




[Home](#) > [Journal of Imaging Informatics in Medicine](#) > [Article](#)

# Development of Medical Imaging Data Standardization for Imaging-Based Observational Research: OMOP Common Data Model Extension

[Open access](#) | [Published: 05 February 2024](#)

(2024) [Cite this article](#)

[Download PDF](#) 

 You have full access to this [open access](#) article



[Journal of Imaging Informatics in Medicine](#)

[Aims and scope](#) →

[Submit manuscript](#) →

[Woo Yeon Park](#) , [Kyulee Jeon](#), [Teri Sippel Schmidt](#), [Haridimos Kondylakis](#), [Tarik Alkasab](#), [Blake E. Dewey](#), [Seng Chan You](#) & [Paul Nagy](#)

 **918** Accesses [Explore all metrics](#) →

[Use our pre-submission checklist](#) →

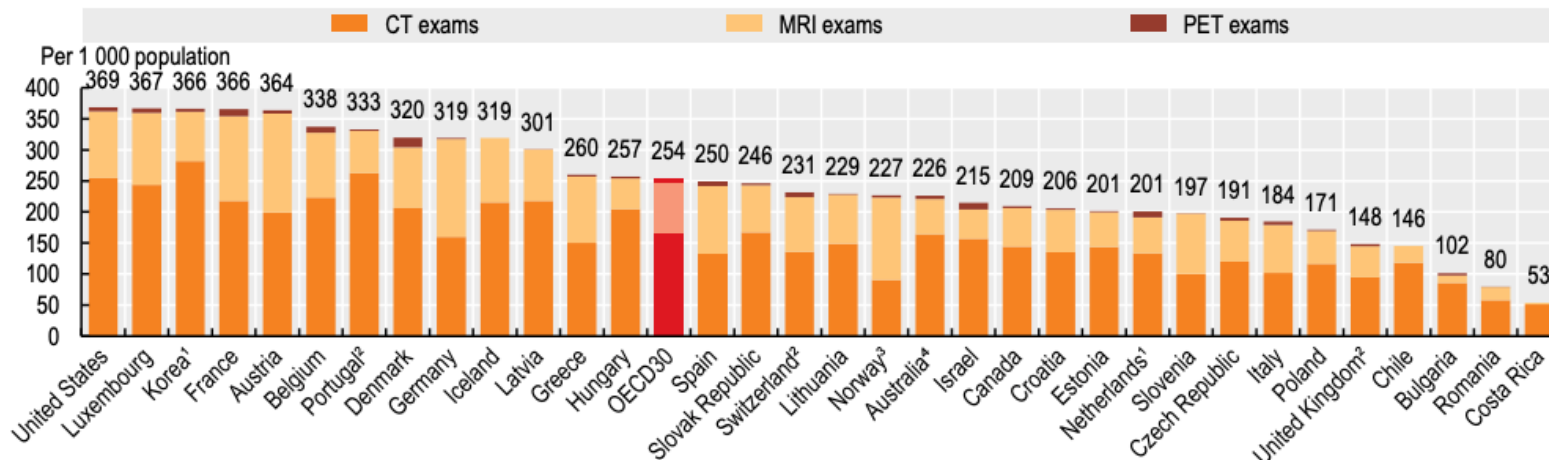
Avoid common mistakes on your manuscript.



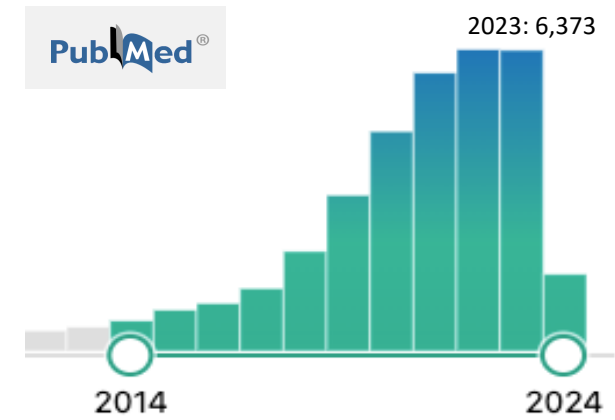
# Medical Imaging

- Advancement in equipment, data storage, artificial intelligence and machine learning further pushes greater use of medical images in clinical and research settings.

Figure 5.24. CT, MRI and PET exams, 2021 (or nearest year)



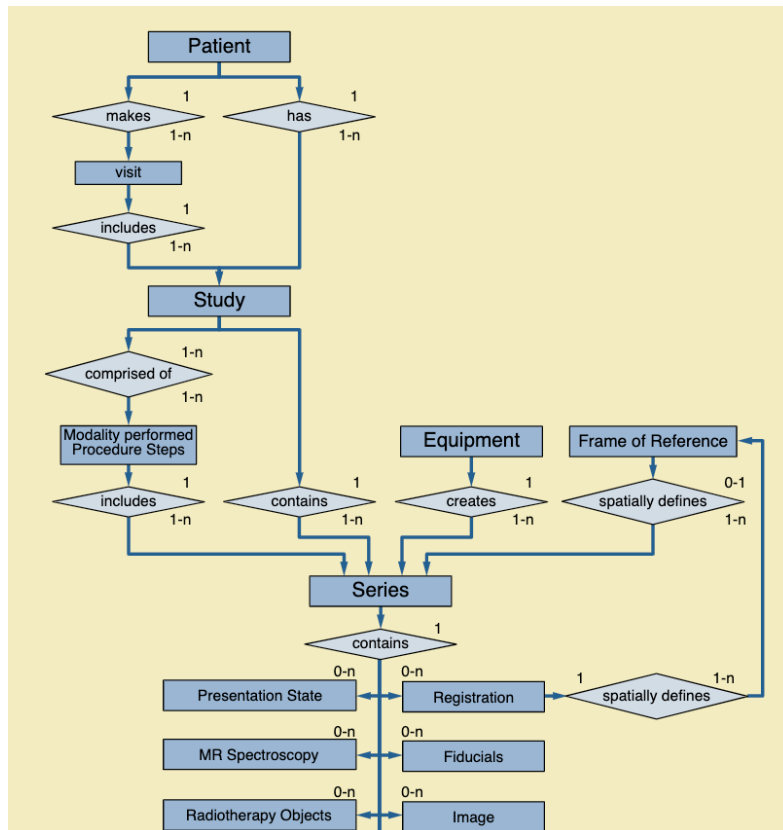
1. Data exclude privately funded exams. 2. Data exclude exams outside hospital. 3. Data include only exams outside hospital. 4. Data exclude exams on public patients. Source: OECD Health Statistics 2023.



PubMed results of “Medical Imaging Machine Learning” (as of March 2024)

# DICOM

- DICOM is a ubiquitous international standard to transmit, store, retrieve, print, process and display medical imaging information.

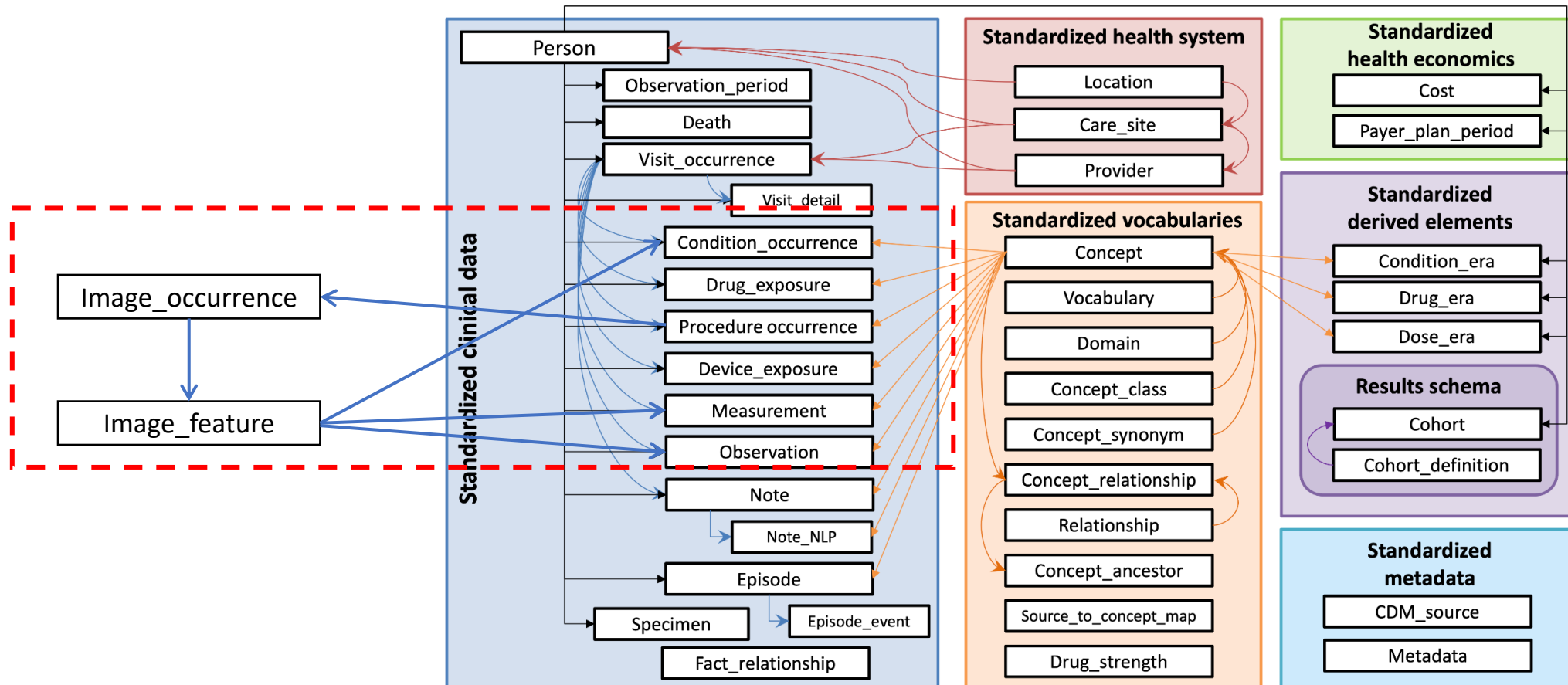


Tag	Name	Value
(0008, 1030)	Study Description	'CT ABDOMEN_W_IV_CONTRAST'
(0008, 103e)	Series Description	'ABD'
(0010, 0010)	Patient's Name	'SIMPSON_HOMER_J'
(0010, 0020)	Patient ID	'5553226'
(0020, 000d)	Study Instance UID	1.2.826.0.1.3680043.2.1125.1.38381854871216336385978062044218957
(0020, 000e)	Series Instance UID	1.2.826.0.1.3680043.2.1125.1.68878959984837726447916707551399667
(0020, 0013)	Instance Number	"20"
(7fe0, 0010)	Pixel Data	Array of 524288 elements

# Study Aims

- Combine imaging data with clinical data in a standardized model
- Enable detailed phenotype definition with imaging features
- Expand OMOP CDM usage for imaging research

# OMOP CDM Medical Imaging Extension (MI-CDM)



# MI-CDM tables (a case study)



Person

Visit Occurrence

Procedure Occurrence

Image Occurrence

Image Feature

Measurement

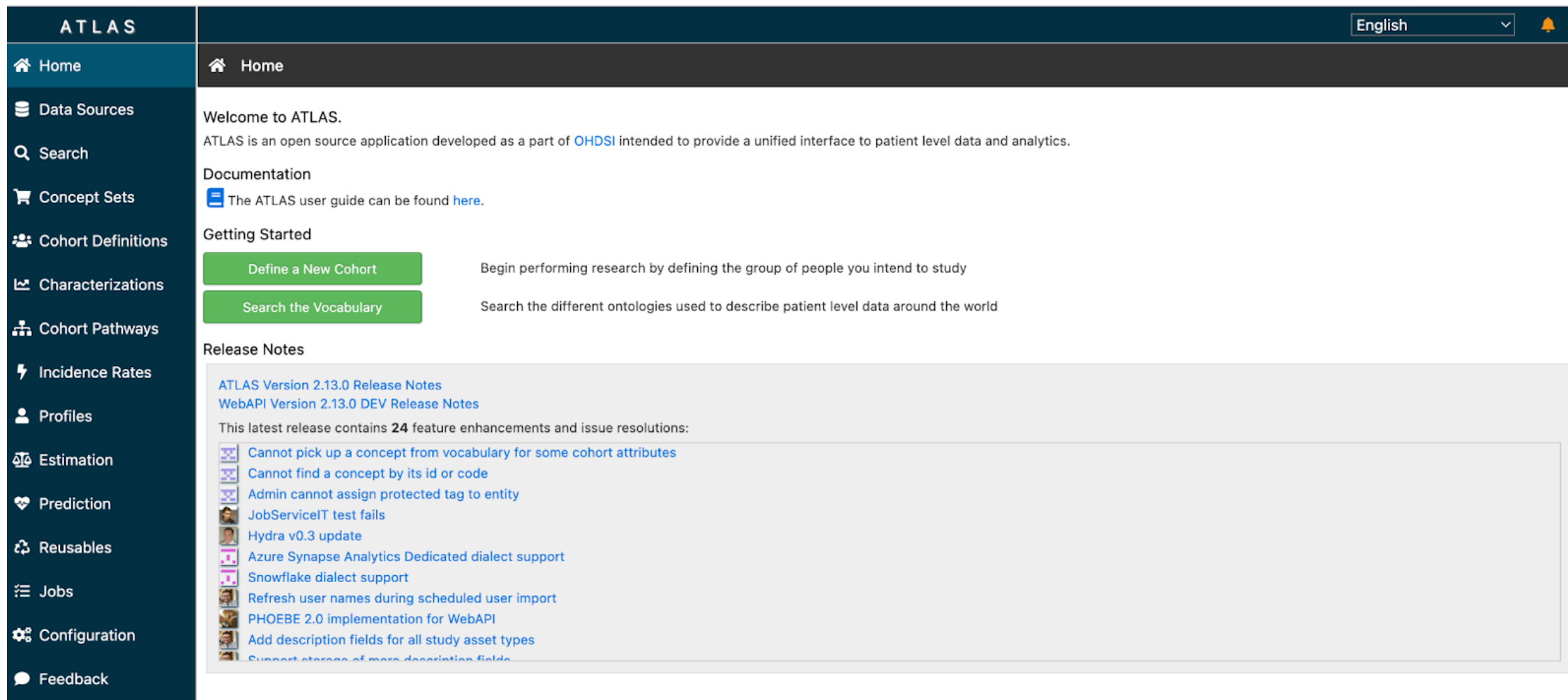
Image's **DICOM attributes:**

modality, acquired dates, study UID, series UID, local path, DICOMweb URI, gross anatomic site


Image's **acquisition parameters and imaging findings:**



slice thickness, kVp, a solid nodule, specific anatomical site, algorithm information

# Seamless Integration with OHDSI Tools




The screenshot displays the ATLAS web application interface. The top navigation bar includes the 'ATLAS' logo on the left, a language dropdown menu set to 'English', and a notification bell icon on the right. A dark sidebar on the left contains a list of navigation items: Home, Data Sources, Search, Concept Sets, Cohort Definitions, Characterizations, Cohort Pathways, Incidence Rates, Profiles, Estimation, Prediction, Reusables, Jobs, Configuration, and Feedback. The main content area features a 'Welcome to ATLAS' message, a brief description of the application, and links to documentation and getting started guides. Two prominent green buttons are visible: 'Define a New Cohort' and 'Search the Vocabulary'. Below these, a 'Release Notes' section highlights the latest update, listing 24 feature enhancements and issue resolutions.

**ATLAS** English 

 Home  Home

Welcome to ATLAS.  
ATLAS is an open source application developed as a part of [OHDSI](#) intended to provide a unified interface to patient level data and analytics.

**Documentation**  
 The ATLAS user guide can be found [here](#).

**Getting Started**












[Define a New Cohort](#) Begin performing research by defining the group of people you intend to study

[Search the Vocabulary](#) Search the different ontologies used to describe patient level data around the world

**Release Notes**

[ATLAS Version 2.13.0 Release Notes](#)  
[WebAPI Version 2.13.0 DEV Release Notes](#)

This latest release contains **24** feature enhancements and issue resolutions:

-  [Cannot pick up a concept from vocabulary for some cohort attributes](#)
-  [Cannot find a concept by its id or code](#)
-  [Admin cannot assign protected tag to entity](#)
-  [JobServiceIT test fails](#)
-  [Hydra v0.3 update](#)
-  [Azure Synapse Analytics Dedicated dialect support](#)
-  [Snowflake dialect support](#)
-  [Refresh user names during scheduled user import](#)
-  [PHOEBE 2.0 implementation for WebAPI](#)
-  [Add description fields for all study asset types](#)
-  [Support storage of more description fields](#)



# Summary & Next steps

- OMOP CDM Medical Imaging extension creates a standardized multimodal dataset with clinical and imaging data to conduct outcome research.

## Next steps

- Vocabulary integration of DICOM and RadLex (Radiology Lexicon) terminology to OMOP CDM vocabulary

### 6 Registry of DICOM Data Elements

Note  
 For data elements that were present in ACR-NEMA 1.0 and 2.0 and that have been retired, the specifications of Value Representation and Value Multiplicity provided are recommendations for the purpose of interpreting their values in objects created in accordance with earlier editions of this Standard. These recommendations are suggested as most appropriate for a particular data element; however, there is no guarantee that historical objects will not violate some requirements or specified VR and/or VM.

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM	RET
(0008,0001)	Length to End	LengthToEnd	UL	1	RET
(0008,0005)	Specific Character Set	SpecificCharacterSet	CS	1-n	
(0008,0006)	Language Code Sequence	LanguageCodeSequence	SG	1	
(0008,0008)	Image Type	ImageType	CS	2-n	
(0008,0010)	Recognition Code	RecognitionCode	SH	1	RET
(0008,0012)	Instance Creation Date	InstanceCreationDate	DA	1	
(0008,0013)	Instance Creation Time	InstanceCreationTime	TM	1	
(0008,0014)	Instance Creator UID	InstanceCreatorUID	UI	1	
(0008,0015)	Instance Coercion Date/Time	InstanceCoercionDate/Time	DT	1	

+

### B DCMR Context Groups (Normative)

B.1 Context Groups  
 This Annex specifies the content of Context Groups required by DICOM IODs.  
 Note  
 Section 7.1 of this Part defines the fields of Context Group tables.

#### CID 2 Anatomic Modifier

Resources:  
 Keyword: AnatomicalModifier  
 FHIR Keyword: dicom-cid-2-AnatomicModifier  
 Type: Extensible  
 Version: 20190118  
 UID: 1.2.840.10008.6.1.1

Table CID 2. Anatomic Modifier

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
SCT	24028007	Right	G-A100	C0205090
SCT	7771000	Left	G-A101	C0205091
SCT	51440002	Bilateral	G-A102	C0238767



concept_id	concept_name	domain_id	vocabulary_id	concept_class_id	standard_concept	concept_code	valid_start_date	valid_end_date	invalid_reason
2128000010	Length to End	Measurement	DICOM	DICOM Attributes	NaN	(0008,0001)	19930101	20991231	NaN
2128000011	Specific Character Set	Measurement	DICOM	DICOM Attributes	NaN	(0008,0005)	19930101	20991231	NaN
2128000012	Image Type	Measurement	DICOM	DICOM Attributes	NaN	(0008,0008)	19930101	20991231	NaN
2128000013	Instance Creation Date	Measurement	DICOM	DICOM Attributes	NaN	(0008,0012)	19930101	20991231	NaN
2128000014	Instance Creation Time	Measurement	DICOM	DICOM Attributes	NaN	(0008,0013)	19930101	20991231	NaN
...	...	...	...	...	...	...	...	...	...
2128011218	Plane through Posterior Extent	Measurement	DICOM	DICOM Value Sets	NaN	128129	19930101	20991231	NaN
2128011219	Plane through Anterior Extent	Measurement	DICOM	DICOM Value Sets	NaN	128128	19930101	20991231	NaN
2128011220	Plane through Center	Measurement	DICOM	DICOM Value Sets	NaN	128130	19930101	20991231	NaN
2128011221	Plane through Inferior Extent	Measurement	DICOM	DICOM Value Sets	NaN	128121	19930101	20991231	NaN
2128011222	Plane through Superior Extent	Measurement	DICOM	DICOM Value Sets	NaN	128120	19930101	20991231	NaN

- Reference implementation