

Covhisto: A Web Application for Cross-Version Visualization and Analysis of ICD-10-GM and OPS

Tessa Ohlsen^{a,b}, Simon Müller^b, Josef Ingenerf^b

^a Institute of Medical Biometric and Statistics, Section for Clinical Research IT, University of Luebeck | University Hospital Schleswig-Holstein, Luebeck, Germany

^b Institute for Medical Informatics, University of Luebeck, Luebeck, Germany

1 Motivation



Causes for code changes

- Defining or deleting codes
- Introducing more detailed subdivisions of existing codes
- Resolving code duplicates or misunderstandings



Resulting challenges

- Compatibility
- Statistical analysis

Example: **K20.1 (Radiation esophagitis)**

- Introduced in 2023
- Before 2023:
 - K20 (Esophagitis)
 - T66 (Unspecified effects of radiation)

1 Motivation



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Resulting challenges

- Compatibility
- Statistical analysis



Our previous work¹

- Neo4J or FHIR ConceptMap
- Technical version compatibility

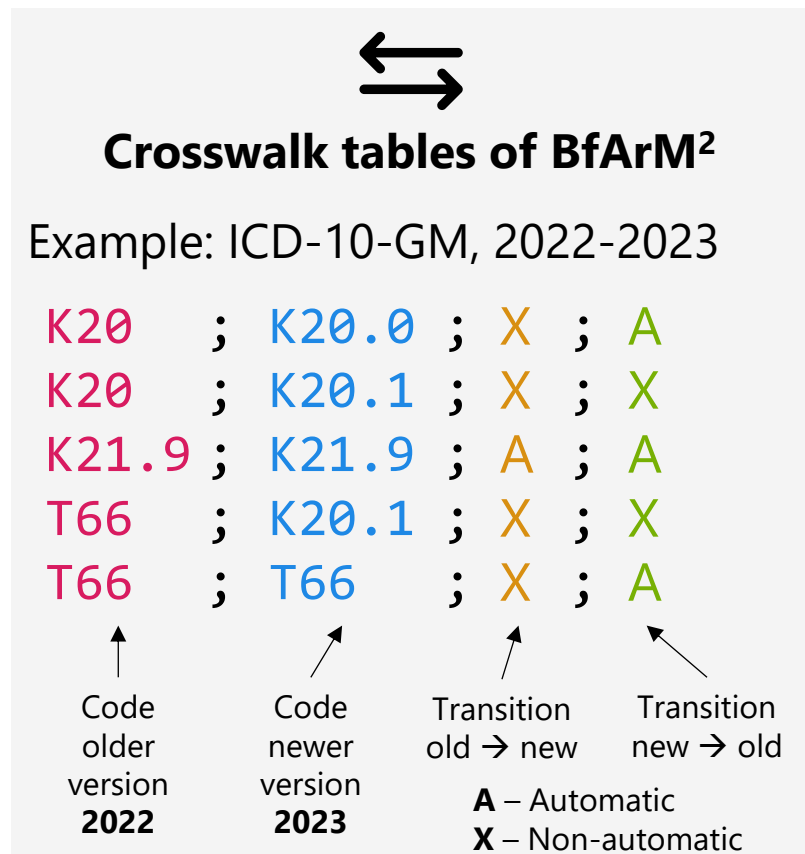


Goal

- Provide user-friendly visualization of medical code evolution over time
- Enable cross-version data analysis

¹ T. Ohlsen, J. Wiedekopf, and J. Ingnerf, Reformatted Crosswalk-Tables Between Annual ICD-10-Versions for Cross Version Data Analysis, *Studies in Health Technology and Informatics*. 319 (2024) 1307–1311. doi:[10.3233/SHTI240652](https://doi.org/10.3233/SHTI240652).

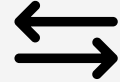
2 Methods – Source data



K20	–	Esophagitis
K20.0	–	Eosinophilic esophagitis
K20.1	–	Radiation esophagitis
K21.9	–	Gastro-esophageal reflux disease without esophagitis
T66	–	Unspecified effects of radiation

² BfArM = German Federal Institute for Drugs and Medical Devices

2 Methods – Source data



Crosswalk tables of BfArM²

Example: ICD-10-GM, 2022-2023

K20	;	K20.0	;	X	;	A
K20	;	K20.1	;	X	;	X
K21.9	;	K21.9	;	A	;	A
T66	;	K20.1	;	X	;	X
T66	;	T66	;	X	;	A
↑		↗		↑		↖
Code older version 2022		Code newer version 2023		Transition old → new		Transition new → old
				A – Automatic		
				X – Non-automatic		



Considered versions

- **ICD-10-GM:**
24 versions, v1.3 (2000) to 2025
- **OPS:**
24 versions, v1.1 (1996 – 2000)
to 2025

² BfArM = German Federal Institute for Drugs and Medical Devices

2 Methods – Preprocessing and storage



Normalization

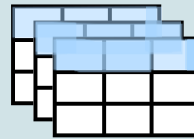
1-100;**N**;1;1-100;**N**;1;A
 1-272.0;**None**;N;X;X;
UNDEF;U62.00;X;X



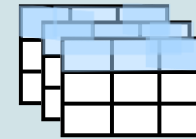
Database system

Versions

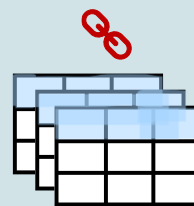
icd10_gm_v1.3
 ...
 icd10_gm_2025



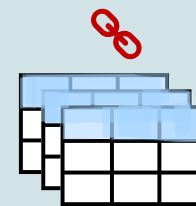
ops_v1.1
 ...
 ops_2025



Crosswalk tables



icd10_gm_cw_v1.3_v2.0
 ...
 icd10_gm_cw_2024_2025



ops_cw_v1.1_v2.0
 ...
 ops_cw_2024_2025



Relevant entries

K20;K20.0;**X**;A
 T66;K20.1;**X**;**X**
 B34.**88**;B34.**8**;A;A

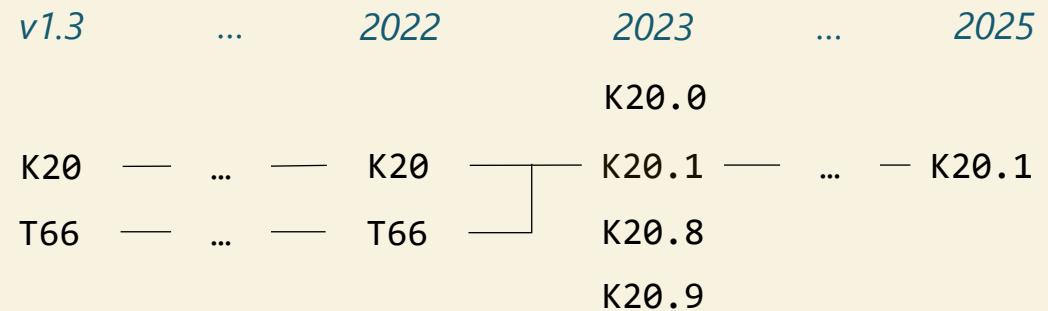
2 Methods – Detecting code changes



Approach

- Input: Version and optionally a specific code
- Graph-based approach

Example:



2 Methods – Detecting code changes



Approach

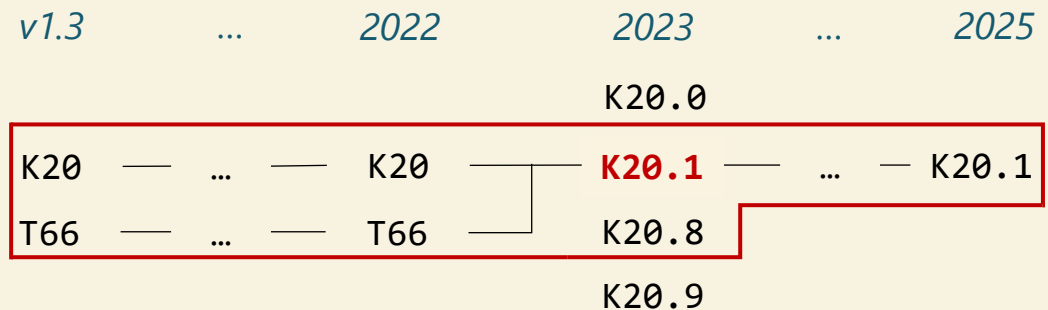
- Input: Version and optionally a specific code
- Graph-based approach



Single Code Chronology

- Focus on a single code to trace its development
- Search moves forward and backward across versions

Example:



2 Methods – Detecting code changes



Approach

- Input: Version and optionally a specific code
- Graph-based approach



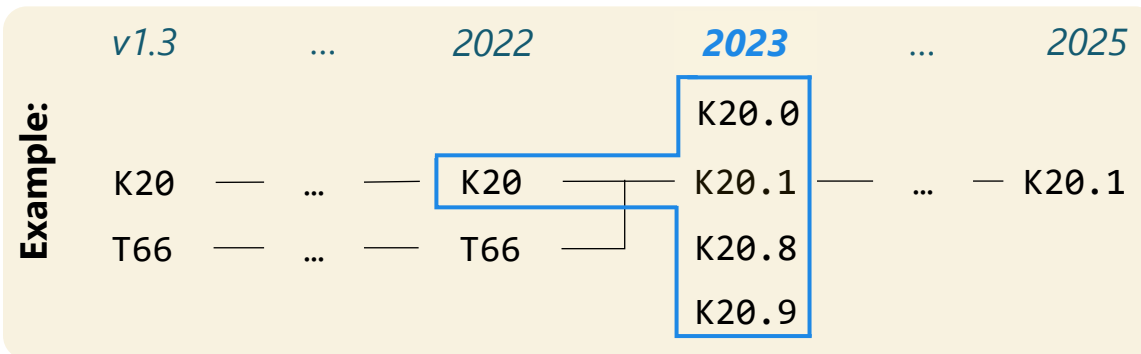
Single Code Chronology

- Focus on a single code to trace its development
- Search moves forward and backward across versions



Versions Map Merging

- Focus on a target version
- Search backward to map all codes to earlier versions



3 Results – Web application *Covhisto*

Code Version History Tool

ICD-10-GM Umsteiger

Übersicht
[Link](#)

Suche/Historie
[Link](#)

Transitive ConceptMap
[Link](#)

ICD-10-GM Codes

2025	2024	2023
2022	2021	2020
2019	2018	2017
2016	2015	2014
2013	2012	2011
2010	2009	2008
2007	2006	2005
2004	2.0	1.3

OPS Umsteiger

Übersicht
[Link](#)

Suche/Historie
[Link](#)

Transitive ConceptMap
[Link](#)

OPS Codes

2025	2024	2023
2022	2021	2020
2019	2018	2017
2016	2015	2014
2013	2012	2011
2010	2009	2008
2007	2006	2005
2004	2.1	2.0
1.1		

Covhisto

Crosswalk table for two consecutive versions

"Auto" Icons



-  Automatisch überleitbar von 2023 nach 2022.
-  Automatisch überleitbar von 2022 nach 2023.
-  Automatisch überleitbar in beide Richtungen.
-  Nicht automatisch überleitbar.

Covhisto

ICD-10-GM Umsteiger

2025 2024 **2023** 2022 2021 2020 2019 2018 2017 2016 2015 2014
2013 2012 2011 2010 2009 2008 2007 2006 2005 2004 2.0

Umsteiger-Rate: 0,95%

ConceptMap

2023 → 2022

FHIR R4

JSON

Generieren

2023	Titel	Auto [?]	2022	Titel
...				
B34.88	Sonstige Virusinfektionen nicht näher bezeichneter Lokalisation		B34.8	Sonstige Virusinfektionen nicht näher bezeichneter Lokalisation
...				
K20.0	Eosinophile Ösophagitis		K20	Ösophagitis
K20.1	Radiogene Ösophagitis		K20	Ösophagitis
K20.1	Radiogene Ösophagitis		T66	Nicht näher bezeichnete Schäden durch Strahlung
...				
K21.0	Gastroösophageale Refluxkrankheit mit Ösophagitis		K20	Ösophagitis
K21.0	Gastroösophageale Refluxkrankheit mit Ösophagitis		K21.0	Gastroösophageale Refluxkrankheit mit Ösophagitis

Covhisto

Changes of one code across multiple versions

Covhisto

ICD-10-GM Code-Suche mit Umsteigern

Code:

K20.1

Version:

2025



Suchen

K20.1

Radiogene Ösophagitis

2025

älter

2023→2022

K20.1 ✖ K20

Ösophagitis

K20.1 ✖ T66

Nicht näher bezeichnete Schäden
durch Strahlung

3 Results – Validation



Search algorithms

Single Code Chronology



- Start: test codes of v1.3 (ICD-10)
- Trace forward up to 2025

Versions Map Merging



- Start: target version 2025
- Traces backward across all previous versions



Results

Search algorithms

- Single Code Chronology results are included in the Versions Map Merging
- Validation successful

Usability survey

- Initial expert reviews provided valuable feedback

4 Conclusion



Statistics

- Not automatically transferable (average):
ICD-10-GM: 0.69 %
OPS: 4.30 %



Relevance

- Small changes can impact analysis
- New versions include medical updates



Solution: *Covhisto*³

- Interactive tool to explore code changes
- Open-source



Outlook

- Extension to SNOMED CT
- FHIR-API
- Real-time generation of ConceptMap
- Performance optimisation

³ Web application *Covhisto*: <https://jacuke.uber.space/> ; Source code: <https://github.com/jacuke/ma/tree/master>



UNIVERSITÄT ZU LÜBECK



UNIVERSITÄTSKLINIKUM
Schleswig-Holstein

Contact

Tessa Ohlsen, M. Sc.

Research Associate

University Medical Hospital Schleswig-Holstein (UKSH) | University of Luebeck
Section for Clinical Research IT (SKFIT)

Institute for Medical Informatics

Ratzeburger Allee 160

23562 Lübeck, Germany

✉ t.ohlsen@uni-luebeck.de

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