

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

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**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

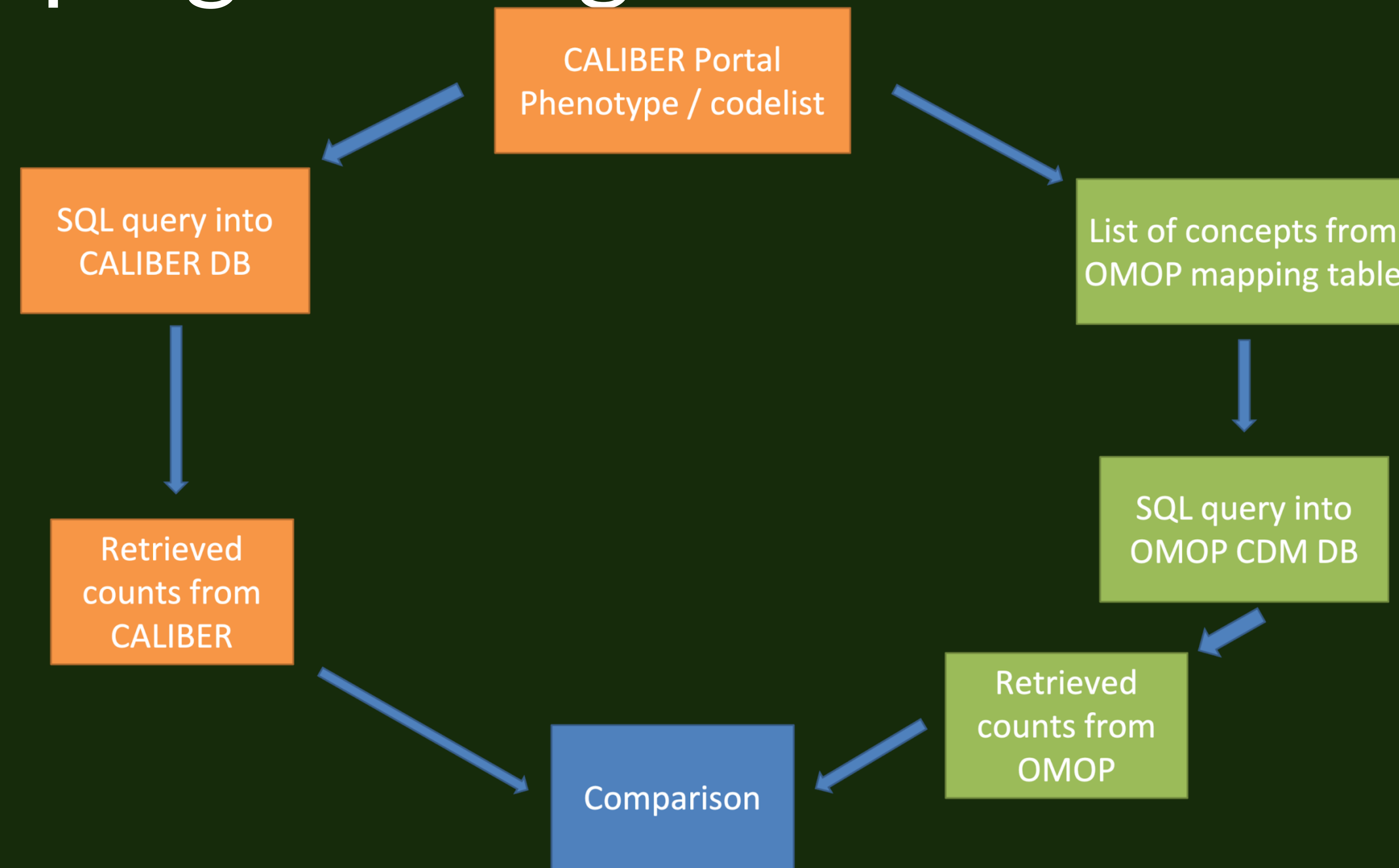
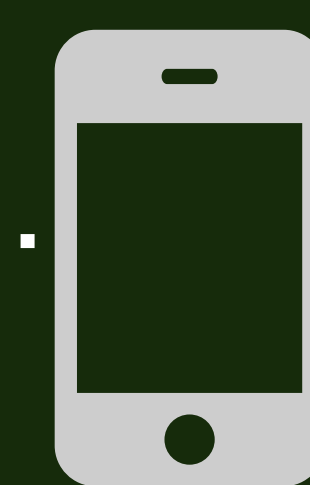


Figure 1. Testing strategy for validating CALIBER transformation to the OMOP CDM. The counts for the same subpopulation were queried against both data formats and the results compared.



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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    | LOINC             |
| 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                   |

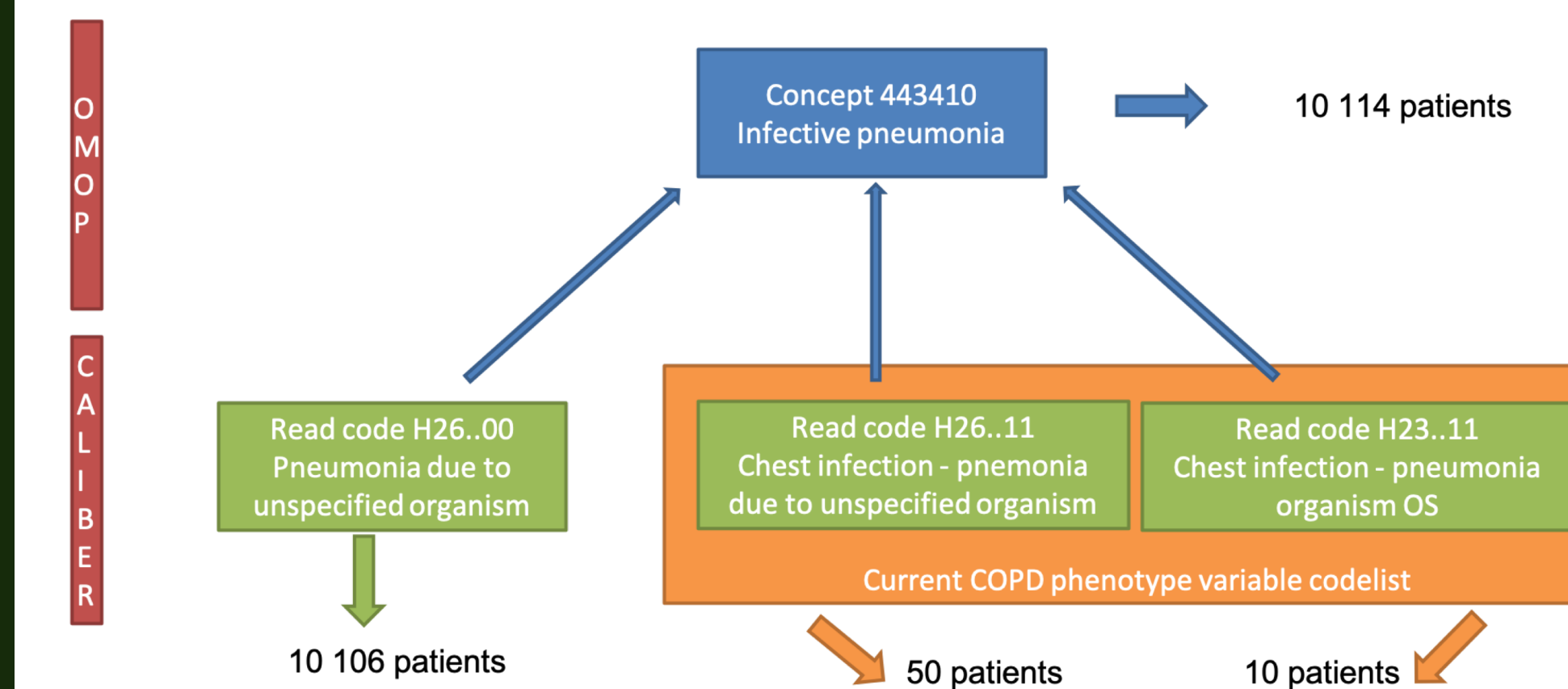


Figure 2. Example of data loss. Multiple source codes are mapped into one concept, however not all of these codes are part of the examined codelist. Thus patient counts based on the codelists retrieved from raw CALIBER does not match counts based on mapped concepts retrieved from OMOP CDM.

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)       |
| <b>Demographics</b>                  |               |                    |
| Female (%)                           | 52.39         | 52.4               |
| Caucasian (%)                        | 90.81         | 90.46              |
| Most deprived fifth (%) <sup>2</sup> | 15.18         | 15.18              |

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