



CQL 1.5 and Quality Data Model (QDM) v5.6 Overview

September 2, 2021

CQL 1.5

About CQL 1.5.1

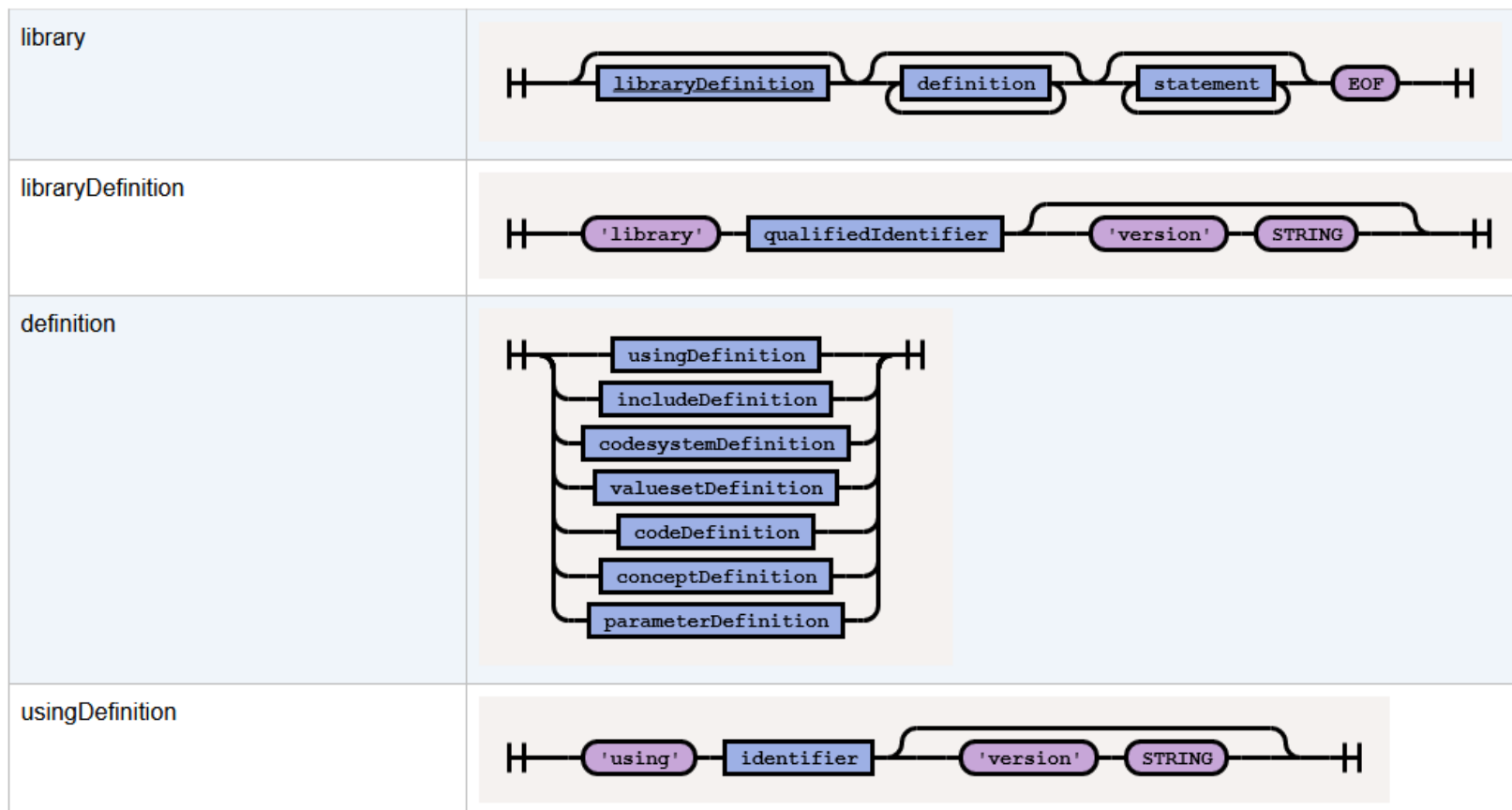
- CQL 1.5.1 was published in May 2021
- CQL 1.5.1 is the first Normative Release
- MAT v6.10 implements the features of CQL 1.5.1
- Full release notes are available on the [Health Level Seven International \(HL7\) website](#).

Selected CQL 1.5.1 Changes

- Syntax Diagrams
- Terminology Guidance
- Comment Tags
- Unified Code for Units of Measure (UCUM) and Calendar Unit Equivalence
- Aggregate Clause
- Fluent Keyword
- Terminology Types

Syntax Diagrams

- Added “railroad” diagrams for syntax



<https://cql.hl7.org/19-l-cqlsyntaxdiagrams.html>

Terminology Guidance

- Terminology Names
 - Identifiers SHOULD match external names
- Direct reference codes
 - SHOULD use ~, rather than =
 - Note that direct reference codes can be more difficult for implementation (less flexible than value sets)

Comment Tags

- @<name>: <value>
- Trial use ([Tags](#))
- Format is prescribed; names are not
- [Suggested “well known” tag names](#)
- Results in *tag* elements in the Expression Logical Model (ELM):

```
/*
@author: Frederic Chopin
@description: Defines whether the patient is included in the initial population
*/
define "InInitialPopulation":
  AgeInYearsAt(start of MeasurementPeriod) >= 16
  and AgeInYearsAt(start of MeasurementPeriod) < 24
  and Patient.gender in "Female Administrative Sex"
```

UCUM/Calendar Unit Equivalence

- Durations above “weeks” rather than “seconds” are not comparable
- 1 day = 1 ‘d’ but 1 year ~ 1 ‘a’

Calendar Duration	Unit Representation	Relationship to Definite Duration UCUM Unit
year / years	'year'	~ 1 'a'
month / months	'month'	~ 1 'mo'
week / weeks	'week'	= 1 'wk'
day / days	'day'	= 1 'd'
hour / hours	'hour'	= 1 'h'
minute / minutes	'minute'	= 1 'min'
second / seconds	'second'	= 1 's'
millisecond / milliseconds	'millisecond'	= 1 'ms'

<https://cql.hl7.org/02-authorsguide.html#quantities>

Aggregate Clause

- New aggregate clause (trial-use in 1.5)

```
define FactorialOfFive:  
  ({ 1, 2, 3, 4, 5 }) Num  
  aggregate Result starting 1: Result * Num
```

- Supports “roll out” interval calculation

```
define "RolledOutIntervals":  
  MedicationRequestIntervals M  
  aggregate R starting (null as List<Interval<DateTime>>): R union ({  
    M X  
    let S: Max({ end of Last(R) + 1 day, start of X }),  
        E: S + duration in days of X  
    return Interval[S, E]  
  })
```

Fluent Keyword

- New “fluent” keyword (trial-use in 1.5)
- Supports “fluent” function invocation

```
define fluent function "confirmed"(Conditions List<Condition>):  
  Conditions C where C.verificationStatus ~ "Condition Confirmed"  
  
define fluent function "active"(Conditions List<Condition>):  
  Conditions C where C.clinicalStatus ~ "Condition Active"  
  and C.abatement is null  
  
define fluent function "activeOrRecurring"(Conditions List<Condition>):  
  Conditions C  
  where C.clinicalStatus ~ "Condition Active"  
  or C.clinicalStatus ~ "Condition Recurrence"  
  or C.clinicalStatus ~ "Condition Relapse"
```

```
define "Diabetes Conditions":  
  [Condition: "Diabetes Mellitus"]  
  
define "Confirmed and Active or Recurring Diabetes Conditions":  
  Conditions.confirmed().activeOrRecurring()
```

Terminology Types

- Vocabulary, CodeSystem, and ValueSet
 - Trial-use in 1.5
 - Allows code systems and value sets to be passed as arguments “by reference” (i.e., without forcing materialization)
- CAUTION: Use of this feature can impact static analysis of terminology usage
- NOTE: Not all engines support this yet

<https://cql.hl7.org/09-b-cqlreference.html#vocabulary>

<https://cql.hl7.org/09-b-cqlreference.html#codesystem>

<https://cql.hl7.org/09-b-cqlreference.html#valueset>

QDM v5.6 Changes

About QDM 5.6

- QDM v5.6 was published in January 2021
- MAT v6.10 implements the features of QDM v5.6
- MAT v6.10 is available for the development/update of eCQMs for the 2023 CMS quality reporting/performance period

Approved QDM 5.6 Changes

1. Introduced *interpretation* and *class* attributes
2. Expanded use of existing *relatedTo* attribute
3. Updated Cumulative Medication Duration guidance
4. Clarified definitions of *relevantPeriod* for “Medication, Order” and “Medication, Dispensed”
5. Updated cardinality for *performer* and *participant* attributes from 0..1 to 0..*
6. Added Location entity
7. Updated definitions and guidance

New *interpretation* attribute [QDM-257](#)

An *interpretation* is a categorical assessment of an observation value. For example, high, low, normal, critical high, or critical low.

Added *interpretation* attribute to the following datatypes:

- “Laboratory Test, Performed”
- “Diagnostic Study, Performed”
- “Assessment, Performed”

Use *interpretation* with laboratory tests that include critical flags. Use for imaging studies (“Diagnostic Study, Performed”) or evaluation instruments (“Assessment, Performed”) may require further evaluation.

New *class* attribute

The *class* attribute represents classification of patient encounter concepts, such as ambulatory, inpatient, emergency, home health, etc.

- ***class* was created and added to the “Encounter, Performed” datatype.**

Expanded use of *relatedTo* attribute

relatedTo enables improved transparency and simplicity in measure expression and avoids double-counting of a single event represented by more than one datatype.

Added *relatedTo* attribute to the following datatypes ([QDM-257](#)):

- “Medication, Order”
- “Medication, Dispensed”
- “Encounter, Performed”
- “Intervention, Performed”
- “Laboratory Test, Performed”
- “Diagnostic Study, Performed”
- “Physical Exam, Performed”
- “Procedure, Performed”

relatedTo with “Medication, Order” and “Medication, Dispensed”

- Opioid use measure uses both “Medication, Order” and “Medication, Dispensed” to assure capture of all opioids regardless of where they are ordered.
- Need to avoid double counting the same prescription identified by both QDM datatypes.
- Quality Improvement (QI)-Core includes [MedicationDispense.authorizingPrescription](#) to indicate the dispensing event is related to the prescription
- Similarly, [MedicationRequest.basedOn](#) allows reference to a CarePlan, MedicationRequest, ServiceRequest, or ImmunizationRecommendation as the reason for the order
- Adding *relatedTo* for these two datatypes will enable measure expressions to avoid the duplication data issue

Adding *relatedTo* attributes Summary

[**Bold** – QDM 5.5; **Red** – QDM 5.6]

"Adverse Event"	"Device, Recommended"	"Intervention, Performed"	"Physical Exam, Performed"
"Allergy/Intolerance"	"Diagnostic Study, Order"	"Intervention, Recommended"	"Physical Exam, Recommended"
"Assessment, Performed"	"Diagnostic Study, Performed"	"Laboratory Test, Order"	"Procedure, Order"
"Assessment, Order"	"Diagnostic Study, Recommended"	"Laboratory Test, Performed"	"Procedure, Performed"
"Assessment, Recommended"	"Encounter, Order"	"Laboratory Test, Recommended"	"Procedure, Recommended"
"Patient Care Experience"	"Encounter, Performed"	"Medication, Active"	"Related Person"
"Provider Care Experience"	"Encounter, Recommended"	"Medication, Administered"	"Substance, Administered"
"Care Goal"	"Family History"	"Medication, Discharge"	"Substance, Order"
"Communication, Performed"	"Immunization, Administered"	"Medication, Dispensed"	"Substance, Recommended"
"Diagnosis"	"Immunization, Order"	"Medication, Order"	"Symptom"
"Device Applied"	"Patient Characteristics"	"Participation"	
"Device, Order"	"Intervention, Order"	"Physical Exam, Order"	

Cumulative Medication Duration (CMD) - “Medication, Order”

- Calculate based on *daysSupplied* (number of days of medication supply per dispense) multiplied by (1 + number of *refills*) for “Medication, Order”.
 - Option 1 - use *daysSupplied*:
- $CMD = daysSupplied, beginning\ with\ author\ dateTime * (1 + \#refills)$
- Since *daysSupplied* addresses a single dispensing event, multiply by (1 + number of *refills*)
 - Option 2 - when *daysSupplied* is absent, derive it from other existing data - *supply* (quantity of medication ordered), *dosage* (quantity per unit), and *frequency* (number of units to be taken per time period)
- $CMD = [(supply / (dosage * frequency))] beginning\ with\ author\ dateTime * (1 + \#refills) .$

CMD for “Medication, Dispensed”

- Calculate based on *daysSupplied* (number of days of medication supply per dispense) for “Medication, Dispensed”.
- Option 1 - use *daysSupplied*:
 - $CMD = daysSupplied$ beginning with *relevant dateTime* (whenHandedOver)
 - Since *daysSupplied* references a single dispensing event, the measure should identify all dispensing events over the time period desired by the measure (e.g., within 180 days after start of “Diagnosis” *prevalencePeriod*)
- Option 2 - when *daysSupplied* is absent, derive it from other existing data - *supply* (quantity of medication dispensed), *dosage* (quantity per unit), and *frequency* (number of units to be taken per time period):
 - $CMD = [(supply / (dosage * frequency))]$ beginning with *relevant dateTime*
- *relevant dateTime* should be used as the *start date* for “Medication, Dispensed” with the assumption that medication administration is expected to begin upon receipt
- $CMD =$ the sum of all dispensing events with each event providing [*relevant dateTime* + # *daysSupplied*].

CMD for “Medication, Administered”

- The *relevantPeriod* addresses a start and stop time for a single medication administration if the event occurred over a time interval (e.g., and intravenous infusion):
 - *startTime* = when a single medication administration event starts (e.g., the initiation of an intravenous infusion, or administering a pill or intramuscular [IM] injection to a patient).
 - *stopTime* = when a single medication administration event ends (e.g., the end time of the intravenous infusion, or the administration of a pill or IM injection is completed - for pills and IM injections, the start and stop times are the same).
- Address multiple administrations over a period of time using CQL logic:
CMD = [date of last “Medication, Administered” – date of first “Medication Administered”].
Also consider the duration of effect of a medication dose to evaluate the appropriate number of administrations and intervals between administrations that represent medication coverage over a given time interval.

Clarified definitions of *relevantPeriod* for “Medication, Order” and “Medication, Dispensed”

- **“Medication, Order”**: The time period for which the ordered supply is authorized to be dispensed (including refills)
- **“Medication, Dispensed”**: The time period for which the dispensed supply is to be administered/taken (i.e., not including refills; each dispensing event *relevant Period* is evaluated individually)

Updated cardinality for all performers of action attributes from 0..1 to 0..*

- Allows reference to multiple performers for an action (applies to attributes: *participant*, *performer*, *sender*, *recipient*, *dispenser*, *prescriber*, *requester*, *recorder*)

Added Location entity

The **Location** entity includes information about a physical place where services and resources are provided and resources and participants may be stored, found, contained or accommodated.

Location includes the following attributes:

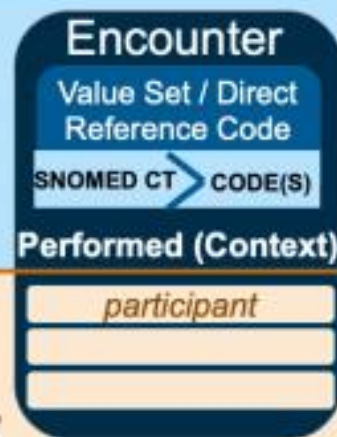
- *Identifier*
- *Id (instance identifier)*
- *locationType*
 - Role type based on function performed (e.g., hospital, emergency department).

Location entity example

To specify that an encounter was performed by an ambulatory clinical practice

- **Encounter, Performed**

[Direct reference code, or value set defining "Office Visit"]



QDM Entities available to reference actors and information about each QDM Entity that can be defined in a measure:

Patient

identifier

Care Partner

identifier

relationship

Practitioner

identifier

role

specialty

qualification

Organization

identifier

organizationType

Location

identifier

locationType

- *participant*

- Organization

- *organizationType* ~ "Ambulatory Clinical Practice"

[Direct reference code or value set defining "Ambulatory Clinical Practice" as a type of organization – example shows CQL reference to a direct reference code]

Updated definitions and guidance

- Retired:
 - “Device, Applied” retired
 - “Encounter, Performed” *negation rationale*
 - “Participation” *recorder*
 - “Procedure, Performed” *priority*
- Guidance:
 - “Procedure, Performed” successful completion discussion
 - *negation rationale* timing

QUESTIONS?
