

Evaluating the transformation of UK national linked electronic health records to the OMOP CDM

Vaclav Papez, PhD^{1*}
Maxim Moinat, MSc^{2**}

*v.papez@ucl.ac.uk,**maxim@thehyve.nl

BACKGROUND: CALIBER research platform links electronic health records (EHR) Clinical Practice Research Datalink (CPRD) primary care data, Hospital Episode Statistics (HES) hospital data and Office for National Statistics (ONS) mortality and socioeconomic data. Disease phenotypes, also implemented in CALIBER, are clinically agreed and validated diagnostic/procedure/drug codes using specific terminologies (Table 1) to describe diseases in EHRs. Observational Medical Outcomes Partnership Common Data Model (OMOP CDM) serves as a main harmonization platform between diverse data source involved in BigData@Heart project including CALIBER. This study evaluates syntactic as well as semantic transformation of all CALIBER data sources into OMOP CDM.

METHODS: We designed an Extract Transform Load (ETL) process based on existing validated mappings consisted of syntactic mapping where data from 20 source tables were mapped onto 14 clinical data tables of CDM version 5.2 and semantic mapping translating source codes into vocabularies supported by OMOP CMD. Cohort of 502,723 patients identified with incident of heart failure (Table 3) was used in ETL process. Testing strategy consists of direct querying into CALIBER and OMOP CDM databases and comparing retrieved numbers (Figure 1 and Table 2,3).

RESULTS: We converted 1,099,195,384 rows of data in total. 356 patients were lost due to the validity of an observation period window (Table 3, Figure 2). All identified data losses were caused by quality of source data or by incomplete mapping. Evaluation of data consistency for disease phenotypes application is in progress.

A successful structural and syntactical mapping to the OMOP CDM, including validation of the mapping coverage

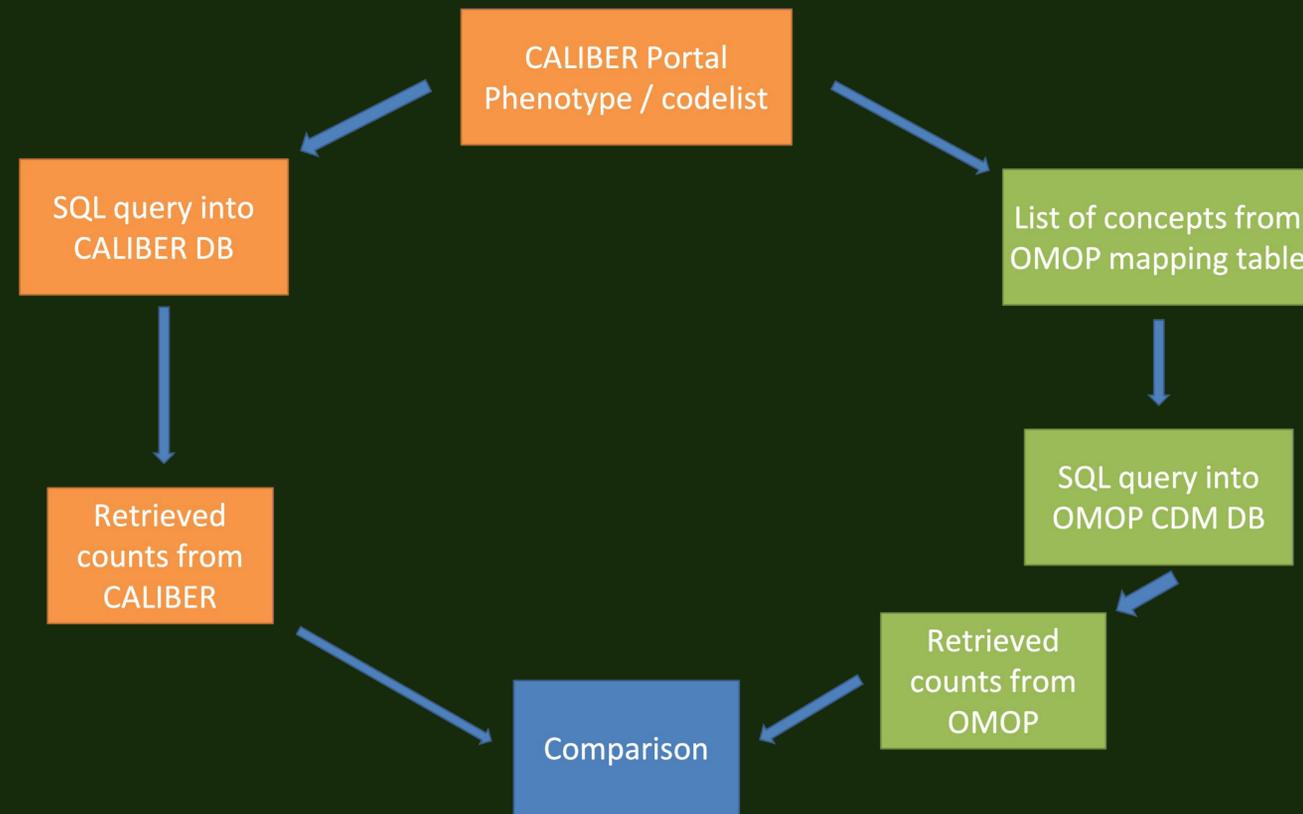
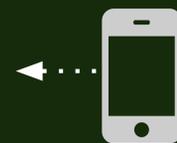


Figure 1. Testing strategy for validating CALIBER transformation to the OMOP CDM. The counts for the same subpopulation were queried against both data formats and the results compared.



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Table 1. Mapping of source (CALIBER) to target (OMOP CDM) vocabularies.

Source vocabulary	Intermediate mapping	Target vocabulary
Read / ICD-10 / ICD-9 / OPCS-4	native	SNOMED-CT
CPRD Product	gemscript, DM+D	RxNorm
CPRD Entity Type	JNJ_CPRD_ET_LOINC	LOIN
CPRD Units	native	UCUM

Table 2. Mapping coverage for disease and drug clinical terminologies used (ET - Entity Type)

Terminology	Used unique terms	Used mapped terms (%)	Total unique events	Total excluded events (%)	Total mapped events (%)
Read	67 886	97.58	320328788	0.22	97.42
ICD-9	495	100	13130	0.92	100
ICD-10	10158	88.53	31905144	0.01	99.09
OPCS-4	8474	99.45	8453813	0	99.88
Drugs	40647	62.53	264589509	1	92.67
Units	22	72.72	27036	1.55	99.95
ET - Lab. results	245	54.28	125581411	0.59	54.06
ET - Test	324	97.22	151645201	12.24	98.16

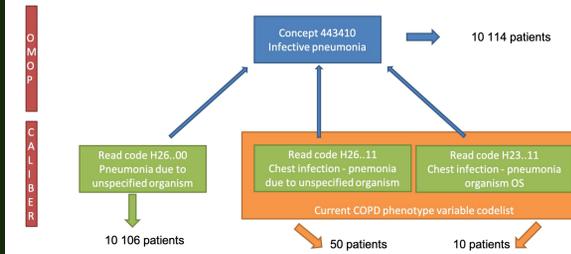


Figure 2. Example of data loss. Multiple source codes are mapped into one concept, however not all of these codes are part of the examined codelist. Thus patient counts based on the codelists retrieved from raw CALIBER does not match counts based on mapped concepts retrieved from OMOP CDM.

Table 3. Comparison of main metrics (subpopulations of used heart failure cohort serves as validation metrics) of the raw data and data transformed to the OMOP CDM. 356 persons are lost in the transformation due to an invalid observation period. The other metrics are comparable.

Metric	CALIBER (raw)	CALIBER (OMOP CDM)
Number of persons	502,723	502,367
Median follow up (IQR)	9.56 (10.39)	9.56 (10.39)
Demographics		
Female (%)	52.39	52.4
Caucasian (%)	90.81	90.46
Most deprived fifth (%) ²	15.18	15.18

Vaclav Papez, PhD^{1*}
Maxim Moinat, MSc^{2**}
Stefan Payrable, MSc²
Richard Dobson, Prof¹
Folkert Asselbergs, Prof¹
Spiros Denaxas, Prof¹

