Overview of Technical Specifications for electronic Clinical Quality Measures (eCQMs)

Like other quality measures, electronic clinical quality measures (eCQMs) are tools that help improve healthcare quality by measuring healthcare processes or outcomes. The Centers for Medicare & Medicaid Services (CMS) use them in quality reporting and value-based purchasing programs, and healthcare organizations can use them to identify opportunities to improve the quality of the care they provide to patients.

Unlike other measures, eCQMs are designed to pull data from the EHR electronically—that is, without the need for a human abstractor. To that end, an eCQM's technical specifications must be drafted in a format that can be processed by computers. To do this, eCQM developers must rely on a series of standards to define the measure data elements and the relationships between those data elements to generate a measure score.

Using Value Sets to Define eCQM Data Elements

Like all measures, eCQMs are generally made up of four main parts: initial population, denominator, numerator, and exclusions/exceptions. Each of these components is discussed in detail in the July Newsletter article ("Technical Specifications"). In eCQMs, each of these parts is made up of data elements ideally found in the electronic health record (EHR) (see Figure 1).

Measure component	Description	Example data elements
Initial Population	Single newborns with a gestational age at birth of 37 weeks or more, who are born in the hospital and who did not have a diagnosis of galactosemia, were not subject to parenteral nutrition, and had a length of stay less than or equal to 120 days that ends during the measurement period	• Estimated gestational age • Encounter, inpatient • Length of stay (in days) • Diagnosis: single live birth • Diagnosis: galactosemia • Procedure, performed: parenteral nutrition
Denominator	Same as initial population	• Same as initial population
Numerator	Newborns who were fed breast milk only since birth	• Substance administered: Breast milk • Substance, Administered: Dietary intake other than breast milk
Exclusions	Newborns who were admitted to the Neonatal Intensive Care Unit (NICU), who were transferred to an acute care facility, or who died during the hospitalization	• Discharge disposition • NICU encounter

Figure 1: Measure Components and Data Elements for 'PC-05: Exclusive Breastfeeding eCQM

Data elements are defined using lists of or individual standardized codes called value sets or direct referenced codes (DRCs). Value sets and DRCs are compiled by measure developers, who use codes from nationally-recognized terminology standards like SNOMED CT, Logical Observation Identifiers Names and Codes (LOINC), and International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) to define clinical concepts. Value sets are referenced in measure specifications by an object identifier (OID). In addition to the list of acceptable codes defining the data element, each value set includes descriptors of those codes, as well as the code system (and version) from which the codes are derived. For example, the value set defining "diagnosis of galactosemia" lists four unique diagnosis codes related to that condition, and specifies that they are from the both SNOMED CT and ICD-10 coding systems (versions 2018-03 and 2019, respectively).

DRCs are specific codes that are referenced directly in the eCQM logic to describe a data element or one of its attributes. DRCs are typically used when a single code is all that is needed to define a given data element.

Both value sets and DRCs are found in the the Value Set Authority Center (VSAC). The VSAC is a repository that allows measure developers to use or modify existing value sets and DRCs to promote harmonization across eCQMs. A free Unified Medical Language System® (UMLS®) license is needed to access the details of the value sets and DRCs in the VSAC.

Measure logic: QDM and CQL

In addition to providing value sets and DRCs to define measure data elements, eCQM specifications must also specify how those data elements should be used to generate a measure score. The information describing how the data elements are used in the measure is known as the measure logic. Measure logic is expressed in Clinical Quality Language (CQL), which is both human-readable and structured to be processed electronically.

While CQL provides the language to express the measure logic, the Quality Data Model (QDM) defines and standardizes the relationships between data elements. The QDM is composed of:

- **Category** refers to a single clinical concept that is the highest level of definition for a QDM element (including *Medication, Procedure, Condition/Diagnosis/Problem, Communication, Encounter*). The QDM Version 5.3, used to develop the measures for 2019 reporting, contains 21 categories.
- **Datatype** provides context within a category. For example, with a '*Medication*' category, datatypes include active medications (*Medication, Active*) and administered medications (*Medication, Administered*).
- **Attribute** provides specific detail within a datatype. There are two types of attributes, *datatype-specific* attributes and *data flow* attributes.
    - **Datatype-specific attributes** provide detail about a QDM element based on its datatype. For example, dosage, supply, and frequency are examples of attributes specific to *Medication* datatypes. Refills is an attribute that applies to some medication datatypes (*Medication, Dispensed* and *Medication, Ordered)* but not others (*Medication, Administered*). Because these attributes apply only to specific datatypes, they are called datatype-specific attributes.
    - **Data flow attributes** provide specific detail about the location of data represented by a QDM element. For example, *Health Record Field* indicates the location within an electronic record where the data should be found, *Source* indicates the originator of the quality data element (an individual or a device), and a *Recorder*, the individual or device that enters the data element into a health record field.

Measure Authoring Tool (MAT) and Health Quality Measure Format (HQMF)

CMS maintains a Measure Authoring Tool (MAT) to support eCQM specification. The MAT is a web-based tool that allows measure developers to author eCQMs. Using the tool, authors create CQL expressions based on the QDM. The tool enables developers to express complex measure logic and export measures in several formats without having to know how to create the machine-readable files. This includes a human-readable representation in Hyper Text Markup Language (HTML) of the measure details such as the measure rationale, references, guidance as well as the population and data criteria.

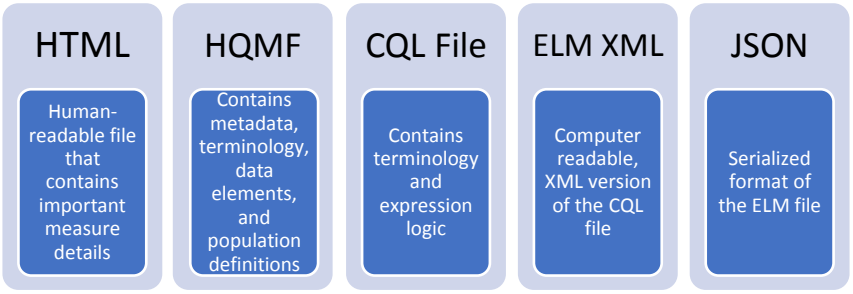

Figure 2: File Formats Exported from the MAT

The MAT also provides a machine-readable HQMF extensible markup language (XML) file, a CQL file containing the terminology and expression logic used by the measure, along with an accompanying Expression Logical Model (ELM) XML document and an ELM Javascript Object Notation (JSON) file. Together, these documents enable the automated integration of eCQMs into EHRs (Figure 2).

Conclusion

In terms of what they measure, eCQMs share many similarities with other clinical quality measures; they share the same overall measure components. They are set apart from other measure types because of the requirement that the measure data be extracted electronically from the EHR. Using CQL and the QDM to specify eCQMs—combined with rigorous scientific acceptability testing—ensures that they can be used for performance measurement. As they become more feasible and widely adopted, eCQMs promise to (1) reduce the burden of manual abstraction and reporting for healthcare organizations, and (2) foster the goal of access to real-time data for bedside quality improvement and clinical decision support.