



Pioneers in Quality:

**eQIM Expert to Expert Webinar Series: Technical Implementation of
Clinical Quality Language (CQL)**

July 23, 2019

Q & A Document

QUESTION 1: Who are the experts?

A: Today's moderator is Lisa Anderson, MSN, RN-BC Project Director, eClinical, Department of Quality Measurement, The Joint Commission and our presenter is Bryn Rhodes, SME, ESAC, Inc. (ESAC, Inc. is a Centers for Medicare & Medicaid Services subcontractor)

Question 2: I need to call in using a landline. When there is a number available, please share.

A: The audio for this session is via internet streaming only (Voice Over Internet Protocol – VoIP). To hear this session, you must have a speaker and/or headphones, and the system/broadband capabilities must be met. There is a short (1 min) diagnostic that can help you determine whether you meet the minimum audio/technical requirements. Use this link to complete a system check before you try to join the session: <https://event.webcasts.com/test/>

You must close the window after running the test or you might simultaneously hear both music and the presentation.

Question 3: Can there be HL7 conversion code also?

A: We need additional information to clarify this question. We are not sure what you are asking.

Question 4: Could you tell me where we can take training in CQL? Any physical training or online training?

A: The eCQI Resource Center is a good place to get started in learning CQL. Here's a link to a CQL intro: https://ecqi.healthit.gov/cqi-clinical-quality-language#quicktabs-tabs_cql3. HL7 does offer a CQL class during their working group meetings, and may offer them outside of the work group meetings. For more information, please visit: <http://www.hl7.org/>. We will also suggest offering this type of education.

Question 5: Will a recording of this presentation be available to attendees?

A: The same link you used to register and join this session will permit you to hear the recording in a couple weeks following this session. You will be prompted to enter registration details and then you will be taken to the site with the recording. You can also visit https://www.jointcommission.org/piq_expert_to_expert_series/ for other recordings and eventually for this session's recording.

Question 6: Are there any open source CQL-to-SQL transpilers based on ANSI SQL which can be customized to meet platform specific needs?

A: Yes, there is a link on slide 29 in the presentation slide deck. It is a little bit out of date, but to bring it up to the latest specifications would be a fairly light lift. In SQL representation, there is something that we call Common SQL, which is the lowest common denominator of all known SQL dialects; but can still be used as SQL output. Common SQL is based on a survey of all known dialects and the lowest common denominator of all of those, and is therefore not ANSI SQL. There are extensions for translating to Oracle including Oracle extensions, if they are translating to IBM db2, which are dialect specific extensions that can be used to support different target environments. It was used in initial pilots as part of the Health eDecisions initiative, but the base structure is there and it's functional.

Question 7: How do you interpret patients on observation in the hospital? Are OBS patients be considered as Inpatient Encounter since they are hospital admission? The OBS patients that later become Inpatient at discharge have some issues with timing of documentation. It appears that the value set for Inpatient Encounter includes Emergency Hospital, Hospital Admission and Hospital Admission, elective. Therefore, my interpretation of OBS patient should be part of hospital admission. What do you think?

A: You are correct, in the 2019 reporting year measure specifications, Observation was not accounted for in the logic. However, in the 2020 reporting year specifications, a new function is included, Global.HospitalizationWithObservation, that does account for observation and helps tie the ED, Observation and Inpatient encounters together.

Question 8: On slide 37: Does the "during" keyword act similarly to the "BETWEEN" function in SQL? Does the "includes" works like the "IN" function in SQL? Does CQL have the ability to do "NOT IN" or does it have a "NOT IN" equivalent? (I'm guessing something like a Exclude?)

A: There is not a 'not in' in CQL. Although SQL allows you to put the 'not' modifier in front of several keywords, CQL does not do that. Instead, there is a generic 'not' operator. Any expression that results in a Boolean, allows the use of 'not'. For example, to say 'x not in y', in CQL, you say '*not* (x in y)'.

B: With regards to 'during', it does act like a 'between' if the left side of the 'during' is a date. 'During' can also be used with intervals. For example, 'relevant period during measurement period'; this is an interval operation which says the left interval is entirely included in the right interval. For 'not in' and 'excludes', like for each operation for intervals, there is a complement, so you can say 'during' and you can also say 'includes'. Those are complementary operations where 'relevant

period includes measurement period' would mean the opposite of 'relevant period during measurement period'.

Question 9: We retrieved the QDM Model Info XML from GitHub at https://github.com/cqframework/clinical_quality_language/blob/master/Src/java/qdm/src/main/resources/gov/healthit/qdm/qdm-modelinfo-5.4.xml. We used the QDM Model Info XML to produce SQL files. We have a couple of questions about it: (1) Who is the author? We cannot find it on eCQI site, only guidance. (2) Is there a schema against which it is validated other than W3C standards? For example, we infer a ClassInfo element contains a negationRationale element, it has two ProfileInfo child elements, positive and negative, but cannot point to that rule in an xsd.

A: The schema to validate the modelinfo file is defined as part of the CQL-to-ELM translator tooling here: https://github.com/cqframework/clinical_quality_language/blob/master/Src/cql-lm/schema/model/modelinfo.xsd. It is an informative aspect of the CQL specification, published as part of that spec here: <https://cql.hl7.org/elm.html>

Question 10: Slide 38: when it states, "1 day after day of start of...", does that start at 00:00 or does it count back from a specific time?

A: The logic states the 'end of the procedure relevant period' is between the start of the qualifying encounter period and the start of the qualifying encounter period plus one day. With the 'day of' operator, those comparisons are actually performed at the 'day'. It does not count backward from zero. Because of the 'day of' qualifier, the comparisons ignore the time component.

Question 11: When these CQL statements are interpreted into SQL, do they take performance into consideration? In other words, would they generate a good execution plan?

A: The short answer is yes, CQL statements do consider performance when interpreted into SQL. The long answer is that CQL retrieves are specifically designed to correspond to the most likely indexes in a relational representation of that content. SQL, that is output, has restriction criteria based on the indexed access path to that data, and the SQL compiler in your target environment will take advantage of those access paths as part of its query optimization.

Question 12: Will the measures continue to be tied to a specific version for the future?

A: We are continuing to improve the specifications and incorporate feedback from implementation. Until the standards and implementation guides being used are normative, it's likely that the specifications will continue to use the most current version.

Question 13: What is the significance of Value sets file for each measure? I see value sets file is a must while executing measure using QDM based execution engine where as FHIR based execution engine does not need value sets file for each measure. So, want to understand the significance of value sets file.

A: This question may be related to the JavaScript engine, as the eCQM measure packages do not contain 'value set' files. For JavaScript related questions or issues, please submit your question to the CQL-execution GitHub: <https://github.com/cqframework/cql-execution>.

Question 14: The 1.3.10 release of the CQL-to-ELM translator has an issue that results in incorrect translation errors when attempting to use any of the ConvertsTo() operators. When is the correction going to be available?

A: There is currently a 1.3.17 release that includes the fix for this issue (it was initially addressed in the 1.3.14 release:

https://github.com/cqframework/clinical_quality_language/releases/tag/v1.3.14. There's also a 1.4.6 release for the STU 4 version of CQL that also includes this fix.

Question 15: Is it recommended to evaluate an eCQM for one client at a time? Seems like that's what the SQL examples showed.

A: Evaluation can be performed either way. Some approaches take a pipelined approach and evaluate each patient individually; others take the SQL and translate it to a population-level query. Filters for all the relationships within the query need to be included when moving from a patient-specific rendering of the SQL to the population-level rendering. For example, if related to medications, linking would be to the patient. It's possible to express the SQL in terms of population, even though it is expressed as patient-specific criteria within the eCQM. If you have a population-level expression on a query planner, a query optimization strategy can take that into account to potentially get significantly better performance by using a population-level approach. However, both approaches are supported.

Question 16: How would you implement First and Last implemented in a neat way in SQL (specifically in Oracle)?

A: To implement First and Last in a neat way in SQL, specifically in Oracle, use `rownum` in Oracle (e.g. `select * from A where rownum = 1`). In Microsoft SQL Server, you'd use a top- `select top 1 *`.

Question 17: For the latest CQL release (STU 3), is there an area to download a PDF of the specifications along with the ELM schema definitions?

A: There is not a single PDF of the CQL specification for the latest CQL release (STU 3). However, the entire specification can be downloaded as a local website. To download a local copy, there is a download page. The link for the entire specification can be found here: <https://cql.hl7.org/full-ig.zip>

Question 18a: A few questions: The model type example in ELM slides showed retrievable=True. Can you give an example of a use case where something cannot be retrievable, and why it would need to be marked as such?

A: Yes, we can give an example of that use case. In the FHIR model, the 'patient' has elements that are of type 'Address'. We need a way to talk about the 'Address' type when there is no 'Address'

table. Addresses are just data types that provide reuse of structure among the definitions, but do not actually correspond to anything stored independently. A non-retrievable data type, a CQL class type, defines that structure in that case.

Question 18b: Can you give an example of a context other than patient, and where it might be used?

A: Yes, we can give an example of another context. For example, to run a measure on the number of beds in a hospital, the context would be something like location or organization, and the criteria would be expressed in terms of the hospital, rather than in terms of any given patient.

Question 18c: For translating CQL to ELM, where are these translators and how do we access them?

A: The CQL to ELM translator is listed on the resources page in the slide deck, and is on the GitHub tools repository located here: https://github.com/cqframework/clinical_quality_language. The CQL-to-ELM translator is also available on Maven if using a Java environment; just include references to those in the project configuration file to get them directly from the Maven Central Repository.

Question 19: Why not simply develop the measures in SQL? This seems overly complex for little value.

A: There was strong consideration to use existing SQL in the initial development of measures. However, SQL does not have the operations needed for some of the most common use cases, such as 'Interval' operations. 'Interval' operations use 'quantity' as a first-class element, 'ratios' as a first-class element, and have the ability to reference terminology. Thus, there is a lot more required for the use of clinically focused elements that SQL just does not support well.

Question 20: I was a bit late to start so I apologize if this was covered, is the CQL version intended to replace the QRDA version for both TJC and CMS?

A: No, CQL is not a replacement for the QRDA because it's not the same kind of specification. Clinical Quality Language (CQL) is a query language specification and QRDA is a document reporting specification. The QRDA format is used to *report* CQL measures.

Question 21: Is OVERLAPS equivalent to DURING?

A: No, 'overlaps' is not equivalent to 'during'. 'Overlap' means, 'Is there any overlap between interval A and interval B'. 'During' means, 'Is the interval entirely contained within interval B?'.

Question 22: We need to process 15+million members for HEDIS CQL measures, has CQL been tested/evaluated for performance at high volumes? Is that an implementation issue?

A: At least one production implementation is currently processing measure results for hospital systems using large volumes of data with a native CQL engine. Exact metrics on performance characteristics of that system are not available. In addition, since CQL is a sharing format, it will generally be translated or interpreted in some way before it is actually executed. Therefore, the performance characteristics of any particular implementation will depend on the specific factors present.

Question 23: Slide 38 - Time phrases with offsets. Where in CQL does it explain what time difference method to use for items provided in examples 3 and 4. There has been a lot of confusion with timing calculation since it seems there may be several ways to calculate time difference each yielding different results.

I have created several JIRA tickets and I have been provided guidance which conflicts with Appendix H of the HL7 CQL specification. According to this example 1 on slide 38 item 3 will be true even if labor.authorDatetime is 24 hours and 59 minutes.

A: The examples in Appendix H that describe 'duration' and 'difference' calculations are different from the timing comparison provided in the referenced example. The Timing Phrases topic in the CQL specification describes how timing phrases are rendered in terms of comparison operations: <https://cql.hl7.org/05-languagesemantics.html#timing-phrases>.

In this example specifically, the criteria is transformed into an interval comparison:
labor.authorDatetime in Interval[start of CSection.relevantPeriod - 24 hours,
start of CSection.relevantPeriod]

Since this operation is done in terms of comparison, the actual evaluation is:
labor.authorDatetime >= start of CSection.relevantPeriod - 24 hours
and
labor.authorDatetime <= start of CSection.relevantPeriod

These comparisons do not specify a precision and occur to the millisecond, so 24 hours and 59 minutes will not result true in this case.

Question 24: In the old HQMF framework, the measure representation could support proportion, interval and statistical measures. What capability is in, or will be in CQL to incorporate statistical functionality?

A: CQL currently defines a full complement of statistical operators the same as generally found in any basic implementation of SQL, such as 'min', 'max', 'sum', 'avg', and even a few less commonly found ones like 'standard deviation' and 'variance. In addition, the CQL specification does support the inclusion of 'external', an operation that can be brought in via an external library. In short, the current CQL-based HQMF specification supports more than the HQMF framework supported with the potential to add additional functionality if needed.

Question 25: Back to slide 38, item 3, is the "24 hours" or "1 hour" relative to midnight of "CSection.relevantPeriod" or "Encounter.relevantPeriod" respectively?

A: No, because the comparison is not specified to occur at a particular precision. The offset is relative to the right side of the timing phrase. For example, 'A 24 hours or less on or before B', is evaluated as, 'A in Interval[B - 24 hours, B]'.

Question 26: From where can I clear up my doubts regarding various conditions and sub conditions while reading eCQM measures?

A: You can find information about eCQMs and CQL on the eCQI Resource Center here: <https://ecqi.healthit.gov/>.

Question 27: This is in extension to valuesets question. We used cqm-execution github project to execute QDM based measures. The driver program used by execution engine refers to measure/json/valuesets json file to execute a CMS/HEDIS measure. Below is driver program snippet.

```
// Load value sets from test fixtures, the getJSONFixture base path is spec/fixtures/json
const valueSets = getJSONFixture('bonnie_measures/CMS107v6/value_sets.json');

// Calculate results.
const calculationResults = Calculator.calculate(measure, patients, valueSets, options);
```

Below is link to sample valuesets json referred above.

https://github.com/projecttacoma/cqm-execution/blob/master/spec/fixtures/json/bonnie_measures/CMS107v6/value_sets.json

A: This is specifically a reference to the cqm-execution project in GitHub. We recommend logging this question as an issue here: <https://github.com/cqframework/cql-execution>,