Accelerating FHIR to OMOP conversions on IQVIA Health Data Transformation Platform

Filip Rzyszkiewicz, Jonathon Cook
IQVIA

Background

FHIR has increasingly become the adopted interoperability standard in healthcare, with global use predicted to continue growing [1.] Developed as a means to increase the ease and rate for health data exchange, it significantly reduces frictions in data sharing between organizations and patients. While the FHIR standard was optimized for interchange, other standards, such as OMOP are optimized for analytics. For this reason, FHIR to OMOP conversions are an important requirement to enable both interoperability and consistency in data analysis. For this reason, FHIR to OMOP conversion is a core component of IQVIA's Health Data Transformation Platform. The coexistence and synergies between these two technologies, OMOP and FHIR, are realized through the FHIR to OMOP conversions enabled within the IQVIA Health Data Transformation Platform.

In healthcare data transformation, the benefits of different approaches, when combined appropriately, often outweigh the sum of their parts. This is the principle behind our work in this space. Enabling FHIR and OMOP interoperability benefits organizations as follows:

- Enable research grade analytics from OHDSI on top of easily exchanged healthcare data
- Reduce implementation costs and increase Extract, Transform and Load (ETL) speed and quality with FHIR server to OMOP database connections [2].
- Deliver open research implementations using the OMOP CDM and OHDSI toolset while still supporting FHIR conformance across the organization.

Methods

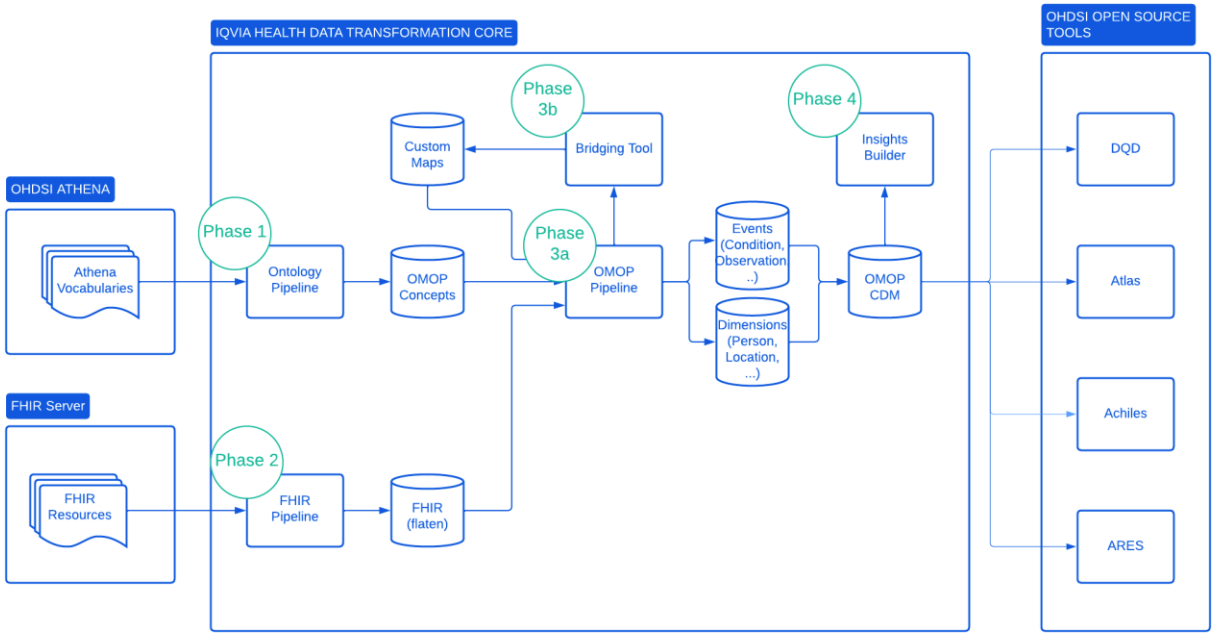
To achieve our goal of transforming patient data within FHIR resources to the OMOP CDM, we used modular components of the IQVIA Health Data Transformation Platform (HDTP). The IQVIA HDTP is an integrated ecosystem of applications developed to accelerate the transformation of disparate patient health data into an analytical ready state, with OMOP being a target data model choice for users. The components from the platform used in this project were the following:

- Health Data Transformation Core (HDTC) – Component to create and monitor pipelines using pre-

defined accelerator and transformation/quality libraries. Accelerators are predefined template scripts for performing transformations, flattening FHIR resources and converting data into OMOP CDM.

- Bridging Tool – Allows users to map incoming structured source data to references such as OMOP Standard Concepts. Makes use of historically mapped records (2m+ OMOP and 118M non-OMOP distinct variables) to apply automated mapping on future deliveries at scale.
- Insights Builder – Business Intelligence tool for row level exploration and analysis of health care data.

Figure 1. Platform high level architecture



To demonstrate the capabilities of HDTP to convert FHIR to OMOP, a dataset containing 30GB of FHIR synthetic data using US CORE R4 profile was generated and converted to OMOP.

To process this data four data products were created on the platform:

- OMOP Vocabularies – Data Product for loading OMOP Concepts from Athena
- FHIR Synthetic – Data Product responsible for flattening FHIR resources into SQL tables.
- OMOP Synthetic Custom Maps – Data Product containing all non-standard mappings.
- OMOP Synthetic – Final Data product containing data converted to OMOP CDM

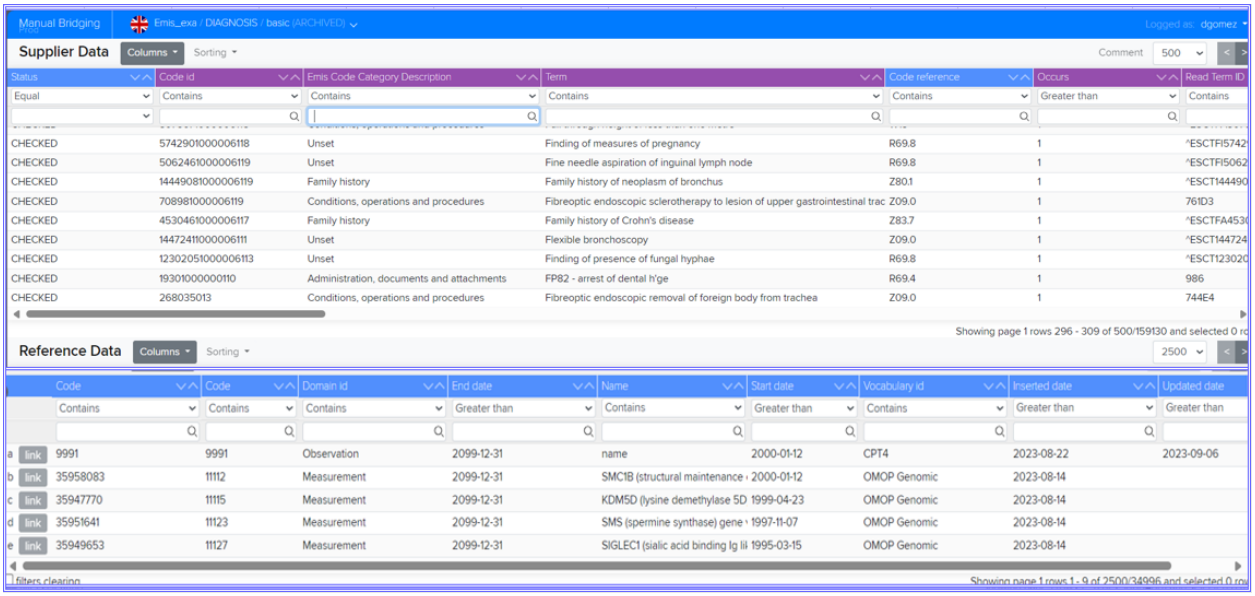
The process we followed:

- Phase 1 – ATHENA references loaded into a Snowflake database
- Phase 2 – FHIR resources loaded into staging database then flattened using SQL scripts
- Phase 3a – From the flattened file, IQVIA OMOP accelerators were applied in a configuration driven approach. All the facts were standardized into a single Event table, from which pre-existing logic was applied to distribute them to the relevant OMOP target tables.
- Phase 3b - In parallel unmapped concepts are processed via Bridging Tool and mapped to the OMOP standard concepts.

- Phase 4 – Applied IQVIA custom quality checks via Insights Builder to confirm the transformation had processed as intended and to review the quality of the transformed data.

Data standardization is one of the most critical parts of OMOP conversions. Integrated with the platform and used for mapping source concepts to OMOP standard concepts, the Bridging Tool supports algorithmic coding and flexible manual searching capabilities for transactions not mapped algorithmically.

Figure 2. Manual Bridging Tool screenshot



Results

IQVIA's Health Data Transformation Platform successfully converted the synthetic FHIR data to OMOP. The results of the conversions were validated in IQVIA Quality Dashboards and OMOP Data Quality Dashboard.

FHIR resources from FHIR US Core profile mapped to OMOP CDM included:

- Patient
- Medication Request
- Medication Administration
- Procedure
- Immunization
- Allergy Intolerance
- Organization
- Practitioner
- Observation
- Location
- Encounter
- Patient

- Condition
- Diagnostic Report
- Medication

Additionally, OMOP open-source tools like Achilles, ARES and ATLAS have been connected to the converted data.

Figure 3. Insights Builder OMOP Quality Dashboard

Conclusion

FHIR to OMOP, and therefore activating analysis on source data in the FHIR format, can be accelerated and made possible for non-technical users by deploying templated scripts developed by IQVIA which minimize the need to redevelop code for each transformation. These scripts can be accessed via a UI and provisioned to users with tooling available in the platform.

By standardizing source data into an Event table, we maximize the reusability of code and automation of the process for mapping facts to OMOP standard concepts, rather than creating complex mappings directly from source tables where logic is repeated and complex.

We can limit the requirement on the end-user to have health care domain expertise with the use of algorithmic mappings from the Bridging Tool. Where codes are missing in the source data, these can be applied or suggested automatically by referencing previous conversions and stored logic.

Health Data Transformation Platform can be complementary to the OHDSI toolset and integrated with open-source tools. The complexity and technical barriers to FHIR to OMOP conversions are therefore lowered, with a corresponding reduction in cost, increase in development speed and quality of transformation.

References

1. “FHIR to OMOP FHIR IG” https://build.fhir.org/ig/HL7/fhir-omop-ig/ (accessed Jun. 18, 2024).
2. “2023 State of FHIR Survey Results” https://www.hl7.org/documentcenter/public/white-papers/23-HL7-010%20State%20of%20FHIR%20Survey%20Results%20_c3.pdf (accessed Jun. 18, 2024).