The Feasibility of Clinical Quality Language (CQL) Based Digital Quality Measures (dQMs) Implementation to OMOP CDM (Work in Progress)

Emir Amaro Syailendra[1], Woo Yeon Park[1], Ben Hamlin[2], Paul Nagy[1]
[1]Johns Hopkins University, School of Medicine, Baltimore, MD, USA,
[2]National Committee for Quality Assurance, Washington, DC, USA

Background

Advancements in healthcare digital standards and EHR automation have enabled quality measures evolution. Digital Quality Measures (dQMs) are digitized measures created to improve quality assessment at the point of care. These measures aim to support the formulation of effective care plans and enable informed care management decisions.[1,2] However, the migration to digital quality measurement still presents several challenges.

The dQMs need standardized data that can be directly queried to assess clinical performance and represent the warehoused knowledge. The future state of digital quality would be dependent upon effective computable and interoperable measures specifications. It would promote the use of existing measures while simultaneously improving the quality and useability. Today, health systems manually curate quality measures from proprietary EHR systems, which takes considerable effort from multiple stakeholders (e.g., clinicians, data analysts).[3]

Clinical Quality Language (CQL) is an HL7 FHIR standard for clinical querying and used for defining dQMs.[4] However, FHIR is not set as a standard for analytical purposes. Moreover, the CQL-based DQMs are specific to US core implementation guide which hinders interoperability. Given the interoperability of using Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM), applying dQMs is one of the possibilities for utilizing the OHDSI vast network.[5] Circe, is a widely used JSON standard for defining patient cohorts based on the OMOP CDM which can be utilized as a template to translate the FHIR-CQL to OMOP CDM standard[5,6] Thus, we believe the implementation of CQL-based dQMs on OMOP data is feasible and could improve the accuracy and relevancy of the measures while lowering the burden on quality reporting.

This study aims to assess the feasibility of dQMs implementation from OMOP data by exploring the steps and challenges in converting CQL-based dQMs into OMOP CDM compatible representations.

Methods

The feasibility assessment consists of two main parts. First, the availability of the required data for the dQMs in OMOP CDM. Second, the performance of the dQMs in real-world data, where the OHDSI network provides tremendous value. Two measures (ADD-E, and PND-E) were chosen to demonstrate the feasibility of applying dQMs to OMOP CDM. The measures were chosen as they have different aspects of assessment within the measures (e.g., adult vs pediatric population, screening vs follow up visit) thus help demonstrate the data availability and the behavior of FHIR-CQL definitions in OMOP data. The FHIR-CQL specifications for the two measures were obtained from National Clinical Quality Assurance (NCQA) HEDIS measures.[7]

The CQL specifications provide a high-level definition of the code sets and logic of quality measures. There is no standard method for converting the CQL into OMOP CDM format. Thus, we generated the quality measures value sets and cohort definitions by using ATLAS platform. The value sets were represented as concept sets within ATLAS. The cohort definitions for the numerator and denominator were generated for each measure which derived from the NCQA measures specifications. We created the cohort definitions using the concept sets created from the previous step.

We executed the cohort definitions to Johns Hopkins Hospital (JHH) de-identified OMOP CDM instance. The results obtained from applying the dQMs cohort definitions to JHH OMOP CDM instance were the patient count and the attrition from each inclusion criteria of the measures.

Results

Translating the DQMs to OMOP-based cohort definitions took five steps, which include creating and obtaining the DQMs, mapping the CQL value sets to standardized codes, creating the OMOP concept sets, defining cohort definitions, and executing also evaluating the cohort definitions to OMOP CDM database.

Here is an example of the CQL code,

define "Delivery with Gestational Age Assessment or Diagnosis during Measurement Period": (Perinatal."Delivery with Gestational Age Assessment or Diagnosis during Period" ("Measurement Period")) DeliveryInfo where Enrollment."Meets Health Plan Enrollment Criteria" ("Member Coverage", null, Interval[DeliveryInfo.deliveryDate - 28 days, DeliveryInfo.deliveryDate], 0)

```
Acquire NCQA-HEDIS   Map CQL Value      Create concept      Build dQM       Execute the
measures             Sets to standard   sets based on       OMOP cohort     dQM cohort
                     vocabularies       the measures        definitions     definitions
                                        value sets
```

Done within ATLAS
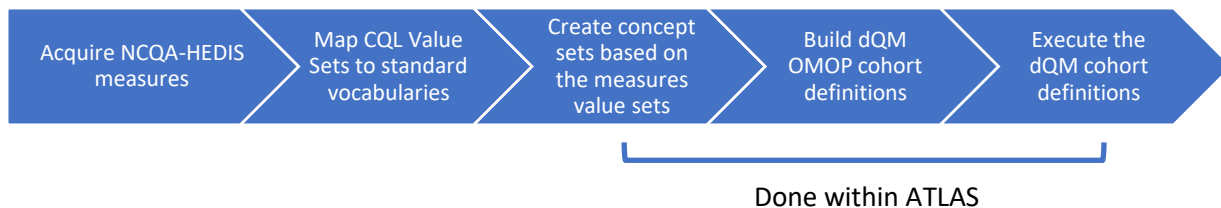
We manually mapped the Value Sets using standard vocabularies (e.g., SNOMED, ICD-10). Then, the Value Sets were converted into OMOP Concept Sets by inputting source codes to ATLAS. Each Concept Set represents a single idea, such as deliveries after 37 gestation weeks. Certain inclusion or exclusion criteria, such as 28 days prior to the delivery date, were input directly into the OMOP Cohort Definition in the next step. The denominator and numerator of a metric is independently defined as a cohort in the ATLAS. Each Cohort Definition may be composed of multiple concept sets created in the last step. We executed the Cohort Definitions to retrieve the patient count and the attrition evaluation.

Figure 1. Example of a concept set derived from value sets within the dQM

Figure 2. Example of a cohort definition for the dQM

Measures	Definition	Patient Count
Prenatal Depression Screening & Follow-up (PNE-D) Denominator 1	Deliveries during the measurement period where deliveries occurred at more than 37 weeks gestation, and not in hospice.	38,305
Prenatal Depression Screening & Follow-up (PNE-D) Numerator 1	Deliveries in which members had a documented result for depression screening, using an age-appropriate standardized screening instrument, performed during pregnancy.	16,455

Follow-Up Care for Children Prescribed ADHD Medication (ADD-E) Denominator 1	Children 6 years of age as of the start of the intake period to 12 years of age, having dispensed ADHD medication and had a negative medication history.	3593
Follow-Up Care for Children Prescribed ADHD Medication (ADD-E) Numerator 1	An outpatient, intensive outpatient, partial hospitalization, observation, health and behavior assessment or intervention, community mental health center, telehealth or telephone follow-up visit with a practitioner with prescribing authority during the initiation phase.	108

Table 1. Summary of patient count

One of the cohort definitions (PND-E Numerator 2) required the sum of depression survey PHQ-9 to be greater than 10. However, the survey data was formatted in question level, and the total score was not calculated on Atlas. This limitation prevented me from completing this metric. The date range was another obstacle as dQM often anchors measurement period end on the December 31st of the measurement year, but the Atlas inclusion criteria uses relative date range. This led the cohort definition to not exactly matching the dQM inclusion criteria.

Conclusion

We demonstrated the workflow of translating CQL-based dQM to OMOP CDM compatible format as concept sets and cohort definitions. The measures computed using the cohort definitions show the feasibility of calculating the dQM using OMOP CDM. However, currently we do not have a standard method for transforming the dQM to OMOP CDM. Moreover, access to the NCQA digital quality measures requires a paid license and caters to US based healthcare quality. Thus, applicability of the metrics should be evaluated for non-US implementation use cases.

Future studies need to be done to compare the metric results from OMOP CDM to the CQL results based on the institutional database. Additional optimizations methods should also be explored, such as more advanced mapping techniques and the potential for automated cohort definition transformation across other healthcare data models.

In conclusion, transforming CQL-based dQMs into OMOP CDM compatible representations is feasible, but not without any challenges and adjustments. Therefore, there is a significant need to develop a standardized method to enable an efficient and effective process in the future.

Reference

1. Centers for Medicare and Medicaid Services. eCQM 101 - Getting Started with Electronic Clinical Quality Measures for Quality Reporting Programs - Introduction. February 2022. Available from: https://ecqi.healthit.gov/sites/default/files/eCQM-101-Introduction-2022-508.pdf. [Accessed: June 11, 2023].
2. Raths D. NCQA's Eric Schneider, MD, Weighs in on CMS' Universal Foundation. Healthcare Innovation [Internet]. [cited 2023 Jun 13]. Available from: https://www.hcinnovationgroup.com/policy-value-based-care/value-based-care-quality-

measurement/article/53056140/ncqas-eric-schneider-md-weighs-in-on-cms-universal-foundation

3. Schreiber M, Krauss D, Blake B, Boone E, Almonte R. Balancing value and burden: the Centers for Medicare & Medicaid Services electronic Clinical Quality Measure (eCQM) Strategy Project. J Am Med Inform Assoc. 2021;28(11):2475-2482. doi:10.1093/jamia/ocab013.

4. CQL (Clinical Quality Language) - Electronic Clinical Quality Improvement (eCQI) Resource Center. Available from: https://ecqi.healthit.gov/cql?qt-tabs_cql=0. [Accessed: June 11, 2023].

5. OHDSI/circe-be. Available from: https://github.com/OHDSI/circe-be. [Accessed: June 11, 2023].

6. CIRCE - Observational Health Data Sciences and Informatics (OHDSI). Available from: https://www.ohdsi.org/web/wiki/doku.php?id=documentation:software:circe. [Accessed: June 11, 2023].

7. HEDIS Measures. Available from: https://www.ncqa.org/hedis/measures/. [Accessed: June 11, 2023].