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Case 1 - WHY IS IT IMPORTANT TO UNDERSTAND THE MEDICATION



SUPERBUGS or multidrug-resistant organisms MDRO

- Microorganisms (primarily **bacteria**)
- **Resistant to** at least one or more classes of **antimicrobial drugs (antibiotics)**
- **Causing infections** difficult or impossible to treat
- **Tested by identifying** bacteria from patient samples (blood, urine, swabs)
- and for their **susceptibility** to various **antibiotics**



<https://www.sintef.no/>

Antimicrobial Stewardship: Strategy to mitigate the risk of MDRO

Responsible Use: Using antibiotics only when prescribed by a healthcare professional and following the regimen to completion.

Process Measures: Evaluates if interventions are effective, such as **reviewing compliance** with guidelines

Outcome Measures: Tracks decreased **antibiotic resistance** rates, lower pharmacy spending

Utilization Metrics: Measures the volume of **antibiotic consumption**, typically reported as days of therapy (DOT) per 1000 patient-days or defined daily doses (DDD).

Data Analysis: analyzing **patterns of prescribing** to provide tailored feedback to clinicians

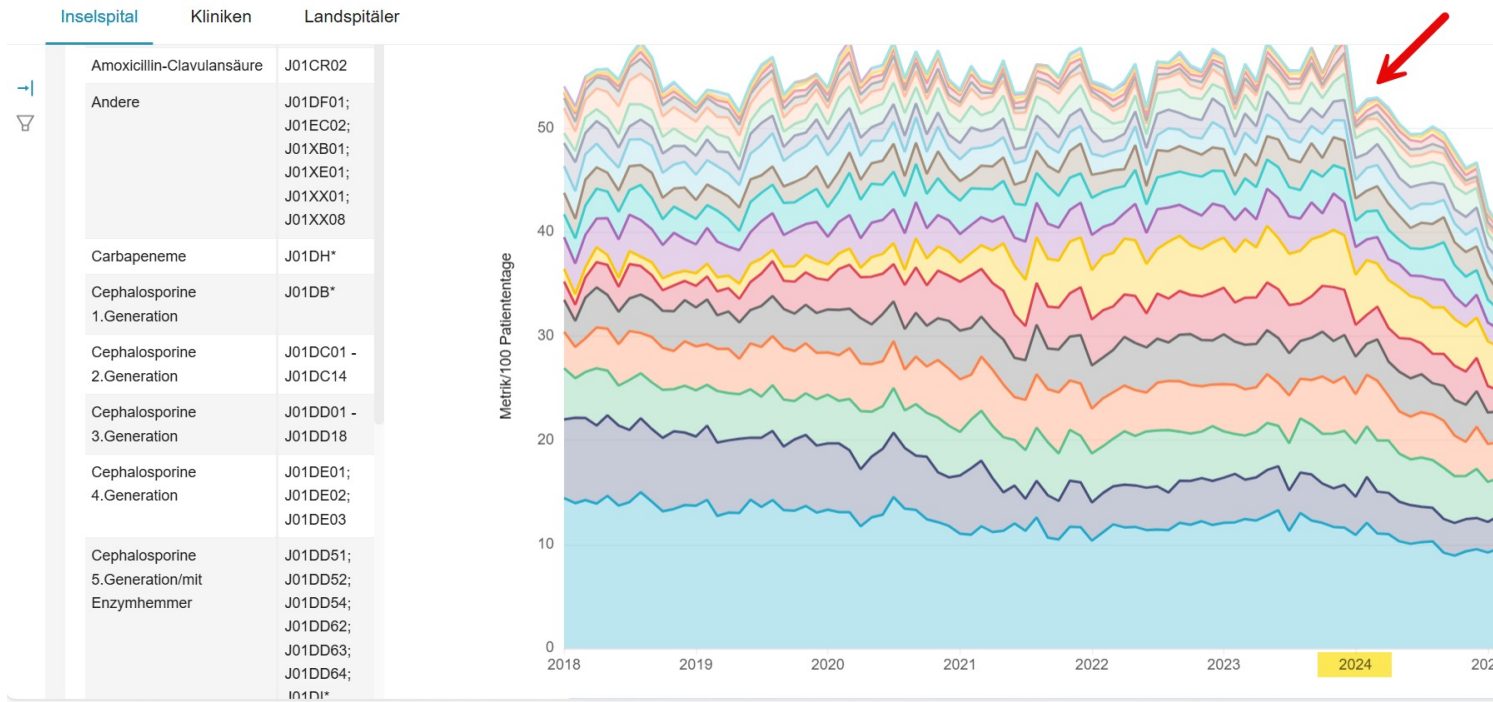
Research: longitudinal studies using Real World Data

Antibiotics Consumption Report

Aggregated Consumption per Antibiotics Class, based on an individual administration per patient / order per ATC category

Antibiotikakonsum - Insel Gruppe ☆ 👤 Noel Frey ✎ 5 months ago

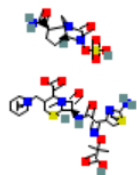
2024: Decrease in consumption?



No! A new EHR 😊

USE CASE Ceftazidime & Avibactam

PubChem

[Summary](#) [Similar Structures Search](#) [Related Records](#)


3 of 105

RefChem:1077369; ceftazidime & avibactam; ceftazidime + avibactam; ceftazidime / avibactam; Avycaz; ...

Compound CID: 90643431

MF: $C_{29}H_{33}N_9O_{13}S_3$ MW: 811.8 g/mol

IUPAC Name: (6R,7R)-7-[[[(2E)-2-(2-amino-1,3-thiazol-4-yl)-2-(2-carboxypropan-2-yloxyimino)acetyl]amino]-8-oxo-3-(pyridin-1-ium-1-ylmethyl)-5-thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylate;[(2S,5R)-2-carbamoyl-7-oxo-1,6-diazabicyclo[3.2.1]octan-6-yl] hydrogen sulfate

SMILES: CC(C)(C(=O)O)O/N=C(\C1=CSC(=N1)N)/C(=O)N[C@H]2[C@@H]3N(C2=O)C(=C(CS3)C[N+]4=CC=CC=C4)C(=O)[O-].C1C[C@H](N2C[C@@H]1N(C2=O)OS(=O)(=O)O)C(=O)N

InChIKey: LVFGWOQWXQLVRO-XJDKXYGGSA-N

InChI: InChI=1S/C22H22N6O7S2.C7H11N3O6S/c1-22(2,20(33)34)35-26-13(12-10-37-21(23)24-12)16(29)25-14-17(30)28-15(19(31)32)11(9-36-18(14)28)8-27-6-4-3-5-7-27;8-6(11)5-2-1-4-3-9(5)7(12)10(4)16-17(13,14)15/h3-7,10,14,18H,8-9H2,1-2H3,(H4-,23,24,25,29,31,32,33,34);4-5H,1-3H2,(H2,8,11)(H,13,14,15)/b26-13+;/t14-,18-;4-,5+/m11/s

Ceftazidime-avibactam is a β -lactam/ β -lactamase inhibitor combination restricted for the **treatment of multidrug-resistant** infections of *Pseudomonas aeruginosa* non-susceptible to ceftazidime and resistant to carbapenems.

<https://doi.org/10.1038/s41467-025-58597-6>

Reality: Regulation & Distribution



Produkt
Fachinfo
Risiken
Fotos
Ähnliche
Content

Neues Compendium

Authorisation

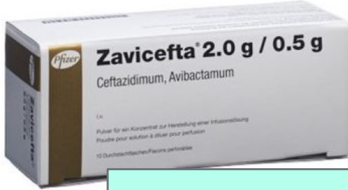
ZAVICEFTA Trockensub 2 g/0.5 g QAB
Pfizer AG

Swissmedic Bezeichnung: Zavicefta, Pulver für ein Konzentrat zur Herstellung einer Infusionslösung

Charakteristika ATC: Antibiotikum, Cephalosporin mit Beta-Laktamase-Hemmer
J01DD52 Ceftazidim und Beta-Lactamase-Inhibitor

Zusammensetzung: Ceftazidim (2 g), Avibactam (500 mg)
Neue aktive Substanz (NAS)

Therapie: Antiinfektiva > Antibiotika > Cephalosporine + Beta-Laktamase-Hemmer



Produktnr.

Basisname Zusatzname

ATC-Code IT1

ATC-Code 2 Größe IT2

DDD Applikation

Dosierung Gal. Form

Hospital's logistics

Product registration / marketing authorisation Switzerland

The Anatomical Therapeutic Chemical (ATC) classification system is a World Health Organization (WHO) standard for classifying medicines. It assigns unique codes based on the organ/system acted upon, and therapeutic/chemical properties, organized into five levels to support drug research, statistics, and regulation

- Die Kombination **Ceftazidim/Avibactam** wurde in den USA im Februar 2015 durch die **FDA** zugelassen und wird unter dem Namen **Avycaz®** vermarktet. Im europäischen Raum ist sie seit ihrer Zulassung durch die **EMA** 2016 unter dem Handelsnamen **Zavicefta®** erhältlich. Dort wird sie durch **AstraZeneca** vertrieben.

Different brand names in the U.S. and in Europe



Zavicefta + ATC Code

<https://www.flaticon.com/free-icons/manual>

Reality: Treatment Guidelines & Resistency Information

←


Ceftazidim-Avibactam

Dosisanpassung für Erwachsene

$Q_0 = 0.05 / 0.03-0.05$; HWZ 2h; PK/PD-Ziel: $T > MIC$

CAVE: Dosierungen beziehen sich auf jeweils auf Gesamtdosis Ceftazidim + Avibactam (d.h. 2.5 g entspricht 2 g Ceftazidim und 0.5 g Avibactam)!



Ceftazidim-Avibactam guidelines as a free text
no standard terminology linked

Isolat	Gram -	Acinetobacter baumannii		Citrobacter freundii*		Citrobacter koseri		Klebsiella aerogenes*		Enterobacter cloacae*		Escherichia coli		Haemophilus influenzae		Hafnia alvei*	
Antibiotika		% S	n	% S	n	% S	n	% S	n	% S	n	% S	n	% S	n	% S	n
Ampicillin		3%	31			96%	160					52%	4184	80%	209		
Amoxicillin-Clavulanat												79%	4183	99%	208		
Piperacillin-Tazobactam		60%	25	66%	59	92%	73	48%	82	66%	284	80%	1115			70%	10
Cephalotin		0%	30			93%	160					67%	4184				
Cefuroxim (i.v.)		7%	30			92%	160					88%	4184	99%	208		
Cefuroxim (p.o.)		0%	30			66%	160					62%	4184				
Ceftriaxon		7%	30			99%	160					89%	4163	100%	208		
Ceftazidim		37%	30			99%	160					89%	4158				
Cefepim		53%	30	92%	135	99%	160	89%	140	86%	425	91%	4163			100%	13
Ertapenem		8%	24	100%	58	100%	73	85%	81	83%	278	100%	1098			100%	10
Imipenem		77%	26	100%	59	100%	74	93%	82	99%	284	100%	1116			100%	10
Meropenem		74%	31	100%	135	100%	160	96%	140	99%	425	100%	4163			100%	13
Aztreonam		7%	29	76%	135	99%	160	64%	140	75%	425	90%	4163			92%	13
Gentamicin		74%	31	99%	130	100%	155	98%	137	97%	419	91%	3945			100%	13
Tobramycin		69%	26	98%	59	100%	74	99%	82	96%	284	87%	1115			100%	10
Amikacin		69%	26	98%	59	100%	74	99%	82	100%	284	97%	1115			100%	10
Cotrimoxazol (TMP-SMX)		77%	31	83%	135	100%	160	99%	140	89%	424	71%	4184			100%	13
Norfloxacin		77%	30	99%	135	99%	160	99%	139	97%	421	84%	4172			100%	13
Ciprofloxacin		77%	26	100%	59	99%	74	99%	82	95%	284	77%	1115			100%	10
Nitrofurantoin (Harnwege)		10%	30	98%	133	59%	159	32%	129	39%	420	97%	4172			92%	13
Fosfomycin (Harnwege)		18%	28	100%	134	100%	159	67%	137	80%	420	99%	4172			100%	



Ceftazidim resistency as a free text,
no standard terminology linked

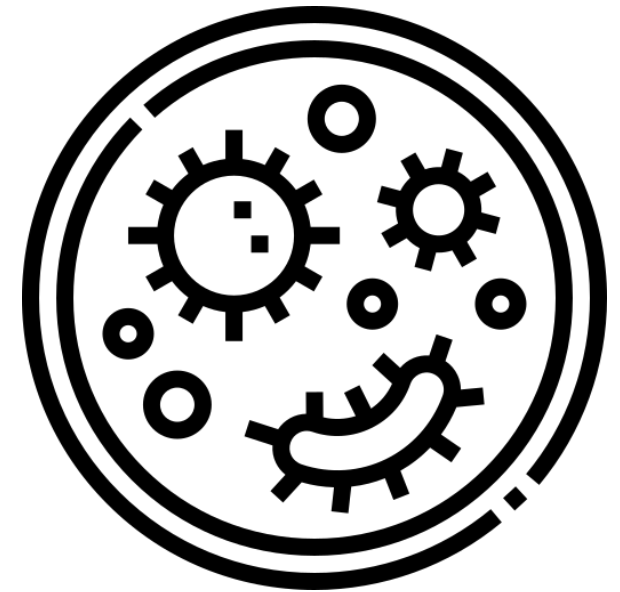


Reality: Resistancy Testing results EHR & Clinical Data Warehouse

BAKTERIENKULTUR	++++ <i>Acinetobacter calcoaceticus-baumannii</i> complex !
GRAM FÄRBUNG	10-25 Leukozyten
RESULTAT	<10 Plattenepithelzellen ++++ Grampositive Kokken kulturell nicht anzüchtbar ++ Gramnegative Stäbchen
Empfindlichkeit	
	<i>Acinetobacter calcoaceticus-baumannii</i> complex KIRBY-BAUER
Amikacin	Sensibel
Cefepim	Resistent
Ceftazidim	Resistent
Ciprofloxacin	Sensibel, erhöhte Dosierung/Exposition
Cotrimoxazol	Sensibel
Gentamicin	Sensibel

U81.6	++++ <i>Acinetobacter calcoaceticus-baumannii</i> complex(SNOMED 243328000)- Ceftazidim/Avibactam(ATC J01DD52): R	3/9/2026 9:36:00 AM
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Hospitals Microbiology:
Resistancy Testing, Antibiotics Susceptibility for *Ceftazidim* as a free text,
no Standard Terminology linked



Clinical Data Warehouse:

- Manual mapping of the Microorganism to SNOMED CT
- Manual mapping of the substance to ATC

Reality: Medication Administration, EHR

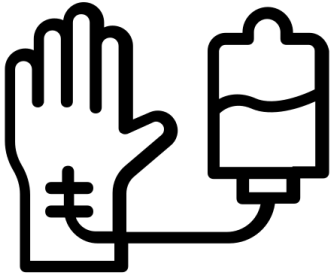
CEFTAZIDIM-AVIBACTAM (ZAVICEFTA) INFUSION

CEFTAZIDIM-AVIBACTAM (ZAVICEFTA) AD 100 ML PERFUSOR



Masterfile EHR Medication:

- Only 80% mapping to ATC available
- Same ATC, different products



Medication **Administration** documentation based on an **EHR ID**:

- Ceftazidim-Avibactam (Zavicefta) Infusion
- Ceftazidim-Avibactam (Zavicefta) Ad 100 ml perfusor



One ATC code, but different products with different

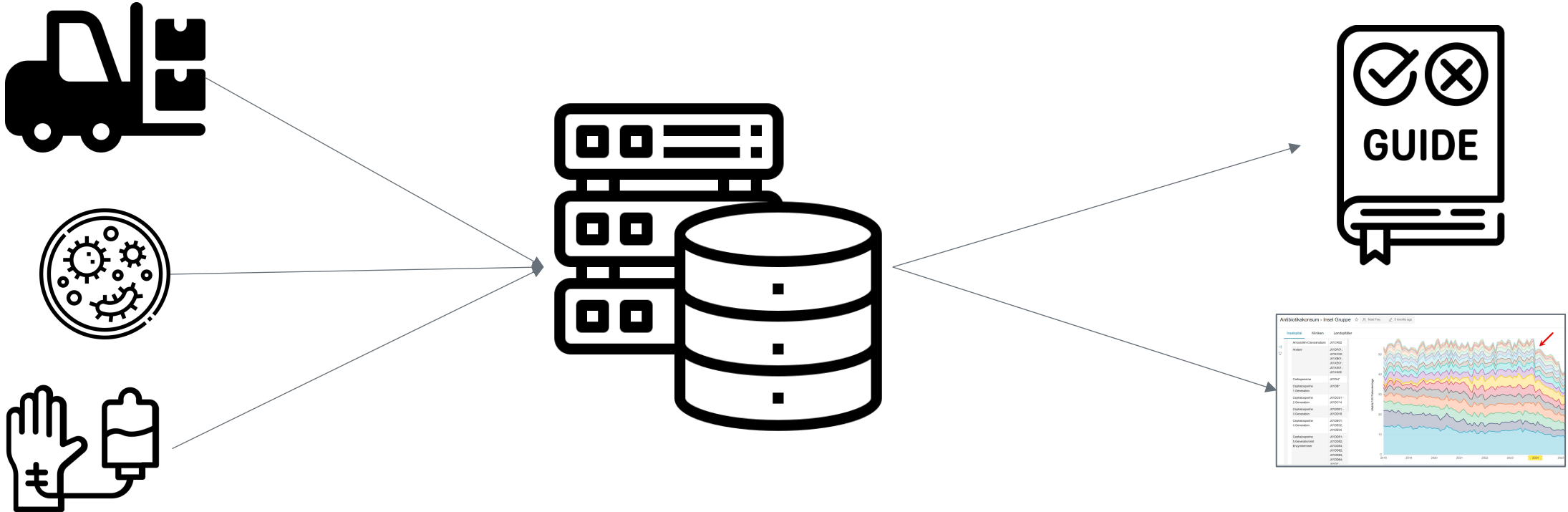
- administration routes,
- concentration,
- substance amount

What Information Is Clinically Relevant?

Extracted core attributes:

- ✓ Ingredient: Ceftazidim-Avibactam
- ✓ Strength: 2 g / 0.5 g
- ⚠ Dose form: Infusion / Perfusor
- ✗ Less relevant for CDS: Brand (Zavicefta)

The goal: knowledge generation



Medication product names in Swiss electronic health records are heterogeneous and often encode multiple attributes (e.g., ingredient, strength, dose form, packaging) in German free text. This **limits interoperability** and reduces the utility of ATC codes, which do not uniquely identify products.

Using RxNorm standard for medication representation

RxNorm is a U.S. National Library of Medicine (NLM) **standardized nomenclature for clinical drugs**, providing normalized names and **unique identifiers (RXCUI)** for **ingredients, strengths, and dosage** forms. It facilitates interoperability between pharmacy, laboratory, and hospital systems, focusing primarily on drugs marketed in the U.S.

The screenshot displays the RxNav web application interface, which is used for navigating RxNorm drugs. The interface is organized into several panels:

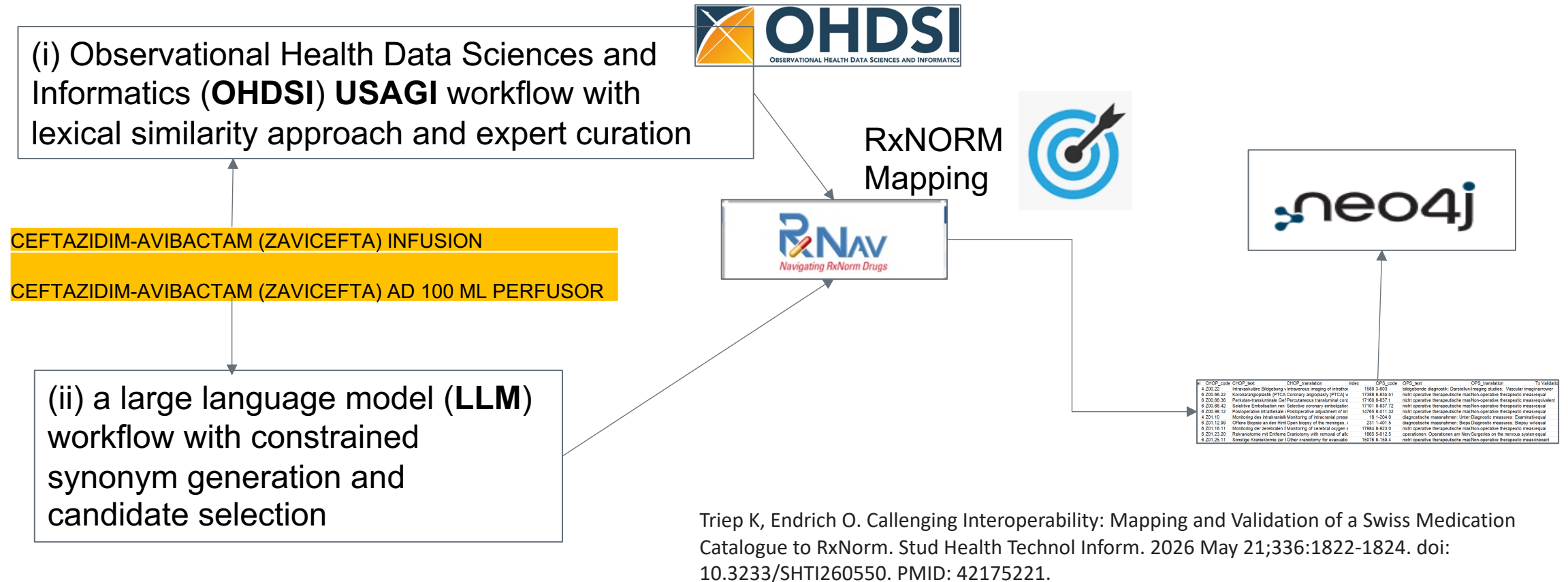
- Views:** Classic (selected), Simple, Table.
- Filters:** H (selected), V, R, S. Group, Form.
- Links:** Legend, MIN, Pack, Precise formulation, Multi, Download.
- IN/MIN Ingredient (2):** H Rx S cefTAZidime, M Rx M avibactam / cefTAZidime.
- PIN Precise Ingredient (3):** Rx S cefTAZidime anhydrous, S cefTAZidime pentahydrate, S cefTAZidime sodium.
- BN Brand Name (3):** H Rx M Avycaz, H Rx S Fortaz, H Rx S Tazicef.
- SCDC Clinical Drug Component (5):** H Rx S cefTAZidime 200 MG/ML, S cefTAZidime 250 MG/ML, H Rx S cefTAZidime 500 MG.
- SBDC Branded Drug Component (7):** H Rx S cefTAZidime 200 MG/ML [Tazicef], H Rx S cefTAZidime 500 MG [Fortaz], H Rx S cefTAZidime 1000 MG [Fortaz].
- SCD/GPCK Clinical Drug or Pack (6):** H Rx S cefTAZidime 200 MG/ML Injectable Solution, S cefTAZidime 250 MG/ML Injectable Solution, H Rx S cefTAZidime 500 MG Injection.
- SBD/BPCK Branded Drug or Pack (7):** H Rx S Fortaz 500 MG Injection, H Rx S Tazicef 1 GM Injection, H Rx S Tazicef 2 GM Injection, H Rx S Tazicef 400 MG/ML Injectable Solution.
- SCDF(P) Clinical Drug Form (3):** H Rx S cefTAZidime Injectable Solution, H Rx S cefTAZidime Injection, H Rx M avibactam / cefTAZidime Injection.
- DF Dose Form (2):** H Rx S Injectable Solution, H Rx S Injection.
- SBDF(P) Branded Drug Form (4):** H Rx S cefTAZidime Injectable Solution [Tazicef], H Rx S cefTAZidime Injection [Fortaz], H Rx S cefTAZidime Injection [Tazicef].

The RxNav logo is centered in the middle of the interface, with the tagline "Navigating RxNorm Drugs".

⚠ Brand Zavicefta is missing (Europe)

Rx Norm unifies standard classifications, connecting ingredients with indications, diseases and physiologic states.

Building Semantic Representation



We compared two workflows for mapping Swiss medication products to RxNorm and RxNorm Extension

OHDSI Workflow and ATHENA Vocabulary

ATC code	Name	DDD	U	Adm.R	Note
J01DD52	<u>ceftazidime and beta-lactamase inhibitor</u>	6	g	P	Refers to ceftazidime

2 different concepts: Brand name, Branded Drug Form

 SEARCH DOWNLOAD LOGIN ?

SEARCH BY KEYWORD ?

zavicefta ×

Drug ×

RxNorm Extension ×

DOMAIN ▼

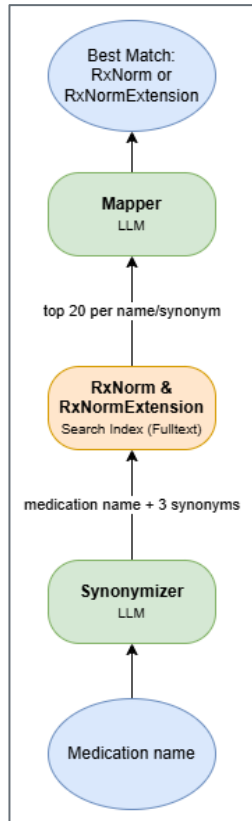
CONCEPT ▼

DOWNLOAD RESULTS

Show by 15 ▼ items Total 17 items 1 2 >

ID ▼	CODE ▼	NAME ▼	CLASS ▼	CONCEPT ▼	VALIDITY ▼	DOMAIN ▼	VOCAB ▼
35406567	OMOP1140152	ZAVICEFTA	Brand Name	Non-standard	Valid	Drug	RxNorm Extension
40745137	OMOP4712036	avibactam / Ceftazidime Injection [ZAVICEFTA]	Branded Drug Form	Standard	Valid	Drug	RxNorm Extension

LLM Workflow



Goal. From the retrieved candidate list, select the single best match for the original (German) medication string. We call a second LLM with a strict system prompt that frames the task as a classification over a fixed candidate list. The model is required to output only the index of the best matching list entry, selected on the basis of:

1. **Active ingredient** match (**highest priority**).
2. **Strength** match (if present in the original name).
3. **Manufacturer** match (only if present in the original name).
4. **Package size** match (only if present).

Stage 2: query **RxNorm** and the **RxNorm Extension** using the original German string plus up to three English synonyms, retrieving the top 20 candidates per query. Candidates are merged and deduplicated by concept identifier to form a consolidated candidate list per record.

Stage 1: an LLM generates up to three English synonyms per input, preserving active ingredient and strength when explicitly present while removing manufacturer and packaging details.

The pipeline takes **German free-text medication strings** from clinical systems and does not use proprietary brand names as matching keys.

Results

We evaluated 179 products; 151 products were not equally mappable at code level.

For these discordant products, the **LLM workflow mapped predominantly to branded-level classes** (121/151, 80.1 %), whereas **manual/USAGI mapping more often selected clinical drug-level classes** (87/151, 57.6 %).

Semantic proximity differed by target vocabulary.

Example: Ceftazidime + Avibactam (Combination Product)

● Clinical-Level Concepts

- Ingredient (IN):
Ceftazidime + Avibactam
- Clinical Drug (SCD):
Ceftazidime 2 g / Avibactam 0.5 g injection

□ Brand-Level Concepts

- Branded Drug Component (BDC):
Ceftazidime + Avibactam (Avycaz / Zavicefta)
- Branded Drug (SBD):
Zavicefta 2 g / 0.5 g injection



Not over-prioritize:

- Zavicefta / Avycaz (*brand*)
- Number of vials (*quantity*)
- Packaging or preparation details

Class comparison LLM & USAGI

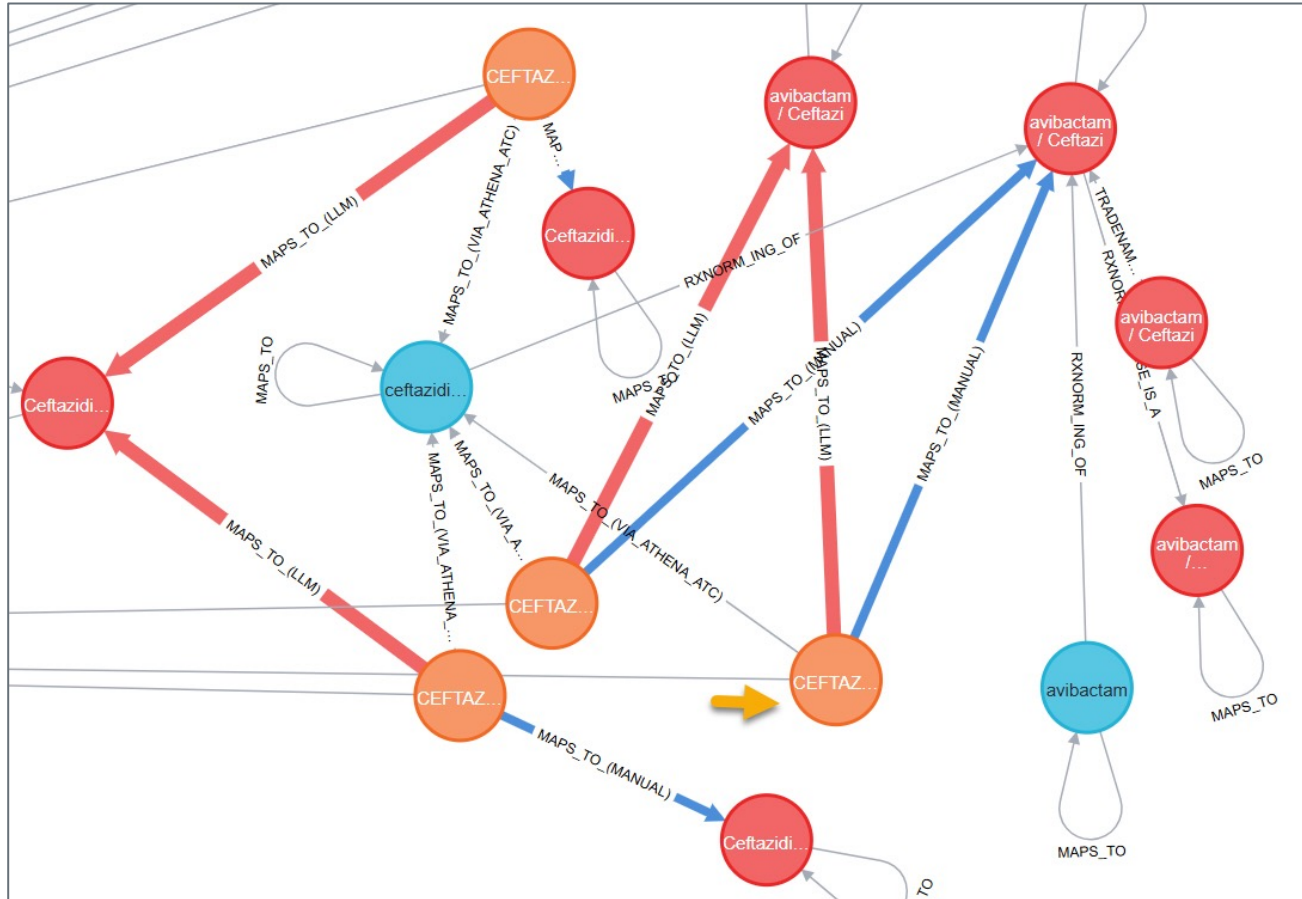
Class	LLM	USAGI manual
Branded Drug	19	14
Branded Drug Box	1	0
Branded Drug Comp	22	1
Branded Drug Form	71	46
Clinical Drug	5	26
Clinical Drug Comp	8	0
Clinical Drug Form	11	6
Ingredient	3	48
Marketed Product	2	1
Quant Branded Drug	8	2
Quant Clinical Drug	1	7
All	151	151

The single most frequent **LLM class** was Branded Drug Form (71/151, 47.0 %)

In contrast, **manual mappings** were split between Clinical Drug Form (48/151, 31.8 %) and Branded Drug Form (46/151, 30.5 %), with Clinical Drug also common (26/151, 17.2 %).

Class comparison of products not equally mappable on code level, LLM and manual USAGI workflow

Graph Representation - Medication



Examples illustrating both mapping approaches, including

cases involving combination products (multi-ingredient formulations) and knowledge graph representations incorporating ATC codes

Nodes:

product = orange,

Rx Norm = blue,

Rx Norm Extension = red;

Relationships:

red = LLM mapping,

blue manual USAGI mapping;

Classes: Ingredient, Clinical Drug, Branded Drug)

The Graph representation was extremely helpful for the visualisation, validation and knowledge creation!

Evaluation of semantic proximity by using the knowledge graph

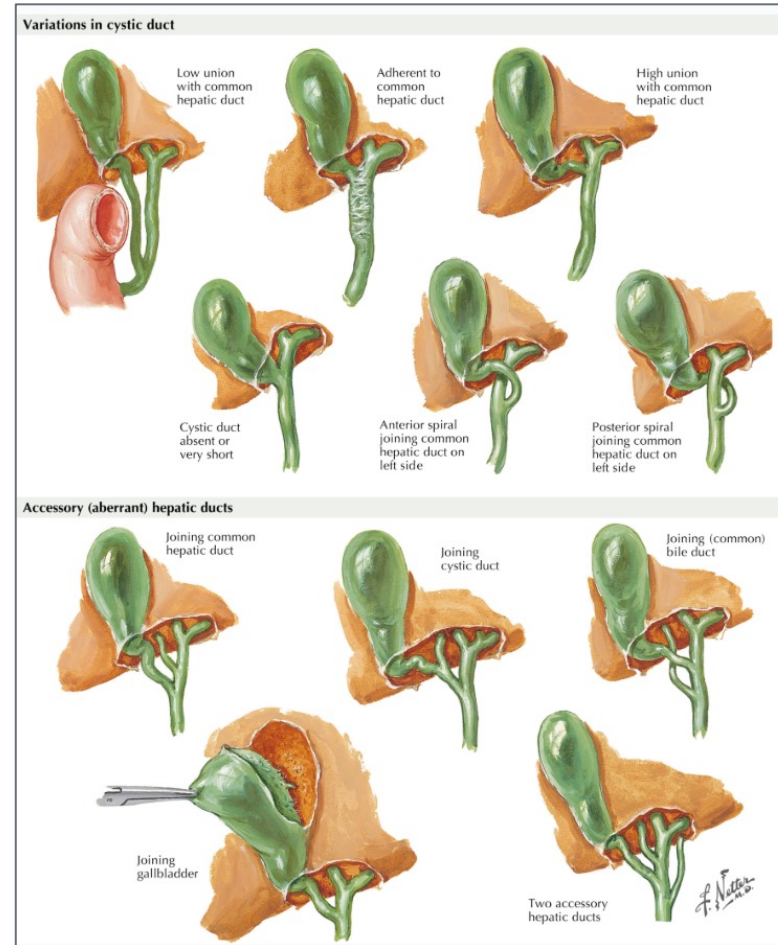
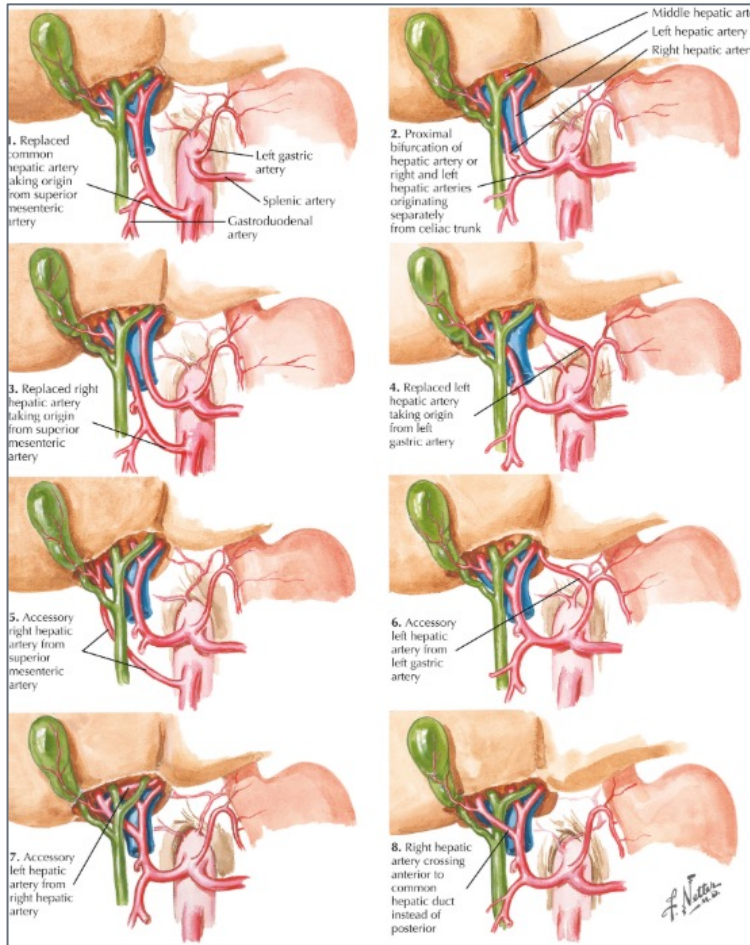
Table 2

Path length comparison, products not equally mappable on code level, Rx Norm Rx Norm Extension, LLM and manual USAGI workflow: median shortest path length

Classes	Rx Norm		Rx Norm Extension		Both	
	LLM	manual USAGI	LLM	manual USAGI	LLM	manual USAGI
Branded Drug	1.33	5.00	2.50	2.62	2.32	2.79
Branded Drug Box	NV	NV	4.00	NV	4.00	NV
Branded Drug Comp	3.25	NV	3.06	2.00	3.09	2.00
Branded Drug Form	2.10	2.50	2.54	2.08	2.48	2.15
Clinical Drug	3.00	3.64	4.00	3.07	3.40	3.31
Clinical Drug Comp	2.80	3.00	2.00	3.50	2.50	3.17
Clinical Drug Form	3.00	2.42	2.43	2.50	2.64	2.44
Ingredient	2.00	3.00	NV	NV	2.00	3.00
Marketed Product	NV	NV	2.50	3.00	2.50	3.00
Quant Branded Drug	NV	NV	2.75	NV	2.75	NV
Quant Clinical Drug	NV	3.43	4.00	NV	4.00	3.43
All	2.47	2.81	2.66	2.46	2.62	2.62

Semantic proximity between mapped concepts was assessed using the median shortest path length in the knowledge graph; shorter paths indicate closer semantic agreement after mapping.

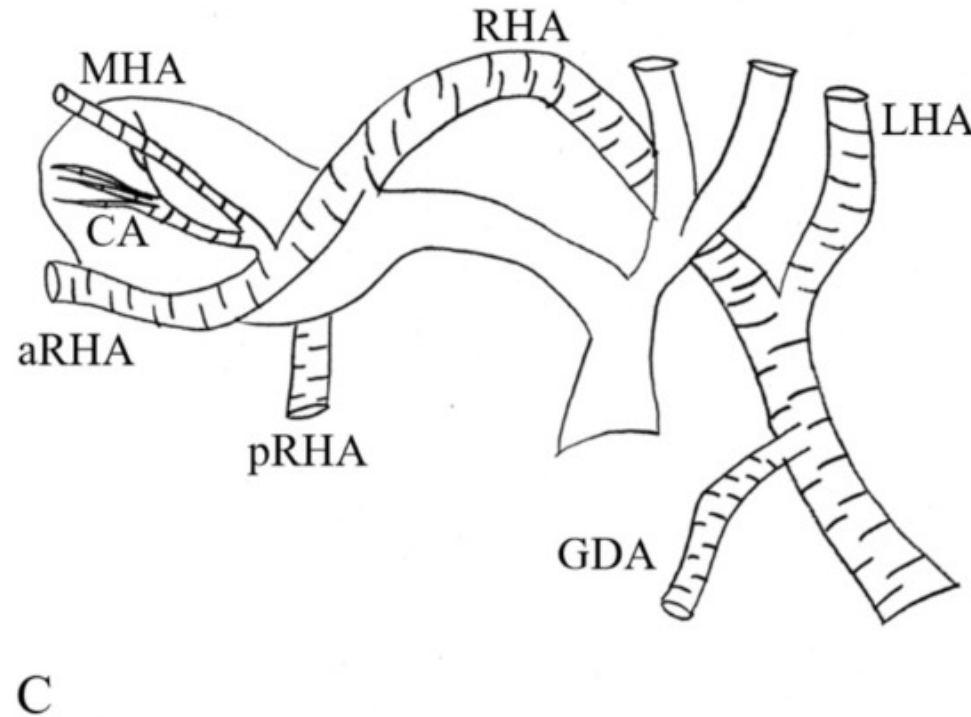
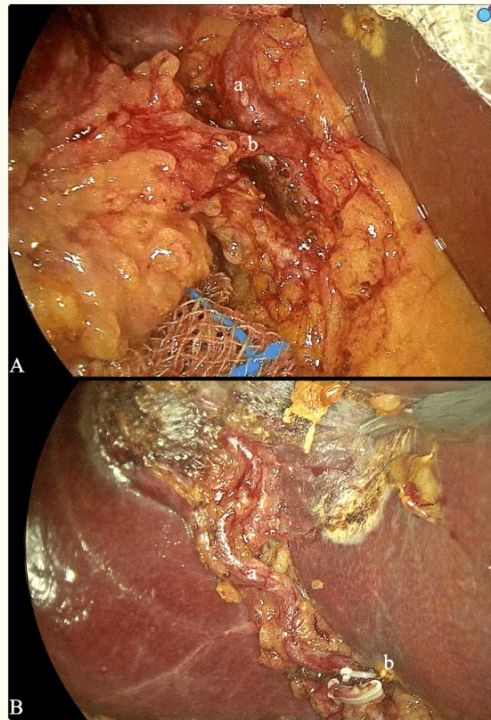
Case 2 - What makes it difficult to describe variation in anatomy?



<https://clinicalpub.com/cholecystectomy/>

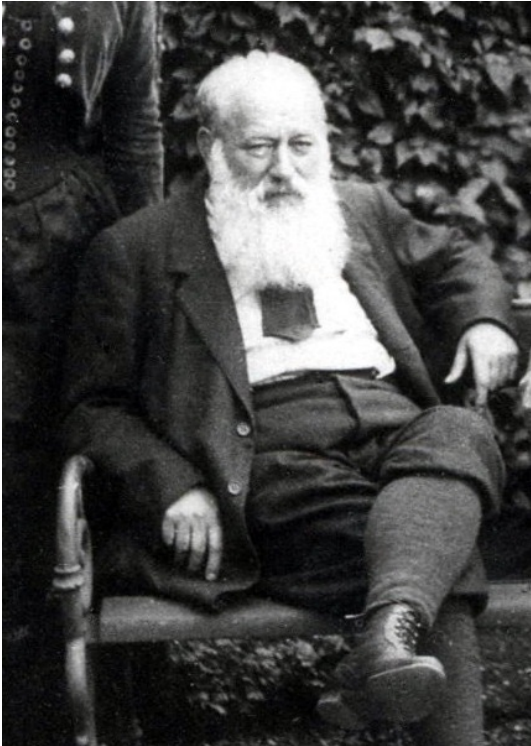
Variation in Method and Approach

Figure 1. Laparoscopic image of the two arteries.



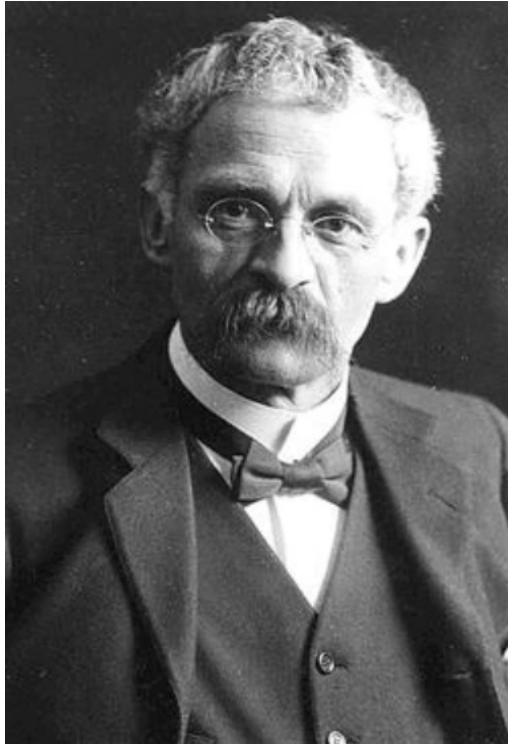
<https://pmc.ncbi.nlm.nih.gov/articles/PMC11426409/>

The Surgeon's Personality



Theodor Billroth

Billroth I & II Magenresektion



César Roux

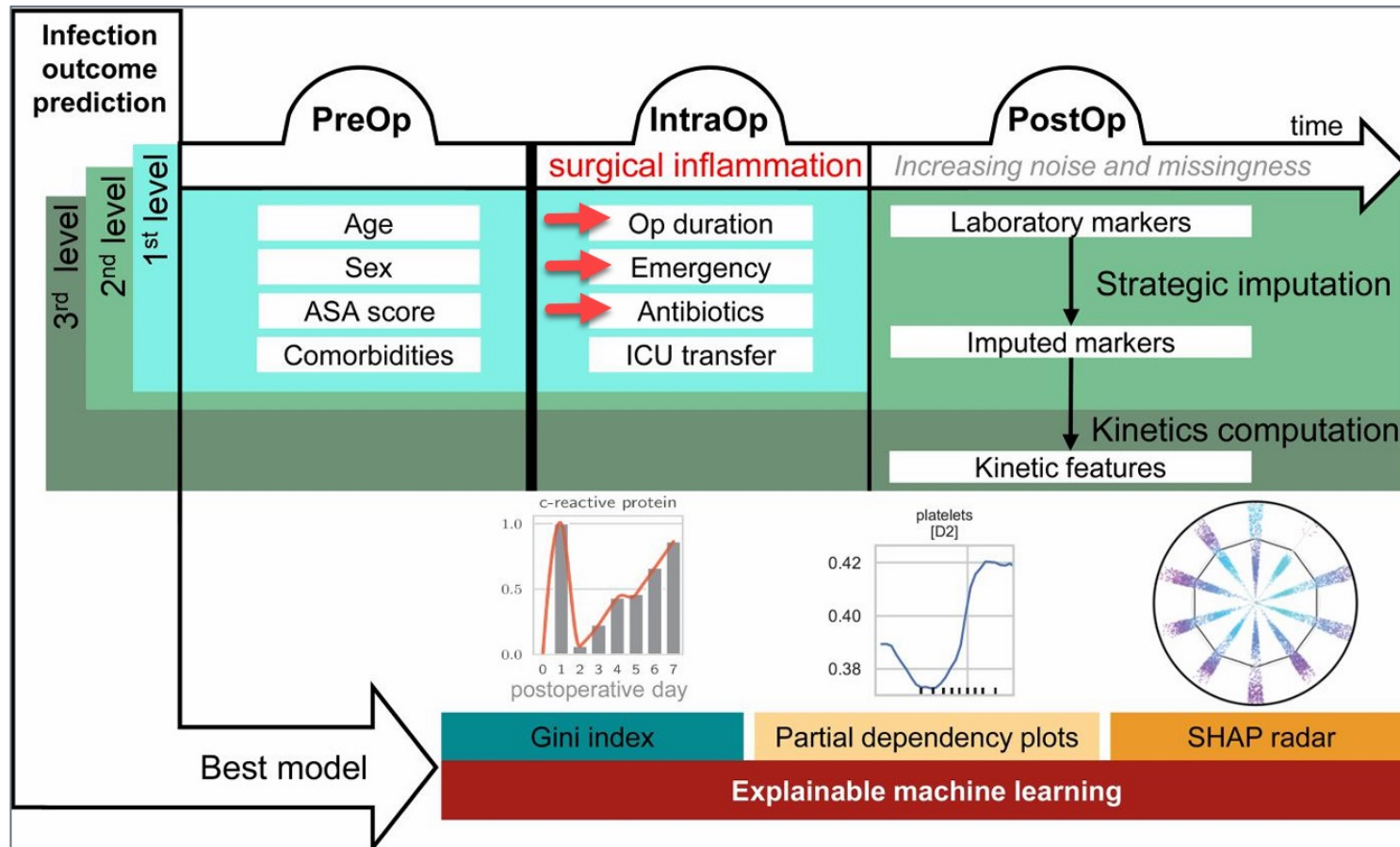
Roux-en-Y-bypass



Da Vinci Roboter

<https://link.springer.com/article/10.1007/s00104-006-1267-3#Fig3>

Use Case: prediction of post-surgical infection



Guillen-Ramirez H, Sanchez-Taltavull D, Perrodin S, Peisl S, Triep K, Gaudet-Blavignac C, Endrich O, Beldi G. Prediction of postoperative infections by strategic data imputation and explainable machine learning. J Am Med Inform Assoc. 2025 Nov 1;32(11):1706-1717. doi: 10.1093/jamia/ocaf145. PMID: 40886713; PMCID: PMC12626223.

Results: The integration of kinetics of laboratory values into a machine learning predictor achieved a recall, precision and ROC AUC at postoperative day 2 of 0.71, 0.69, and 0.83, respectively. Moreover, infection detection outperformed clinician-based decision-making, as reflected by the postoperative timing of antibiotic administration.

Hypothesis

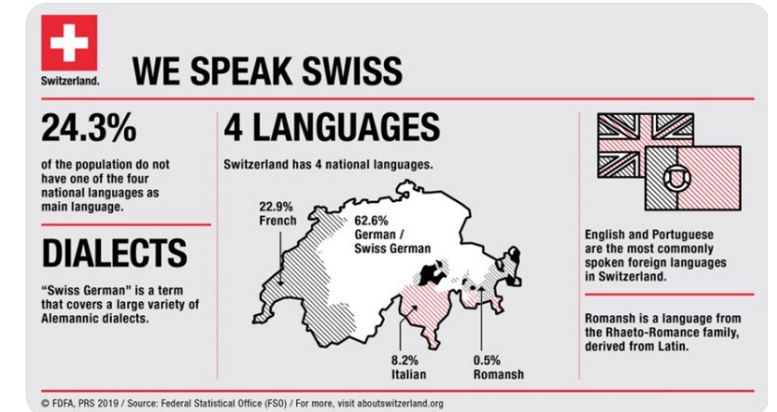
- **Type** of surgery / **invasiveness** is important for risk prediction
- **Clustering** on surgery type & invasiveness can be done by using a procedure **classification**



The Challenge – procedures classification

Medical (surgical) procedures classifications are typically:

- Country or healthcare context specific
- Often non-english
- Mapping to Standard Terminologies is generally not available
- Multiaxial, includes abbreviations, personal names and descriptions
- Semantically ambiguous
- Inconsistent in hierarchy



USE CASE OPS (Germany) and CHOP (Switzerland)

 Bundesinstitut für Arzneimittel und Medizinprodukte	.4x Sonstige 5-511 Cholezystektomie Inkl.: Blutstillung im Bereich des Gallenblasenlagers (mit Leberbettnaht) Einlage einer Gallengangs-/T-Drainage bei Gallengangsrevision Hinw.: Eine intraoperative Cholangiographie durch Zugang im Rahmen einer Laparotomie oder Laparoskopie ist gesondert zu kodieren (3-13c.3)
Kode-Suche in OPS Version 2024 Drei- oder Viersteller: OK!	5-511.0 Einfach, offen chirurgisch .01 Ohne operative Revision der Gallengänge .02 Mit operativer Revision der Gallengänge
Übersicht über die Kapitel	5-511.1 Einfach, laparoskopisch .11 Ohne laparoskopische Revision der Gallengänge .12 Mit laparoskopischer Revision der Gallengänge
Kapitelgliederung	5-511.2 Einfach, Umsteigen laparoskopisch - offen chirurgisch .21 Ohne operative Revision der Gallengänge .22 Mit operativer Revision der Gallengänge
Gruppengliederung	5-511.3 Erweitert

The German Procedure Classification **OPS**

33'750 distinct terminal codes

1 Language: German

51.19.0 Detail der Subkategorie 51.19 51.19.00 Sonstige diagnostische Massnahmen an den Gallenwegen, n.n.bez. 51.19.10 Chromoendoskopie an den Gallenwegen ☐ INKL. Virtuelle Chromoendoskopie 51.19.20 Endoskopie der Gallenwege durch Inzision d. Gallenwege, der Gallenblase oder über den Zystikusstumpf 51.19.30 Endoskopische Laser-Endomikroskopie an den Gallenwegen 51.19.99 Sonstige diagnostische Massnahmen an den Gallenwegen, sonstige	Gastrointestinaltrakt, sonstige 51.38.11 Anastomose zwischen Gallenwegen und Gastrointestinaltrakt 51.38.21 Anastomose zwischen Gallenwegen und Gastrointestinaltrakt, laparoskopisch
51.2 Cholezystektomie 51.21 Sonstige partielle Cholezystektomie ☐ EXKL. Partielle laparoskopische Cholezystektomie (51.24) 51.22 Cholezystektomie ☐ EXKL. Laparoskopische Cholezystektomie	51.22.00 Cholezystektomie, n.n.bez. 51.22.10 Cholezystektomie ohne operative Revision der Gallengänge 51.22.11 Cholezystektomie mit operativer Revision der Gallengänge 51.22.12 Erweiterte Cholezystektomie ☐ INKL. Leberbettnresektion

The Swiss Procedures Catalogue **CHOP**

10,860 distinct terminal codes

3 Languages: German, French, Italian

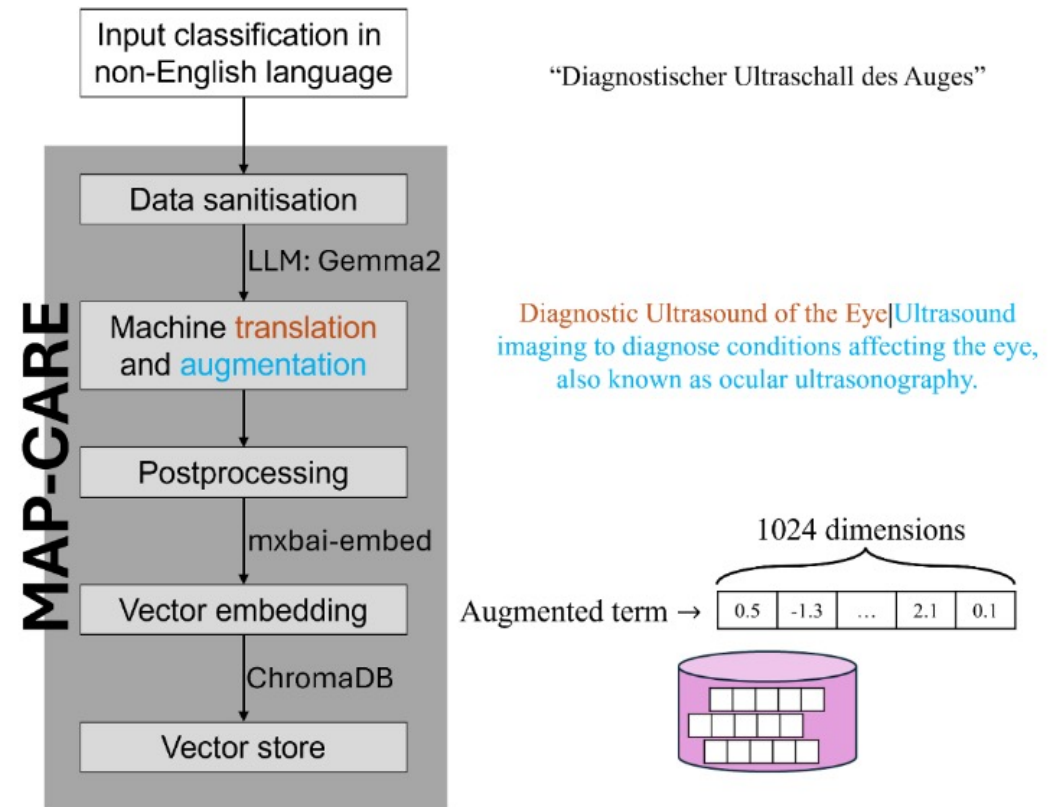
MAP-CARE FRAMEWORK

processing a (non-English) medical classification, exemplified by the Swiss Classification of Operations and Procedures (CHOP)

term is **translated** and contextually augmented using an LLM, *Gemma2*.

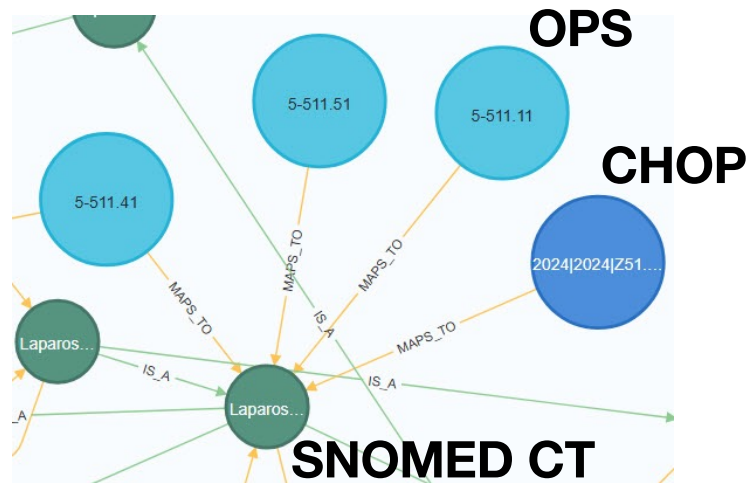
enhanced description is transformed into a **semantic numeric** representation encoded into a 1024-dimensional numeric vector that captures its semantic meaning using the embedding model *mxbai-embed*.

generated **vectors** from the complete classification are stored in *ChromaDB*, a database designed for efficient vector management and retrieval.



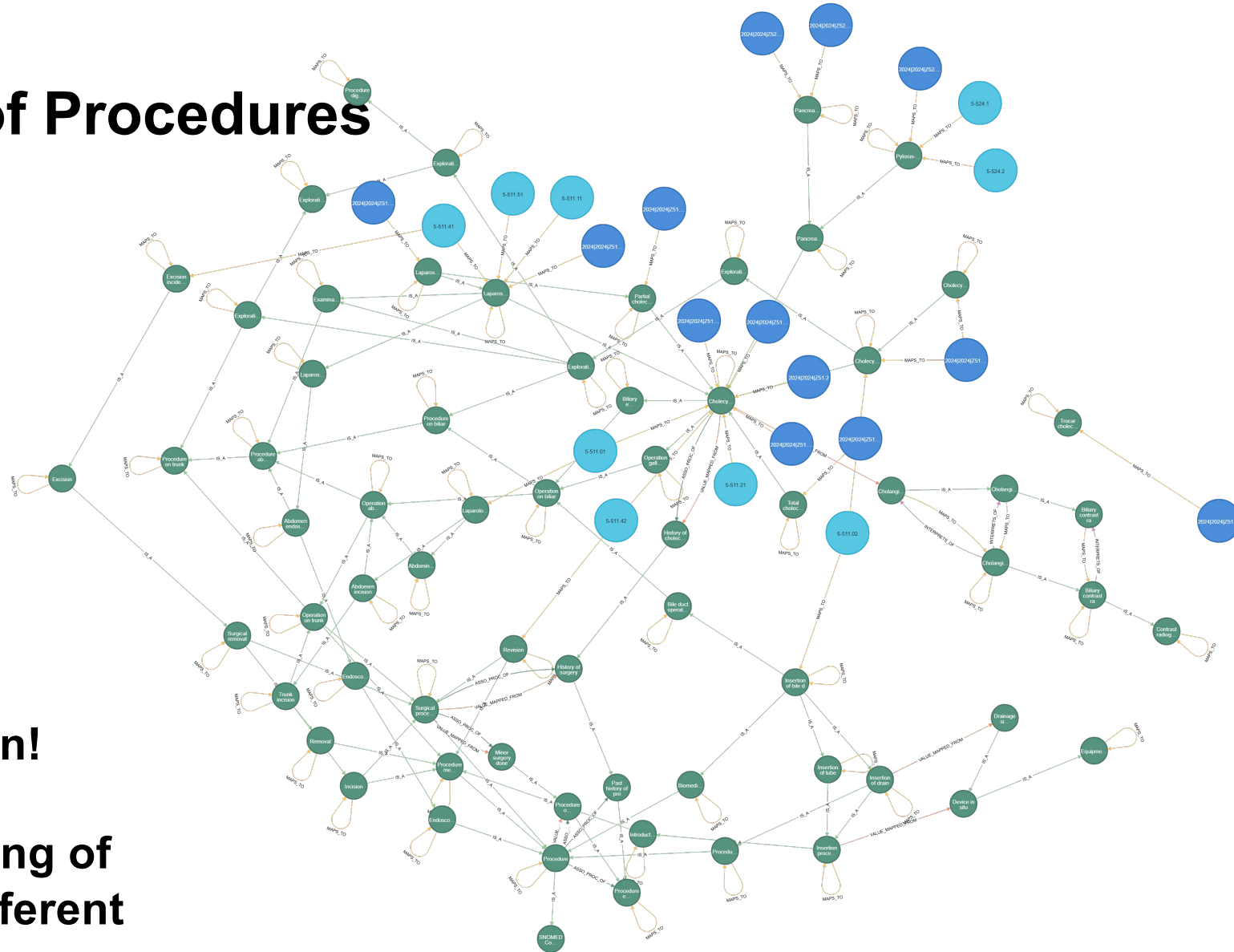
[GitHub - HugoGuillen/MAPCARE: MAP-CARE: Multilingual Approach for Procedures in Clinical and Retrieval Embeddings · GitHub](#)

Graph Representation of Procedures

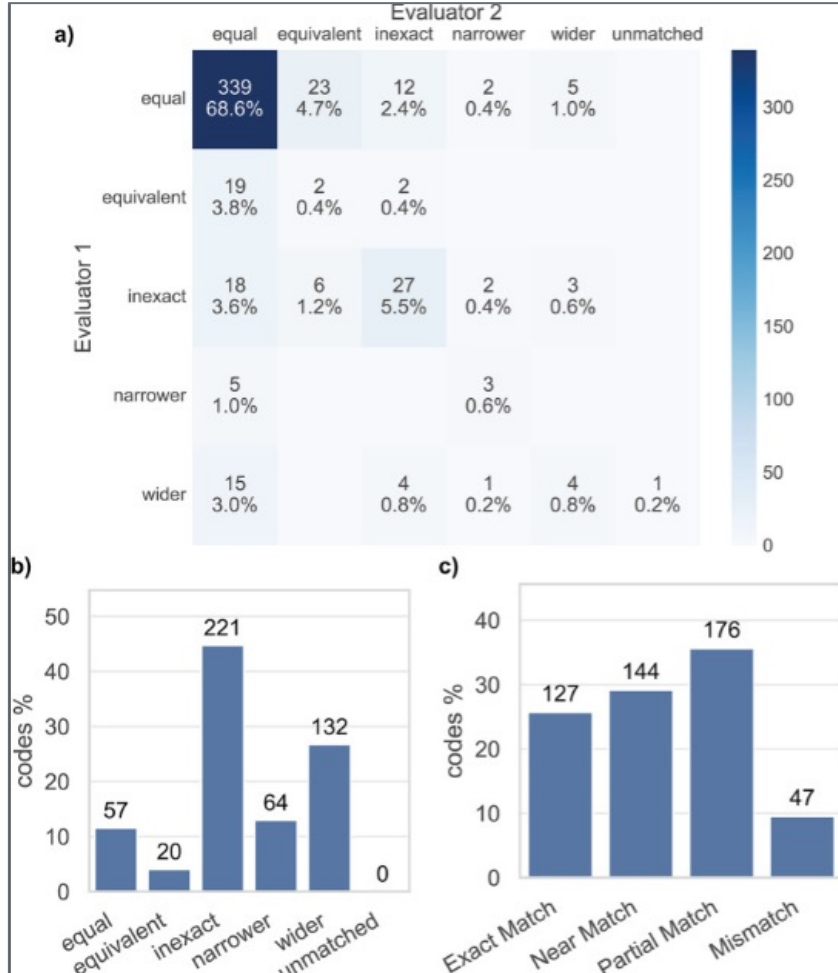


Concept «**Cholecystectomy**»
represented in OPS, CHOP and
SNOMED CT for **visual validation!**

Graph allows deep understanding of concept representation with different terminologies

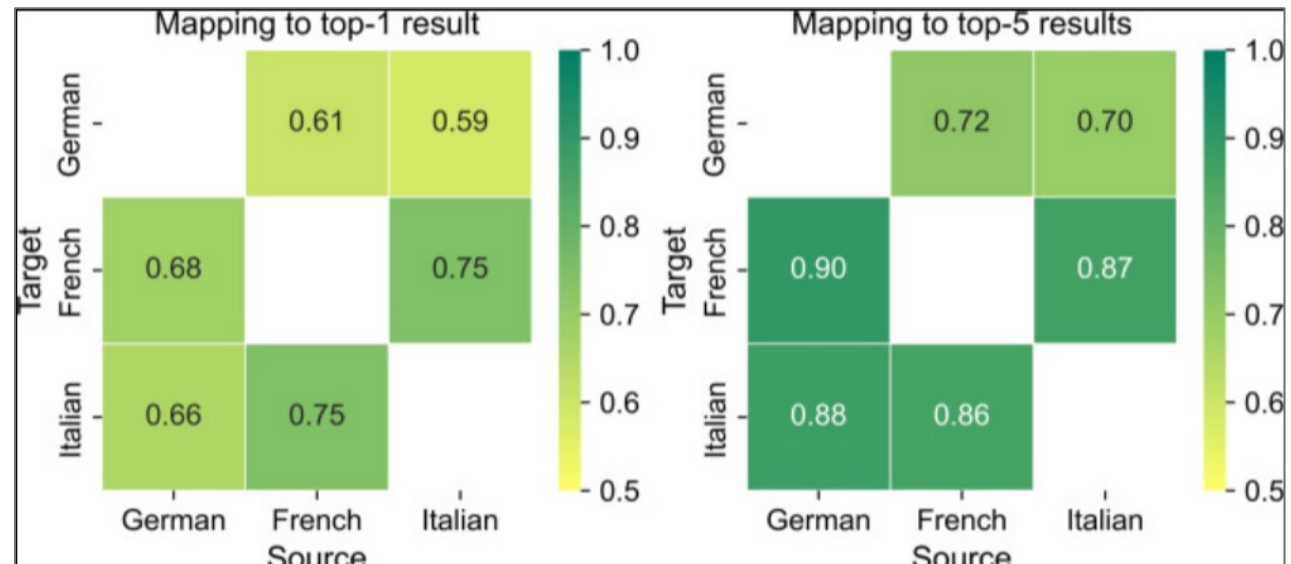


Validation



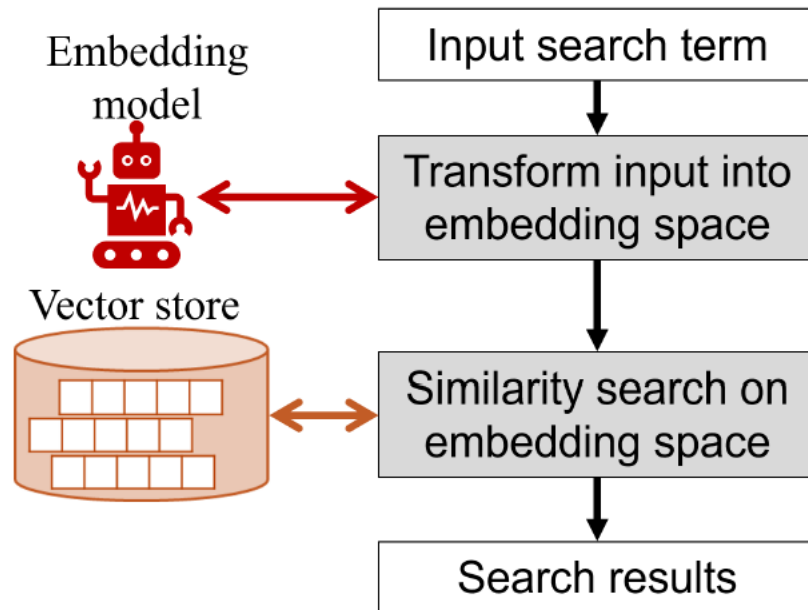
500 terms

- Accuracy in **translation**
- Accuracy in **semantic matching**
- Accuracy in **cross-classification mapping**



Goal: Term-retrievement by Natural Language Search

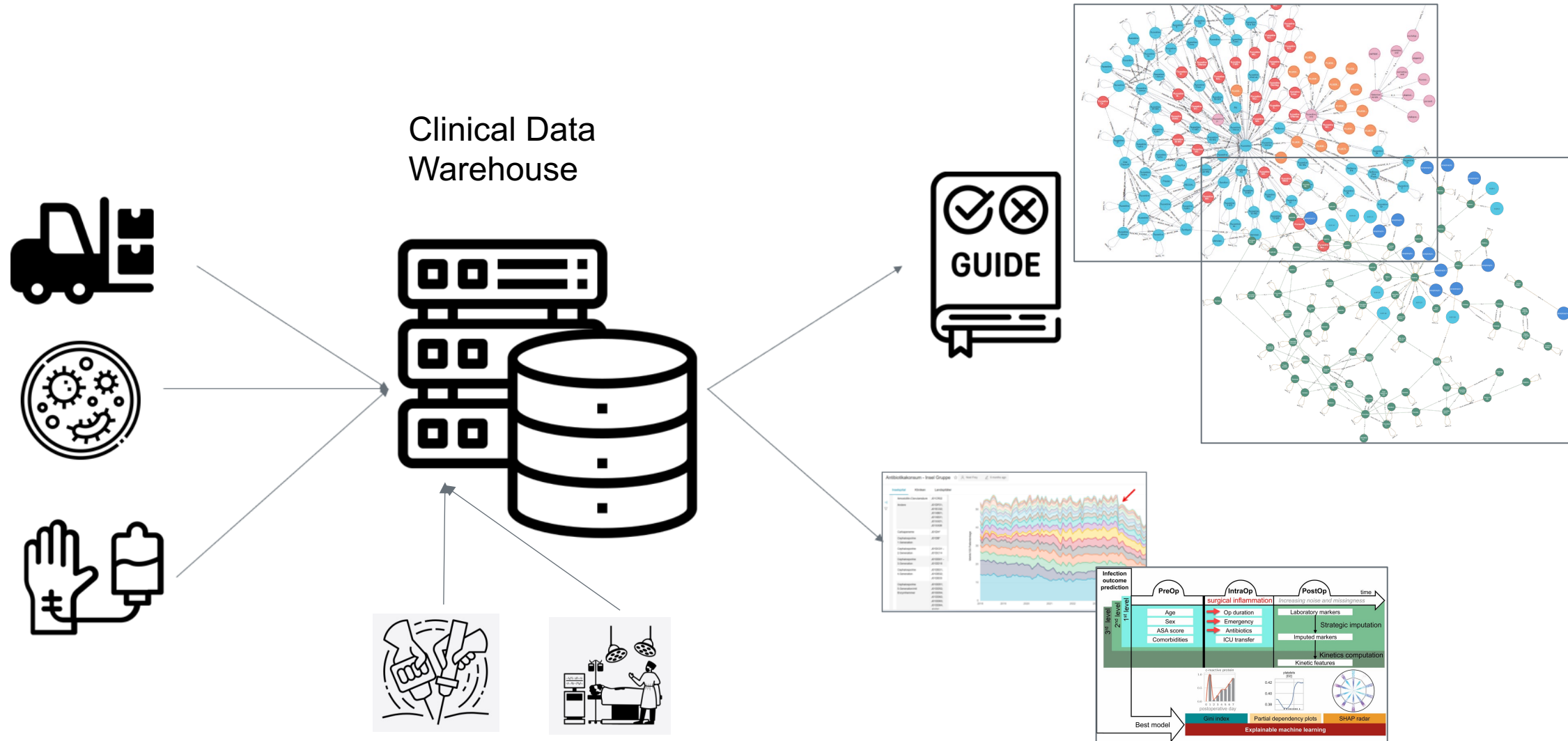
Natural language search



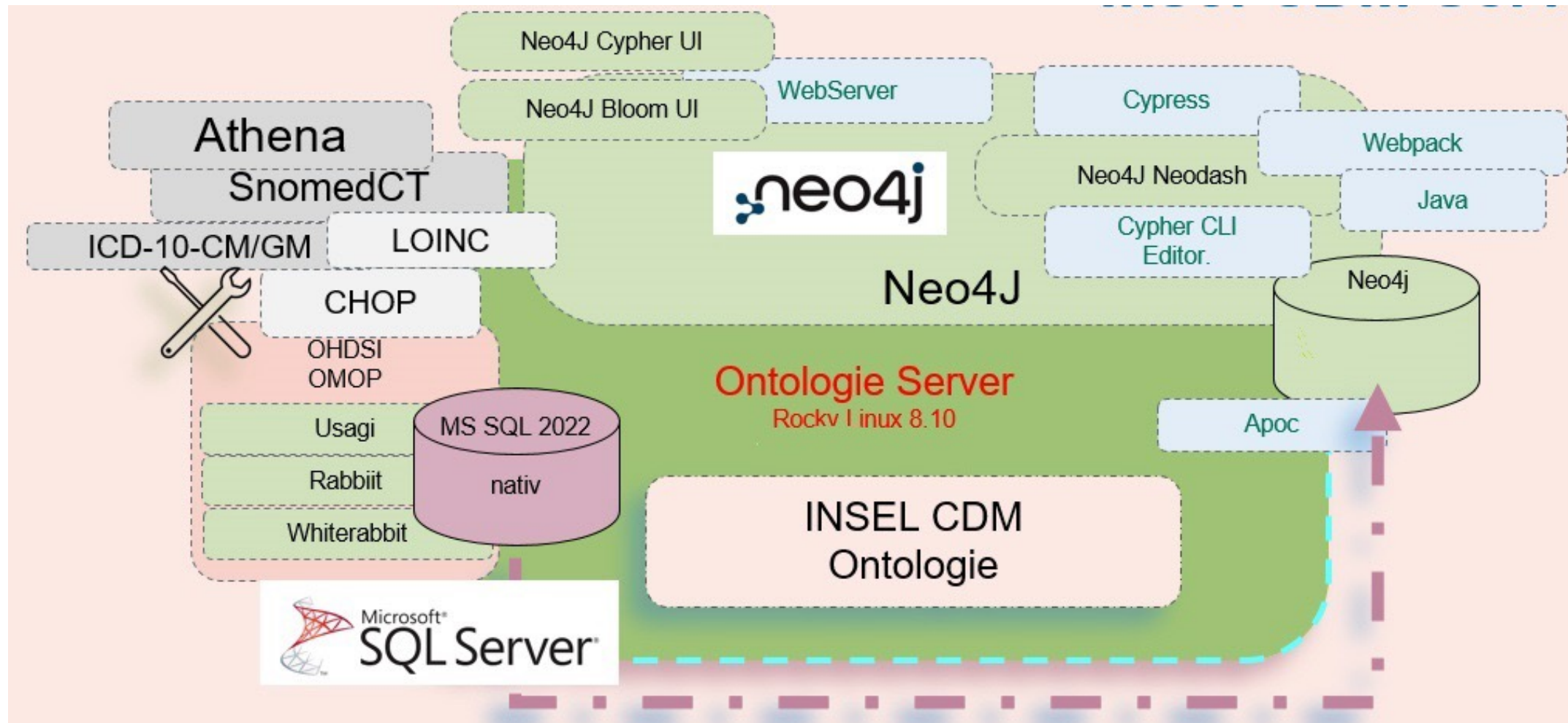
“Relief for blocked coronary vessels”

	zcode	german	english
0	Z00.4G.B3	Eingesetzte vaskuläre Plugs in Koronarien, 3 Plugs	Vascular plugs implanted in coronary arteries, 3 plugs
+	Z00.4G.B2	Eingesetzte vaskuläre Plugs in Koronarien, 2 Plugs	Vascular plugs implanted in coronary arteries, 2 plugs
2	Z00.4G.B4	Eingesetzte vaskuläre Plugs in Koronarien, 4 Plugs	Vascular plugs implanted in coronary arteries, 4 plugs
3	Z00.4G.B	Eingesetzte vaskuläre Plugs in Koronarien, nach Anzahl	Vascular plugs used in coronary arteries, by number
4	Z00.66.44	Selektive Embolisation von Koronarien mit Plugs	Selective coronary embolization with plugs

Building semantic layer supports knowledge generation



Insel Ontology Ecosystem



Summary

- The demonstrated processing using LLM / OHDSI workflows offers a flexible, scalable, and robust solution for the multilingual and cross-system integration of medical data.
- The innovative usage combined with semantic embeddings sets a new standard for the accessibility and utility of multilingual medical information.
- Building a semantic layer supports knowledge generation
- Visualisation enables transparency, validation, insight

**Key message: Interoperability in health care
improves outcomes and reduces adverse events
Knowledge storage and representation is a foundation for the
meaningfull data usage for care improvement and research**

