finding site|=66754008|Appendix structure|}

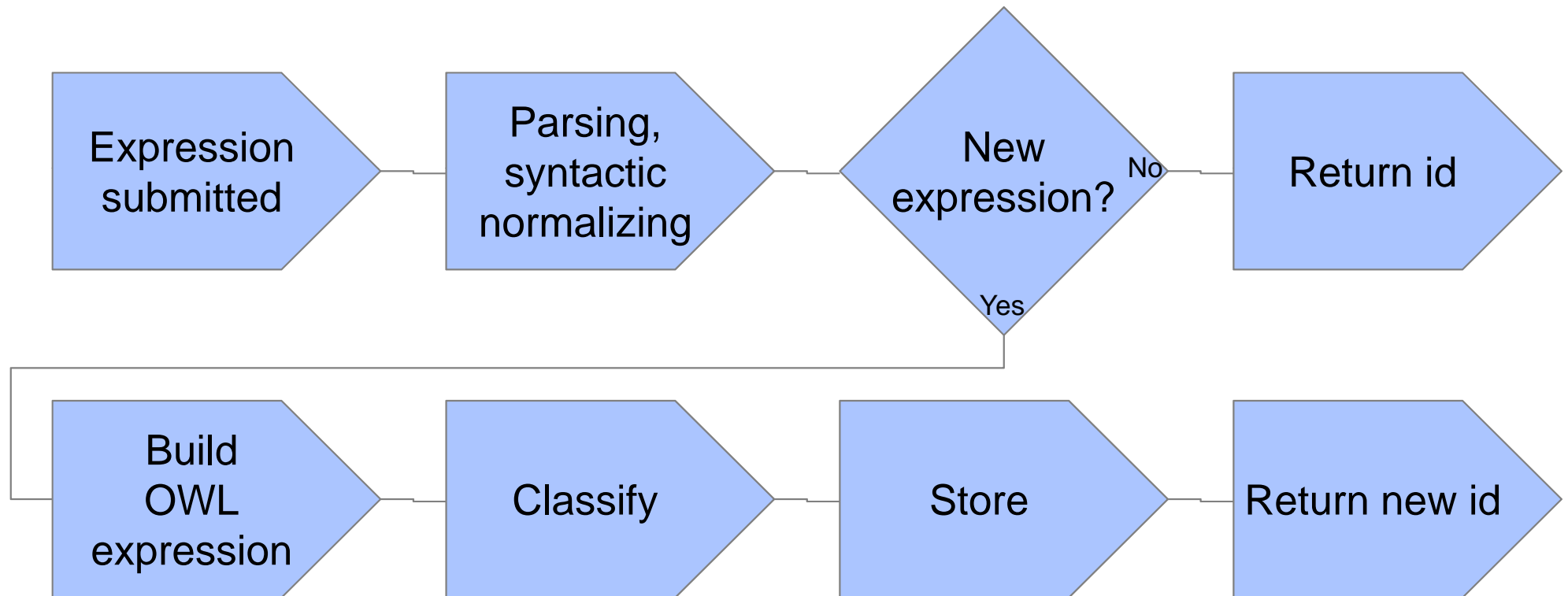
128139000|Inflammatory disorder|:

{ 363698007|Finding site|=66754008|Appendix structure|}

Structural eq

Semantic eq

Expression repository flow

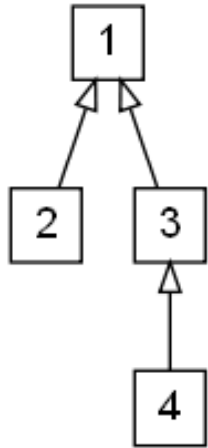


Expression repository: Data store

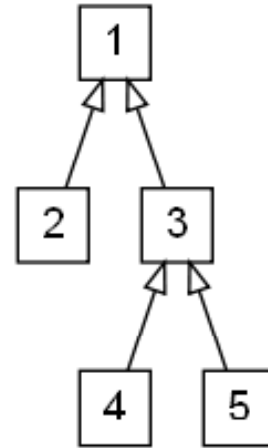
- Data stored in tables in the relational database PostgreSQL
- Communicate through a Java class
- Contains a full release
- Manages the expression's history
- Data storage and retrieval methods include
 - Store an expression
 - Store equivalence among expressions
 - Store parents and children to an expression
 - Get an expression's parents
 - Get an expression's ancestors
 - Get an expression's children
 - Get an expression's descendants

Expression repository: Data store

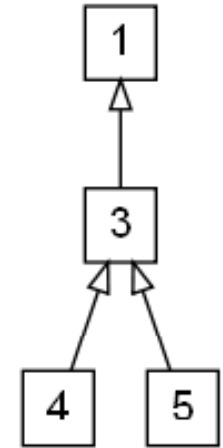
Transitive closure table



2002-01-31



2005-07-31



2012-01-31

Source	Destination	Start	End	Direct
2	1	2002-01-31	2012-01-31	Yes
3	1	2002-01-31		Yes
4	1	2002-01-31		No
5	1	2005-07-31		No
...

Current international
full release gives
8 000 000 rows

Differences to Technical Implementation Guide

- Uses a full release
- Manages the expression's history
- Uses a classifier
- Do not store the normal form



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