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Health Information Technology

Electronic Clinical Quality Measure Logic and Implementation Guidance

Version 2.0

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Record of Changes

Version	Date	Author / Owner	Description of Change
1.13	May 5, 2017	CMS / ONC (MITRE)	• Updated language in Introduction to include Merit-based Incentive Payment System (MIPS) Eligible Clinician and broadened from specific quality reporting programs to generic • Removed tools, resources, and standards references, now referencing the eCQI Resource Center for this information • Renumbered and updated Table 3, Example Inputs and Results for Overlap
			Section 2: • Updated language in subsections 2.1, 2.2, 2.3, 2.4 • Converted table graphic to image, Figure 1 (Sample Measure Item Count), in subsection 2.2
			Section 3: • Modified introductory paragraph in Section 3. • Removed Tables 1 and 2, Eligible Professional and Eligible Clinician eCQM Types and Versions and Eligible Hospital eCQM Types and Versions
			Section 4: • Updated language and logic sample in subsections 4.3.1, 4.3.3, 4.6, 5.2, 5.3 • Updated language in subsections 4.3.2, 4.3.4, 4.3.5
			Section 6: • Updated language in subsection 6.1 – UHSIK • Updated language in subsection 6.2 – QDM Category and Code System • Updated language in subsection 6.5 – Allergies to Medications and Other Substances • Updated language in subsection 6.6 – Principal Diagnosis in Inpatient Encounters • Updated language in subsection 6.9 – Activities That Were "Not Done" • Updated language in subsection 6.10 – Newborn/Gestational Age • Updated language in subsection 6.11 – Source • Updated language in subsection 6.12 – Patient Characteristic Birthdate and Patient Characteristic Expired • Added subsection 6.15.2 – The 2016 Value Set Addendum

Version	Date	Author / Owner	Description of Change
			Appendix C • Updated table number for Table 4, Time Unit and Interval Definitions in Appendix C • Updated table number for Table 5, Time Interval Calculations in Appendix C
			• Updated Acronym list
2.0	May 4, 2018	CMS/ONC (MITRE)	• Updates and edits resulting in Version 2.0 for release

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1.   Introduction

The Centers for Medicare & Medicaid Services (CMS) and the Office of the National Coordinator for Health Information Technology (ONC), provide this guidance document for use with the updated Eligible Hospital (EH), Critical Access Hospital (CAH), Eligible Professional (EP), and Eligible Clinician electronic Clinical Quality Measures (eCQM) specifications released in May 2018 for use in calendar year (CY) 2019 performance/reporting under CMS's quality reporting and value-based purchasing programs.

This document provides guidance for those using and/or implementing the eCQMs. These eCQMs are fully specified for potential inclusion in Calendar Year (CY) 2019 performance/reporting under CMS's quality and value-based reporting programs. eCQMs will not be eligible for 2019 reporting unless and until they are proposed and finalized through notice, public comment, and rulemaking for each applicable program. CMS and ONC strongly recommend that you review this document to understand each eCQM's intent and operation before implementation. Additional help can be found on the Electronic Clinical Quality Improvement (eCQI) Resource Center). Appendix A provides information on the standards and code systems used in conjunction with the updated eCQMs.

This document provides the following information:

1. Sections 2 through 6 provide general implementation guidance, including defining how specific logic and data elements should be conceptualized and addressed during eCQM implementation.

2. Section 7 provides information to stakeholders on how to use JIRA, the CMS and ONC feedback system, to provide feedback, track issues, and ask questions about measure intent, specifications, certification, standards, and issues uncovered during implementation associated with the eCQMs.

For additional information directly relevant to implementing the eCQM updates for 2019 reporting/performance, please refer to the eCQM Implementation Checklist as well as the tools, resources, and standards used by eCQMs provided on the eCQI Resource Center.

2. Electronic Clinical Quality Measure Types

eCQMs can be classified based on the unit of analysis—patients or episodes—and how the score is computed, whether by proportion or continuous variable. This section describes these classifications and detail on computing eCQMs.

2.1 Patient-based Measures

Patient-based measures evaluate the care of a patient and assign the patient to membership in one or more measure segments or populations. Most Eligible Professional/Eligible Clinician eCQMs are patient-based.

All information in the patient record referenced in the measure must be considered when computing a patient-based measure. The criteria for inclusion of a patient in a measure population may first require satisfying conditions during multiple episodes of care—for example, a diagnosis in one episode of care and treatment in a subsequent episode of care.

2.2 Episode-of-Care Measures

Episode-of-care measures evaluate the care during a patient-provider encounter and assign the episode of care to one or more measure population segments. All Eligible Hospital eCQMs and a few Eligible Professional/Eligible Clinician eCQMs are episode-of-care measures

In an episode-of-care measure, the episodes of care are identified in the Initial Population (IP). An episode is based on a specific event that will be referenced in other segments of the eCQM (such as Initial Population, Denominator, Numerator, etc.) through definition statements in Clinical Quality Language (CQL).

To identify the encounters or procedures that are counted in an episode-of-care-based measure, review the guidance section of the header and the context of the measure logic section. For example, for measure CMS133, the item counted is the cataract surgery procedure, as defined in the **Initial Population** definition as follows:

```
  "Performed Cataract Surgery" CataractSurgeryPerformed

where exists (["Patient Characteristic Birthdate"]BirthDate
where Global."CalendarAgeInYearsAt"( BirthDate.birthDatetime,
start of "Measurement Period")>= 18)
```

In this example, we can see that the Initial Population includes all patients who had a cataract surgery performed, where the patient was at least 18 years of age during the measurement period.

2.3 Proportion Measures

Most of the eCQMs in current CMS reporting programs are proportion measures. In a proportion measure, the scored entities (either patients or episodes) for a collection of patients are assigned to the populations and strata defined by an eCQM, and the appropriate "rates" are computed.

The populations defined by a proportion measure are as follows:

- **Initial Population** – the set of patients or episodes of care to be evaluated by the measure.

- **Denominator** (DENOM) – a subset of the IP.

- **Denominator Exclusions** (DENEX) – a subset of the Denominator that should not be considered for inclusion in the Numerator.

- **Denominator Exceptions** (DEXCEP) – a subset of the Denominator. Only those members of the Denominator that are considered for Numerator membership and do not meet Numerator criteria are considered for membership in the Denominator Exceptions.

- **Numerator** (NUMER) – a subset of the Denominator. The Numerator criteria are the processes or outcomes expected for each patient, procedure, or other unit of measurement defined in the Denominator.

- **Numerator Exclusions** (NUMEX) – a subset of the Numerator that should not be considered for calculation.

The computation of a proportion measure proceeds as follows:

1. Patients or episodes of care are classified using the IP criteria, and those satisfying the criteria are included in the IP.

2. The members of the IP are classified using the Denominator criteria, and those satisfying the criteria are included in the Denominator.

3. The members of the Denominator are classified using the Denominator Exclusion criteria, and those satisfying the criteria are included in the Denominator Exclusions.

4. The members of the Denominator that are not in the Denominator Exclusion population are classified using the Numerator criteria, and those satisfying the criteria are included in the Numerator.

5. Those members of the Denominator that were considered for membership in the Numerator, but were rejected, are classified using the Denominator Exceptions criteria, and those satisfying the criteria are included in the Denominator Exceptions.

Additionally, reporting strata may be defined for a measure. Strata are variables a measure is designed to report (e.g., report separately by age group, such as 14–19, 20–25). For eCQMs, the Reporting Stratification section is included in the human-readable rendition. If a measure does not have reporting strata defined, "None" is displayed as the default. If a measure contains reporting stratification, each of the reporting strata is listed separately under the population criteria section.

For eCQMs with multiple numerators and/or strata, each patient/episode must be scored for inclusion/exclusion to *every* population. For example, if an eCQM has three numerators and the patient is included in the first numerator, the patient should be scored for inclusion/exclusion from the populations related to the other numerators as well. When the measure definition includes stratification, each population in the measure definition should be reported both *without* stratification and *stratified* by each stratification criteria.

Specific programs may require reporting of performance rates, but these are not required for certification. The performance rate for a single population is defined as:

$$Rate = NUMER/(DENOM - DENEX - DEXCEP)$$

There are a few measures with more than one population, to support compilation of a single performance rate. In this instance, the performance rate calculation is specified in the header (please refer to the example in Figure 1 from CMS145/NQF0070 Coronary Artery Disease (CAD): Beta-Blocker Therapy-Prior Myocardial Infarction (MI) or Left Ventricular Systolic Dysfunction (LVEF <40%).

Rate Aggregation	This measure is intended to have one reporting rate, which aggregates the following populations into a single performance rate for reporting purposes:
	- Population 1: Patients with left ventricular systolic dysfunction (LVEF <40%)
	- Population 2: Patients with a prior (within the past 3 years) myocardial infarction
	For the purposes of this measure, a single performance rate can be calculated as follows:
	Performance Rate = (Numerator 1 + Numerator 2)/ [(Denominator 1 – Denominator Exceptions 1) + (Denominator 2 – Denominator Exceptions 2)]

Figure 1. Performance Rate Calculation Defined in Header for Multiple Populations

2.4   Continuous Variable Measures

Continuous variable measures may be either episode- or patient-based measures. They include the following elements:

- **Initial Population** of patients or episodes, roughly analogous to the IP in proportion measures.

- **Measure Population** (MSRPOPL)(subset of IP), roughly analogous to the Denominator in proportion measures.

- **Measure Population Exclusions** (MSRPOPLEX) – a subset of the Measure Population, which are not used in Measure Observation calculations.

- **Measure Observations** that describe the computation to be performed over the members of the Measure Population after removing the Measure Population Exclusions. For example, measure CMS55 computes the median for the difference between the Emergency Department (ED) arrival and departure times over all ED visits in the Measure Population, excluding ED encounters with an admission source in "Hospital Setting".

The computation of a continuous variable measure proceeds as follows:

1. Patients or episodes of care are classified using the IP criteria, and those satisfying the criteria are included in the IP.

2. The members of the IP are classified using the Measure Population criteria, and those satisfying the criteria are included in the Measure Population.

3. Measure Population Exclusions are a subset of the Measure Population that should not be considered during calculation of the Measure Observation criteria.

4. Each remaining member of the Measure Population is evaluated against the defined Measure Observations criteria, and the results are aggregated using the specified operator.

Results should be reported for each population without stratification as well as for each defined stratum separately. Results for a continuous variable measure, such as the IP and Measure Population, require specifying the number of patients or episodes that fall into each of these populations without stratification, as well as those populations stratified by any defined strata. The aggregated continuous variable computed, defined by the Measure Observation, should be reported for the unaggregated Measure Population, as well as for each stratum of the Measure Population.

CMS55v6 is an example of a stratified continuous variable measure (Figure 2). The un-aggregated Measure Population includes all patients admitted to the hospital after arrival at the ED. Furthermore, CMS55v6 defines two stratifications: patients with a diagnosis of psychiatric / mental health disorders and patients without a diagnosis of psychiatric / mental health disorders. This measure requires reporting the observations for all three instances—all patients, patients with the diagnosis, and patients without the diagnosis.

Initial Population	Inpatient Encounters ending during the measurement period with Length of Stay (Discharge Date minus Admission Date) less than or equal to 120 days, and preceded within an hour by an emergency department visit at the same physical facility
Measure Population	Equals initial population
Measure Population Exclusions	Emergency department encounters being transferred from another hospital setting (any different facility, even if part of the same hospital system)
Measure Observations	Time (in minutes) from ED facility location arrival to ED facility location departure for patients admitted to the facility from the emergency department
Supplemental Data Elements	For every patient evaluated by this measure, also identify payer, race, ethnicity and sex

Figure 2. Example of a Stratified Continuous Variable Measure

3. Electronic Clinical Quality Measures

Sortable and downloadable Eligible Hospital, Critical Access Hospital, and Eligible Professional, Eligible Clinician tables of eCQMs are also located on the eCQI Resource Center.

Table 1. Eligible Professional and Eligible Clinician eCQMs

eCQM ID#	NQF #	Title	Type	Patient / Episode
CMS2v8	0418	Preventive Care and Screening: Screening for Depression and Follow-Up Plan	Proportion	Patient
CMS22v7	Not Applicable	Preventive Care and Screening: Screening for High Blood Pressure and Follow-Up Documented	Proportion	Patient
CMS50v7	Not Applicable	Closing the Referral Loop: Receipt of Specialist Report	Proportion	Patient
CMS52v7	0405	HIV/AIDS: Pneumocystis Jiroveci Pneumonia (PCP) Prophylaxis	Proportion	Patient
CMS56v7	Not Applicable	Functional Status Assessment for Total Hip Replacement	Proportion	Patient
CMS65v8	Not Applicable	Hypertension: Improvement in Blood Pressure	Proportion	Patient
CMS66v7	Not Applicable	Functional Status Assessment for Total Knee Replacement	Proportion	Patient
CMS68v8	0419	Documentation of Current Medications in the Medical Record	Proportion	Episode
CMS69v7	0421	Preventive Care and Screening: Body Mass Index (BMI) Screening and Follow-Up Plan	Proportion	Patient
CMS74v8	Not Applicable	Primary Caries Prevention Intervention as Offered by Primary Care Providers, including Dentists	Proportion	Patient
CMS75v7	Not Applicable	Children Who Have Dental Decay or Cavities	Proportion	Patient
CMS82v6	Not Applicable	Maternal Depression Screening	Proportion	Patient
CMS90v8	Not Applicable	Functional Status Assessments for Congestive Heart Failure	Proportion	Patient
CMS117v7	0038	Childhood Immunization Status	Proportion	Patient
CMS122v7	0059	Diabetes: Hemoglobin A1c (HbA1c) Poor Control (> 9%)	Proportion	Patient
CMS123v7	0056	Diabetes: Foot Exam	Proportion	Patient
CMS124v7	0032	Cervical Cancer Screening	Proportion	Patient
CMS125v7	2372	Breast Cancer Screening	Proportion	Patient
CMS127v7	Not Applicable	Pneumococcal Vaccination Status for Older Adults	Proportion	Patient

eCQM ID#	NQF #	Title	Type	Patient / Episode
CMS128v7	0105	Anti-depressant Medication Management	Proportion	Patient
CMS129v8	0389	Prostate Cancer: Avoidance of Overuse of Bone Scan for Staging Low Risk Prostate Cancer Patients	Proportion	Patient
CMS130v7	0034	Colorectal Cancer Screening	Proportion	Patient
CMS131v7	0055	Diabetes: Eye Exam	Proportion	Patient
CMS132v7	0564	Cataracts: Complications within 30 Days Following Cataract Surgery Requiring Additional Surgical Procedures	Proportion	Episode
CMS133v7	0565	Cataracts: 20/40 or Better Visual Acuity within 90 Days Following Cataract Surgery	Proportion	Episode
CMS134v7	0062	Diabetes: Medical Attention for Nephropathy	Proportion	Patient
CMS135v7	0081	Heart Failure (HF): Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy for Left Ventricular Systolic Dysfunction (LVSD)	Proportion	Patient
CMS136v8	0108	Follow-Up Care for Children Prescribed ADHD Medication (ADD)	Proportion	Patient
CMS137v7	0004	Initiation and Engagement of Alcohol and Other Drug Dependence Treatment	Proportion	Patient
CMS138v7	0028	Preventive Care and Screening: Tobacco Use: Screening and Cessation Intervention	Proportion	Patient
CMS139v7	0101	Falls: Screening for Future Fall Risk	Proportion	Patient
CMS142v7	0089	Diabetic Retinopathy: Communication with the Physician Managing Ongoing Diabetes Care	Proportion	Patient
CMS143v7	0086	Primary Open-Angle Glaucoma (POAG): Optic Nerve Evaluation	Proportion	Patient
CMS144v7	0083	Heart Failure (HF): Beta-Blocker Therapy for Left Ventricular Systolic Dysfunction (LVSD)	Proportion	Patient
CMS145v7	0070	Coronary Artery Disease (CAD): Beta-Blocker Therapy–Prior Myocardial Infarction (MI) or Left Ventricular Systolic Dysfunction (LVEF <40%)	Proportion	Patient
CMS146v7	Not Applicable	Appropriate Testing for Children with Pharyngitis	Proportion	Episode
CMS147v8	0041	Preventive Care and Screening: Influenza Immunization	Proportion	Patient
CMS149v7	2872	Dementia: Cognitive Assessment	Proportion	Patient
CMS153v7	0033	Chlamydia Screening for Women	Proportion	Patient
CMS154v7	0069	Appropriate Treatment for Children with Upper Respiratory Infection (URI)	Proportion	Episode

eCQM ID#	NQF #	Title	Type	Patient / Episode
CMS155v7	0024	Weight Assessment and Counseling for Nutrition and Physical Activity for Children and Adolescents	Proportion	Patient
CMS156v7	0022	Use of High-Risk Medications in the Elderly	Proportion	Patient
CMS157v7	0384	Oncology: Medical and Radiation – Pain Intensity Quantified	Proportion	Episode
CMS158v7	Not Applicable	Pregnant women that had HBsAg testing	Proportion	Patient
CMS159v7	0710	Depression Remission at Twelve Months	Proportion	Patient
CMS160v7	0712	Depression Utilization of the PHQ-9 Tool	Proportion	Patient
CMS161v7	0104	Adult Major Depressive Disorder (MDD): Suicide Risk Assessment	Proportion	Episode
CMS164v7	0068	Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antiplatelet	Proportion	Patient
CMS165v7	0018	Controlling High Blood Pressure	Proportion	Patient
CMS167v7	0088	Diabetic Retinopathy: Documentation of Presence or Absence of Macular Edema and Level of Severity of Retinopathy	Proportion	Patient
CMS169v7	Not Applicable	Bipolar Disorder and Major Depression: Appraisal for alcohol or chemical substance use	Proportion	Patient
CMS177v7	1365	Child and Adolescent Major Depressive Disorder (MDD): Suicide Risk Assessment	Proportion	Episode
CMS249v1	Not Applicable	Appropriate Use of DXA Scans in Women Under 65 Years Who Do Not Meet the Risk Factor Profile for Osteoporotic Fracture	Proportion	Patient
CMS347v2	Not Applicable	Statin Therapy for the Prevention and Treatment of Cardiovascular Disease	Proportion	Patient
CMS349v1	Not Applicable	HIV Screening	Proportion	Patient
CMS645v2	Not Applicable	Bone density evaluation for patients with prostate cancer and receiving androgen deprivation therapy	Proportion	Patient

Table 2. Eligible Hospital and Critical Access Hospital eCQMs

eCQM ID#	NQF #	Title	Type	Patient / Episode
CMS9v7	0480	Exclusive Breast Milk Feeding	Proportion	Episode
CMS26v6	Not Applicable	Home Management Plan of Care (HMPC) Document Given to Patient/Caregiver	Proportion	Episode

eCQM ID#	NQF #	Title	Type	Patient / Episode
CMS31v7	1354	Hearing Screening Prior to Hospital Discharge	Proportion	Episode
CMS32v8	0496	Median Time from ED Arrival to ED Departure for Discharged ED Patients	Continuous Variable	Episode
CMS53v7	Not Applicable	Primary PCI Received Within 90 Minutes of Hospital Arrival	Proportion	Episode
CMS55v7	0495	Median Time from ED Arrival to ED Departure for Admitted ED Patients	Continuous Variable	Episode
CMS71v8	Not Applicable	Anticoagulation Therapy for Atrial Fibrillation/Flutter	Proportion	Episode
CMS72v7	Not Applicable	Antithrombotic Therapy By End of Hospital Day 2	Proportion	Episode
CMS102v7	Not Applicable	Assessed for Rehabilitation	Proportion	Episode
CMS104v7	Not Applicable	Discharged on Antithrombotic Therapy	Proportion	Episode
CMS105v7	Not Applicable	Discharged on Statin Medication	Proportion	Episode
CMS107v7	Not Applicable	Stroke Education	Proportion	Episode
CMS108v7	0371	Venous Thromboembolism Prophylaxis	Proportion	Episode
CMS111v7	0497	Median Admit Decision Time to ED Departure Time for Admitted Patients	Continuous Variable	Episode
CMS113v7	0469	Elective Delivery	Proportion	Episode
CMS190v7	037	Intensive Care Unit Venous Thromboembolism Prophylaxis	Proportion	Episode

4. CQL Measure Logic

Beginning with the eCQM Annual Update for 2019 reporting/performance, eCQMs are represented using Clinical Quality Language logic via the Quality Data Model (QDM) v5.3 as an effort to harmonize standards between clinical decision support (CDS) and eCQM reporting. CQL is a clinically focused, high-level query language that can express more sophisticated eCQMs than previously possible. It is an evolutionary step beyond what was possible with QDM logic and is designed to tackle many of the issues encountered with previous eCQM specifications. A significant new feature of CQL is its use of *libraries*, which are collections of CQL definitions or function statements that can be shared across measures, as well as between measures and decision support rules. This results in greater consistency across measures and enables decision support to reuse the same statements. **Note:** CQL is only replacing the QDM logic portions for measure specification. QDM will continue as the data model for eCQMs.

In addition to CQL and QDM, a Health Level Seven International (HL7) implementation guide for using CQL and QDM to express eCQMs as Health Quality Measures Format (HQMF) documents is available. The HL7 Version 3 Implementation Guide: Clinical Quality Language (CQL)-based Health Quality Measure Format (HQMF), Release 1, Standard for Trial Use 2.1 - US Realm implementation guide, along with QDM v5.3 Annotated and the CQL Formatting and Usage Wiki should be used as primary sources for interpreting eCQM representation. The following subsections provide an overview of this material, including common logic expressions and proper usage.

4.1 Evaluating CQL Logic and QDM Elements

A measure consists of populations (such as Denominator, Numerator, etc.), where each population is in turn composed of a combination of QDM data elements and CQL logic to form expressions. These expressions define the criteria for membership in each population based on the intent of the measure.

For example, the following definition establishes the global criteria for an **Inpatient Encounter**:

```
    ["Encounter, Performed": "Encounter Inpatient"]
EncounterInpatient
    where "LengthInDays"(EncounterInpatient.relevantPeriod)
<=120
        and EncounterInpatient.relevantPeriod ends during
"Measurement Period"
```

The first part of this definition, enclosed in brackets, is a reference to a QDM Data Element. QDM describes clinical information using Data Elements, which identify a Data Type and a Value Set. The Data Type combines a Category of clinical information, such as Encounter, Medication, or Procedure, with a context, such as Performed, Administered, or Ordered. The Data Type then determines the structure of the information using attributes, which may include such information as dosage, supply, and reason. For detailed descriptions of each type of Data Element available in the QDM, please refer to the QDM v5.3 specification.

Returning to the Inpatient Encounter example, the next part of the definition establishes the criteria that must be met by an instance of an "Encounter, Performed" to be considered an

"Inpatient Encounter". In this case, that the encounter was 120 days or less, and that it ended during the measurement period. Throughout the rest of the measure, the identifier "Inpatient Encounter" can be used whenever the measure author needs to refer to the encounters that meet these criteria.

The CQL Formatting and Usage Wiki contains additional information regarding the use of CQL and QDM in the section Authoring Measures in CQL. What follows is a short summary of that content, focused on interpreting measures written in CQL.

4.2   Understanding Clinical Quality Language Basics

CQL is a high-level *query* language, meaning that it can be used to write expressions that determine *what* data is to be returned, not *how* it is to be returned. *How* the data is to be returned is part of the implementation of a quality measure and may be accomplished in various ways (for example, by queries in a database system or map-reduce processing on an Apache Hadoop® (software utility) cluster). CQL is intentionally silent on any of those details, allowing the logic expressed by CQL queries to be used in a broad variety of implementation environments to achieve the same result.

CQL expressions are made up of several basic elements:

- Values, like the number 5, or the quantity 5 'mm[Hg]'
- Operators, like '+', '-', 'and, 'or', 'intersect', and 'union'
- Functions, like CalculateAge() and First()
- Identifiers, like "Inpatient Encounter"

These basic elements can be combined to express criteria, then labeled with identifiers so they can be used, either to define additional criteria, or as the definition of a top-level population.

When the members of an eCQM population are patients, the criteria are expressed as a simple "yes or no" test that determines whether the patient is in or out of that population. For example, the definition of **Initial Population** for Patient-Based Measures is:

```
exists ["Patient Characteristic Birthdate"] Birthdate

where Global."CalendarAgeInYearsAt"
(BirthDate.birthDatetime,start of "Measurement Period")>=6)


    and exists("HIV Diagnosis")
    and exists ("Followup HIV Visit")
    and exists ("CD4 Count Under 200")
```

For this example, a patient is a member of the Initial Population if they have a Birthdate characteristic that indicates they were 6 years of age or older at the start of the measurement period, and the patient has an HIV Diagnosis, a Followup HIV Visit, and a CD4 Count Under 200. As illustrated by this example, "yes or no" tests can be combined with the 'and' and 'or' to build up the criteria based on the measure intent.

In a patient-based measure, each population criteria (i.e., Initial Population, Denominator, Numerator, etc.) is defined as a "yes or no" test; however, there may be other definitions within the measure that return lists. In the foregoing example, **HIV Diagnosis** is one such definition:

```
["Diagnosis": "HIV 1"] HIV

where HIV.prevalencePeriod starts before end of
"Measurement Period"
```

4.3   Libraries

CQL libraries are collections of CQL expression definitions, functions, and other declarations. Each of the eCQM program measures contains a *primary* library that defines the criteria used by the populations of the measure. The HQMF document references this library and defines the populations by identifying which expressions in the CQL library define each population.

Libraries can contain:

- Expressions, like "Inpatient Encounter"
- Terminologies, such as references to code systems, value sets, and codes
- Functions, like "CalendarAgeInYearsAt"

When a measure includes a reference to a *shared* library, components of that library can then be referenced throughout the measure via the definition for **Diagnosis Exception**:

```
"Inpatient Encounters" Encounter

    with ["Diagnosis": "Cardiopulmonary arrest"] CardioArrest

          such that CardiacArrest.prevalencePeriod starts
          90 minutes or less on or after start of
          Global.Hospitalization(Encounter)
```

This example defines a Diagnosis Exception as an Inpatient Encounter with a Cardiopulmonary arrest diagnosis that starts 90 minutes or less on or after the start of the Hospitalization period for the Encounter, as determined by the Global.Hospitalization function.

The "Global" in this definition is referring to a shared library used by many of the measures to share definitions and functions like "Hospitalization".

For more information on libraries, refer to the Using Libraries to Shared Logic section of the [CQL Implementation Guide](#).

4.4   Queries

A central construct in CQL is the *query*, which is a specific type of expression that allows easy and precise expression of relationships between data. Queries in CQL are *clause based*, meaning that they have different types of clauses that can be used depending on what operations must be performed on the data.

The general structure of a CQL query is:

<source> <alias>
  <with or without clauses>
  <where clause>
  <return clause>
  <sort clause>

Because all the clauses are optional, the simplest query is just a *source* and an *alias* as follows:

```
"Outpatient Encounters" Encounter
```

Here, the source is just a reference to "Outpatient Encounters", which is an expression that returns a list of encounters. This source is given the alias "Encounter". The alias allows the elements of the source to be referenced anywhere within the query. Because this simple query does not have any clauses, it simply returns the same result as the source.

4.4.1   Where Clause

The 'where' keyword introduces a 'where' clause, which allows you to filter the results of the source:

```
"Outpatient Encounters" Encounter
  where Encounter.relevantPeriod during "Measurement
Period"
```

This query returns only those encounters from the source whose relevantPeriod occurred entirely during the measurement period. The 'where' clause allows you to specify any condition in terms of the aliases introduced in the query, such as "Encounter" in this case. The condition in the 'where' clause is evaluated for every encounter in the "Outpatient Encounters" query source, and the result then includes only those encounters for which the condition evaluated to true.

4.4.2   Relationships (With and Without Clauses)

Describing relationships between data is so common in quality measurement that CQL provides special constructs to make expressing these relationships as simple as possible, the 'with' and 'without' keywords. The 'with' keyword can be used to describe cases that should only be considered if a related data item is present. The 'without' keyword can be used to express the converse case, when a case should only be considered if a related data item is not present. The following example query limits the outpatient encounters returned to only those that had a streptococcus test performed during the encounter. The 'such that' clause describes the condition of the relationship, which is expressed in terms of the aliases "Encounter" (for the main source of the query) and "Test", which is only available in the 'such that' clause.

```
["Encounter, Performed": "Outpatient"] Encounter
  with ["Laboratory Test, Performed": "Streptococcus Test"]
Test
    such that Test.resultDatetime during
Encounter.relevantPeriod
```

In addition, the 'without' keyword can be used to describe cases that should only be considered if a particular data item is *not* present:

```
["Encounter, Performed": "Outpatient"] Encounter
  without ["Laboratory Test, Performed": "Streptococcus
Test"] Test
    such that Test.resultDatetime during
Encounter.relevantPeriod
```

This query limits the outpatient encounters returned to only those that did *not* have a streptococcus test performed during the encounter. Just like the 'with' clause, the 'without' clause uses 'such that' to describe the condition of the relationship.

4.4.3   Specific Occurrences

Specific occurrences in versions of QDM prior to v.5 allowed measure logic to associate criteria with a specific occurrence or single instance of a QDM Data Element. This functionality was necessary in QDM because logic could not be applied to the result of an expression. CQL, however, allows expressions to be built up from other expressions, so the ability to express different criteria that apply to the same instance of a QDM Data Element is a natural part of the language.

4.5   Timing Calculations

Assessing the relative timing of events within a patient's medical record is an essential part of computing eCQMs. To enable unambiguous interpretation of the eCQMs, clear definition of the computation of time intervals is required. A simple expression such as "the treatment must occur within 3 days of the diagnosis" has many possible interpretations, including "the treatment must occur within 72 hours of the diagnosis" and "the treatment must happen within 3 business days of the diagnosis."

ISO 8601:2004 defines data elements and interchange formats for the representation of dates and times, including time intervals. A full list of definitions related to timing is part of the [HL7 Cross-Paradigm Specification: Clinical Quality Language, Release 1, Standard for Trial Use 2](#) (refer to section 5.4.1 Definitions).

To determine the length of time between two dates, CQL provides two different approaches: 'duration', the number of whole periods between two dates, and 'difference', the number of period boundaries crossed between two dates. These differing approaches give measure developers multiple options to correctly express timing relationships for implementation of measures.

4.5.1   Duration

CQL provides for greater specificity when calculating duration. Conceptually, the calculation is performed by considering two dates on a timeline, and counting the number of whole periods (i.e., year, day, and hour) that fit on that timeline between the two dates. CQL allows this calculation as fine-grained as needed to meet this intent of the measure. The precision of the

calculation is only limited by the available data. The example in subsection 4.5.2illustrates both Duration and Difference timings.

4.5.2   Difference

Difference calculations are performed by truncating the date/time values at the next level of granularity and then performing the corresponding duration calculation on the truncated values. For example, to calculate a difference in years, months, days, and the time components of the values are ignored.

To illustrate the difference, consider the following example:

> Date 1: 2012-12-31
>
> Date 2: 2013-01-01
>
> Duration In Years: years between Date1 and Date2
>
> Difference In Years: difference in years between Date1 and Date2
>
> The Duration In Years expression returns zero because a full year has not passed between the two dates; however, the Difference In Years expression returns 1 because one year boundary was crossed between the two truncated dates, 2012 and 2013.

4.5.3   Intervals

CQL supports intervals of numbers and date/time values. Intervals use standard mathematical notation to indicate open and closed [i.e., whether the endpoint is included in (closed) or excluded from (open) the interval]. Intervals can be compared using a complete set of 'Comparison Operators' such as "A during B", "A overlaps B", or "A includes B". Precise relationships between intervals can be expressed using natural language 'Timing Phrases' such as "A starts before start B" or "A starts 1 day or less after end B."

The unit in which a time interval (or its duration) is expressed may depend on the necessary level of accuracy for the purposes of measurement. The selection of the time unit to be used should be made according to the level of granularity needed to meet the intent of the measure. The Time Interval Calculations section of the CQL Formatting and Usage Wiki provides additional details related to timing, values, and calculation using CQL. Additionally, Appendix B provides time interval definitions and examples.

5.   Data Elements and Value Sets

The data elements used in eCQMs are built from the datatypes and attributes in the Quality Data Model located at http://ecqi.healthit.gov/qdm-quality-data-model. That site provides additional explanation and description of the elements contained in the QDM.

5.1   Value Set Location and Tools

Value Sets – Value Set Authority Center

The National Library of Medicine (NLM), in collaboration with ONC and CMS, maintains the NLM Value Set Authority Center (VSAC) (https://vsac.nlm.nih.gov). The VSAC provides downloadable access to all official versions of value set content contained in the eCQM specifications. The value sets are lists of unique coded identifiers with names (called "descriptions") for groupings of clinical and administrative concepts selected from standard vocabularies. Value sets are used to define the set of concepts (for example, diabetes or clinical visit) that will identify selected populations and satisfy measure criteria in eCQMs. Value sets used in eCQMs and available in the VSAC can either directly contain code system members or reference other value sets (i.e., "a grouping value set"). The VSAC also provides value set authoring capabilities for registered value set authors and maintains up-to-date value set content based on each new version of the underlying code systems (CPT, ICD-10, SNOMED CT, LOINC, etc.) used in value sets. To find the list of code systems, select 'help' in the VSAC. To encourage appropriate use of value sets, authors should complete the value set metadata fields provided in VSAC. These fields include Clinical Focus, Data Element Scope, Inclusion Criteria, and Exclusion Criteria. More information is provided in VSAC authoring guidelines.

NLM has an application programming interface (API) to the VSAC content in addition to a web interface. The API documentation is accessible in the Help section of the VSAC Web page available at https://vsac.nlm.nih.gov.

The VSAC also offers the "Downloadable Resource" Table, accessible from the "Download" tab on the VSAC Web page. This location provides links to the value set content used in each of the official eCQM release sets, including the previous eCQM releases. The release downloads for the value set collections are provided in both Excel and Sharing Value Sets (SVS)-compliant XML for all Eligible Hospital and all Eligible Professional/Eligible Clinician value sets. These downloads provide delta files to help users identify which value sets have changed from the last release. The VSAC also provides three additional resources:

- The Binding Parameter Specification (BPS) documents the information used to create the value set expansions made available for an annual release or addendum. The BPS contains the code system version, the value set definition version, and the expansion profile information used to create each of the value set expansions included in the annual release, sorted by measure and QDM data element datatypes.

- A list of Retired/Legacy Codes Currently in eCQM Value Sets Published in the value set release.

- A list Code System Versions used in eCQM Value Sets Published in the value set release.
- A list of Direct Referenced Codes, the individual terminology codes specified within measure logic to describe QDM elements when a single code is appropriate rather than a value set.

Access to the VSAC requires a free Unified Medical Language System® (UMLS) Metathesaurus License (available at https://uts.nlm.nih.gov/license.html). Any use of value sets must be consistent with the licensing requirements and copyright protections covered by this UMLS license.

NLM VSAC Collaboration Tool

The VSAC Collaboration tool supports communication, knowledge management, and document management by value set authors and stewards. VSAC Collaboration provides a central site where value set authors can post value sets for collaborative discussion. Teams can share threaded discussions about the value sets, view recent value set expansions posted by site members, organize their value sets by usage and the team's workflow needs, and receive activity and change notifications from VSAC.

The VSAC Collaboration Tool can be accessed directly at https://vsaccollab.nlm.nih.gov/collab/page/ and through the VSAC Authoring Tool (https://www.nlm.nih.gov/vsac/support/usingvsac/author_registration.html Authoring Tab). The VSAC Collaboration Tool training webinars and slides are available at https://www.nlm.nih.gov/vsac/support/userforum/userforum.html.

Metadata Portal – United States Health Information Knowledgebase

The Agency for Healthcare Research and Quality (AHRQ), in collaboration with CMS, NLM, and ONC, maintains the CMS Quality Reporting Program Portal in the United States Health Information Knowledgebase (USHIK) (http://ushik.ahrq.gov/mdr/portals/mu). USHIK presents the eCQMs, data elements, and their value sets. The eCQMs may be downloaded in HL7's HQMF format (xml), Adobe (pdf), Excel (xls), and comma-separated value (csv) format. USHIK allows for comparisons between measure versions and provides a single flat-file format containing all the eCQM clinical data elements. All user feedback on measures received by USHIK is sent to the ONC JIRA issue trackers for review. UHSIK has been integrated with the eCQI Resource Center, allowing end users to access eCQM details and comparisons from the Eligible Hospital/Critical Access Hospital and Eligible Professional/ Eligible Clinician pages of the eCQI Resource Center.

5.2   Direct Referenced Codes

Beginning with QDM v5.3 Annotated, a *direct referenced code* can be used to specify QDM elements in measure logic rather than creating "single code value sets". This prevents using an alternative identifier for a code system concept and eliminates additional implementation work to unpack the value set. These codes, such as birth date and death date, are included directly with the measure logic and in the terminology section of the HQMF. Some value sets that contain only one code will continue to exist for the following circumstances:

1. There is only one code available at the time the value set is created; however, there is a reasonable expectation that additional codes will be created to represent the intent of the value set.

2. A value set initially contained multiple codes, however all except one was retired by the code system(s). Since the measure may need to allow look-back, the value set remains valid with only one active code.

An example of direct reference code use from CMS22, where **Diastolic blood pressure** is a QDM element referenced by a single code within the CQL logic. This code is then called out in both the Terminology and Data Criteria (QDM Elements) sections:

> ```
> "Qualifying Encounters During Measurement
> Period" QualifyingEncounter
> ```
>
> ```
> with ["Physical Exam, Performed": "Diastolic
> blood pressure"] DiastolicBP
> ```
>
> ```
> such that DiastolicBP.relevantPeriod starts
> during QualifyingEncounter.relevantPeriod and
> DiastolicBP.result is not null with ["Physical
> Exam, Performed": "Systolic blood pressure"]
> SystolicBP
> ```
>
> ```
> such that SystolicBP.relevantPeriod starts
> during QualifyingEncounter.relevantPeriod and
> SystolicBP.result is not null sort by start of
> relevantPeriod
> ```

Terminology

- codesystem "LOINC" using "2.16.840.1.113883.6.1 version 2.63"

- code **"Diastolic blood pressure"** using **"LOINC version 2.63 Code (8462-4)"**

- code "Systolic blood pressure" using "LOINC version 2.63 Code (8480-6)"

Data Criteria (QDM Data Elements)

- "Physical Exam, Performed: Diastolic blood pressure" using "**Diastolic blood pressure** (LOINC version 2.63 Code 8462-4)"

- "Physical Exam, Performed: Systolic blood pressure" using "Systolic blood pressure (LOINC version 2.63 Code 8480-6)"

5.3   QDM Category and Code System

The CMS Measures Management Blueprint includes a section on Quality Data Model categories with recommended code systems. Most data elements are linked to a value set or grouping value set that complies with these recommendations. Downloadable resources of value sets by QDM datatype are also available on the VSAC website at the "Download" tab.

Some measures combine different options (definitions) to express instances of a single QDM datatype within the logic. An example for **Qualifying Encounters** can be found in the Initial Population for CMS131:

```
 ( ["Encounter, Performed": "Office Visit"]

union "Encounter, Performed": "Annual Wellness Visit"]

union "Encounter, Performed": "Preventive Care Services –
Established Office Visit, 18 and Up"]

union ["Encounter, Performed": "Preventive Care Services-
Initial Office Visit, 18 and Up"]

union ["Encounter, Performed": "Home Healthcare Services"

union ["Encounter, Performed": "Ophthalmological Services"]
) Encounter

where Encounter.relevantPeriod during "Measurement Period"
```

In this example, seven distinct types of encounters all use the same QDM datatype (Encounter, Performed) and each binds a grouped value set using a single code system, using the logic (Union) to express that any of these encounter types meet the measure criteria. Together, these seven types of encounters provide codes that cover the recommended code system, SNOMED CT, as well as the transitional code systems, Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS).

CMS/ONC encourages users of the eCQM updated for 2019 reporting/performance to report suggested additions and deletions to data elements both within value sets and between code systems using the [JIRA Clinical Quality Measures Feedback System](the homepage link) at http://jira.oncprojecttracking.org/browse/CQM/ (direct link to issue tracking).

5.4   Drug Representations Used in Value Sets

Value sets referring to specific, non-vaccine, prescribable medications use generalized drug concepts (for example, RxNorm "SCD" - Semantic Clinical Drugs[1]). It is expected that vendors/providers will report the drug entities in patient data using the generalized drug concepts included in the defined value sets. These accord with CMS guidance about the preferred use of generalized drug concepts. Implementers should use the relationships found in RxNorm (https://www.nlm.nih.gov/research/umls/rxnorm/index.html) to support mapping between specific drug entities found in patient records to those found in the value sets provided. Vaccine medications are currently represented using CVX codes.

5.5   Discharge Medications

The use of "Medication, Discharge" has a very specific meaning in the Eligible Hospital eCQMs for 2019 reporting/performance. As with prior eCQM versions, this designation refers to medications that have been reconciled and are listed on the patient's Discharge Medication List. "Medication, Discharge" events should not be confused with medications that happen to be

---

[1]   https://www.nlm.nih.gov/research/umls/rxnorm/docs/2015/appendix5.html.

active at the time of discharge. "Medication, Discharge" events should start and end within the time duration of the episode of care, even though the medication itself may not be started until after the episode ends. It is expected that, at the time of discharge, discharge medications will be the same as the subsequent home medication lists for those medications that are germane to the quality measure, but this cannot be assumed at the time of admission because changes may have occurred since the prior episode of care.

Example measure logic for "Medication, Discharge" is seen in CMS105 where the numerator logic refers to a "Statin at Discharge" definition that contains ["Medication, Discharge": Statin Grouper"] and refers to the presence of a stain medication on the discharge medication list of the ischemic stroke encounter.

```
Numerator

TJC."Ischemic Stroke Encounter" IschemicStrokeEncounter
  with "Statin at Discharge" DischargeStatin

      such that DischargeStatin.authorDatetime during
      IschemicStrokeEncounter.relevantPeriod

Statin at Discharge

          ["Medication, Discharge": "Statin
          Grouper"]
```

Vendors/providers generating Quality Reporting Document Architecture (QRDA Category I) output will need to generate "Medication, Discharge" events for all medications on the discharge list with appropriate timestamps to enable the correct function of measure logic.

5.6   Allergies to Medications and Other Substances

All measures that reference allergy value sets are updated to reference value sets that contain appropriate codes from RxNorm that align to ingredient-level concepts. Users can utilize RxNorm relationships to link ingredients to the specific drug entities that may occur in patient records. The reactions that occur, such as rash or wheezing, should be expressed using codes that represent the appropriate condition using SNOMED CT.

This means allergens included in "Medication, allergy: *medication allergen (or ingredient)*" value sets should be represented using RxNorm "ingredient-type" concepts. These concepts only identify the ingredient and not the form or strength and have the RxNorm term type (TTY) consistent with ingredient-level identifiers. If patient allergy and intolerance data in the EHR is not recorded using an RxNorm ingredient-type concept, reporting entities will need to use RxNorm relationships to identify the correct ingredient concept for the drug concept used in the EHR.

SNOMED CT is expected to be used for coding non-medication allergy-inducing entities.

5.7   Principal Diagnosis in Inpatient Encounters

Previously, QDM used the datatype "Diagnosis, Active (ordinarily: Principal)" to convey a specific meaning in the eCQMs for hospitals and should be consistent with its definition in the Uniform Hospital Discharge Data Set (UHDDS) as "that condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care." QDM v4.2 changed the way encounter-based diagnoses should be expressed and these changes carry through to QDM v5.3 as well. QDM v4.2 added attributes to "Encounter, Performed" to allow "Encounter, Performed (principal diagnosis)" or "Encounter, Performed (diagnosis)" and removed the "Diagnosis" *principal* attribute. The designation refers to the principal diagnosis of an episode of care, as in the previous definition. This is typically determined at or after discharge time by a coder and is used for the billing transaction. In EHRs, the Principal Diagnosis is typically chosen from among the diagnoses that were active during the encounter and, if consistent with the UHDDS definition, should be labeled as "Principal." For purposes of measure computation, the principal diagnosis should be considered to start during the episode of care.

The QDM Encounter, Performed attribute "principal diagnosis," associates the diagnosis with the encounter by definition. Other diagnoses present within the encounter can be expressed with the Encounter, Performed attribute "diagnosis"; however, such other diagnoses may have started prior to, at the start of, or after the start of the encounter. The Encounter, Performed attribute (diagnosis) does not specify the exact timing relationship. Therefore, to express the timing relationship of a specific diagnosis with an encounter, the measure must use the QDM datatype Diagnosis to associate with the Encounter, Performed (i.e., onset at the start or end of the episode of care). The admission or discharge diagnoses recorded by the provider should not be used as a substitute for the principal diagnosis unless they are concordant with the principal diagnosis as defined by CMS.

Vendors and providers generating QRDA Category I output will need to specify diagnoses appropriately to enable the measure logic to function correctly. Although it is most probable that the principal diagnosis commences prior to the episode of care, the principal diagnosis should always be reported with a QRDA Category I entry that starts during the episode of care.

5.8   Principal Procedure in Inpatient Encounters

The use of "Procedure, Performed (ordinality: Principal)" had a very specific meaning in the Eligible Hospital measures. This designation refers to the principal procedure during an episode of care, as defined by CMS, and is typically determined at or after discharge time and used for the billing transaction. The principal procedure is typically chosen from among the procedures performed during the encounter. The procedure that is chosen (post-discharge) as the principal procedure should be labeled as "Principal" and the timing should reflect the timing of the actual procedure.

Vendors/providers generating QRDA Category I output will need to label procedures appropriate to enable the measure logic to function correctly.

5.9   Medical Reason, Patient Reason, System Reason

Because of limitations in EHRs and use of free text in some record systems, it may be difficult to capture certain data elements that should exclude patients or components of care (e.g., medication administration, physician order not done) from a measure. The use of negation to identify these exclusions is expressed in the logic via exceptions and exclusions. The concepts of medical reason, patient reason, and system reason, when deemed appropriate by providers, are selected to identify the reason for the exclusion. For example, a rare but relevant comorbidity would be a medical reason for exclusion, while a patient's religious preference would be a patient reason for exclusion. It is intended that these concepts be used only when the record has a documented reason for exclusion. Although it is not necessary to report that reason electronically, it is expected that there is a legitimate medical, patient, or system reason for exclusion and that that evidence supporting the reason is present in the record.

Health IT vendors/providers using these concepts are expected to have a documented reason for these exclusions and could be expected to demonstrate the relevant justification if audited. **The CMS QRDA Implementation Guide provides more detailed guidance on how to use null values to describe activities that were "not done."**

5.10   Activities That Were "Not Done"

A negation attribute may be used to identify situations where an expected action did not occur, an order was not placed or administered, or a finding was not observed for a documented reason. Prior to April 2014, the approach to an action being "not done" required providing a single code to indicate that a set of activities were "not done." In 2014, this approach was modified to use some ingredient-level codes for medications that were "not done."

In the May 2016 eCQM release, the QRDA Category I Release 3 and CMS QRDA Implementation Guide directed implementers instead to use null values to replace a specific code associated with a value set when describing activities that were negated or "not done." Thus, providers are not required to specify that they did not perform a specific member from the value set; rather, the recommended approach is that they will indicate what they did not do on *any* of the items in the value set. This approach is intended for use with all datatypes that use negation to describe activities "not done." It does not change the expression of negation in the HQMF; however, it does require using an HL7 nullFlavor code instead of a specific code from the value set associated with these activities in the QRDA Category I file.

The intent of the null flavor in this context is to specify that ALL the activities in the value set were intentionally not done, not that a single activity was not done or that it is not known why that activity was not completed. It is not appropriate for users to certify that an activity was not done using negation unless the provider intentionally did not order or perform the activity in question and documented a justification why that was the case.

Figure 3 presents an example of a negation instance being "not done" in a QRDA Category I file.

```
<entry>
        <!--Medication administered not done,
            patient refusal: Drug declined by patient - reason intolerance.
            No "Antibiotic Medications for Pharyngitis" were administered -->
        <act classCode="ACT" moodCode="EVN" negationInd="true">
            …
        <consumable>
          <manufacturedProduct classCode="MANU">
              …
              <manufacturedMaterial>
                  <code nullFlavor="NA"
sdtc:valueSet="2.16.840.1.113883.3.464.1003.196.12.1001">
                        <originalText>None of value set: Antibiotic Medications for
Pharyngitis</originalText>
                  </code>
              </manufacturedMaterial>
          </manufacturedProduct>
        </consumable>
            …
        </act>
    </entry>
```

Figure 3. Example of a Negation Instance Being "not done" in a QRDA Category I File

Vendors/providers using these concepts are expected to have a documented reason for these exclusions and could be expected to demonstrate the relevant justification if audited.

In referencing value sets used to negate activities, developers had previously used ingredient-level value sets to group medications for negation because this provided improved usability to providers. Now that the updated approach allows negation of the entire value set, the same detailed value sets used for Medication, Order or Medication, Administered in the measure logic can be used throughout and the logic can be implemented in a more workflow-friendly fashion. Ingredient-level value sets have been retired for negation purposes, but are still used for allergies. This approach also should streamline additional types of negations, such as groups of procedures.

Beginning with QDM v5.3 Annotated, a *direct referenced code* could be used to specify QDM elements in measure logic rather than creating value sets. For "not done" measure logic specified using value sets, the foregoing described approach should be followed when report is "not done". If "not done" measure logic is specified using *direct referenced code*, then *direct referenced code* itself should be negated directly and null flavor should not be used when submitted in a QRDA Category I file. The CMS QRDA Implementation Guide STU 5 provides additional guidance on how to use null values to describe activities that were "not done" using value sets, and how to report "not done" if *direct referenced code* is used.

5.11 Clinical Trial Participation

Participation in a clinical trial may be a clinical reason to exclude a patient from an expected course of action in some eCQMs; however, only participation in certain types of trials may be relevant based on the steward's intent. Due to limitations in data from EHRs, the specific nature

of clinical trial participation may not be captured in the eCQMs. Measure developers have taken two approaches to address this issue. In some cases, particularly for hospital measures, clinical trial participant exclusions have been removed from the measure. In other cases, measure developers have provided guidance for the type of clinical trial that should be considered to meet measure intent. It is recommended that implementers carefully review the guidance regarding clinical trial participation and developer intent regarding acceptable types of clinical trials.

5.12 Newborn/Gestational Age

Two of the eCQMs (CMS113 and CMS9) are designed for use in an encounter that includes delivery, birth, or the time immediately after birth and require capture of gestational age. In the specifications, a newborn at term indicates the gestational age is ≥ 37 weeks and 0 days using best estimated due date (EDD) and rounded off to the nearest completed week. This represents a derived value that is calculated from existing data. These measures represent this gestational age calculation as an observation (i.e., the result of an Assessment, Performed), ideally as a component of a standard labor and delivery assessment during delivery, or prenatal assessments prior to delivery.

5.13 Source

All QDM datatypes allow *dataflow* attributes, including *source, recorder,* and *health record field*. *Source* refers to the individual or device that is the originator of the quality data element. *Recorder* refers to the individual or device that enters the information into the *health record field* (where the information is found in the EHR). With respect to health record field, it is generally too prescriptive for a measure to expect the exact location for any specific information to be present. QDM can express source and recorder, but the ability of any given EHR to determine such provenance of a specific data element is limited. Therefore, measures do not use the source and recorder attributes in QDM. For example, to know that a diagnosis was entered by a specific type of clinician (e.g., a nurse versus a physician) requires a code system that can express types of providers, a value set describing the type required, and the EHR's ability to map such a value set to the originator of the data and share it as metadata with the information. The structure of the eCQMs, therefore, does not require such information at this time for certification. Although the intent of some measures is to use information from a specific source, this is not currently captured in the eCQMs for 2019 reporting/performance and will not be included in certification. The ability to capture electronically the source of a data element will require evaluation of standards and code systems, as well as the use of such standards routinely in EHRs, to be incorporated into future stages of eCQMs.

5.14 Patient Characteristic Birthdate and Patient Characteristic Expired

Beginning with QDM v5.3, measure developers will be able to specify individual codes to describe QDM elements rather than creating value sets. The term used for such a single code in an eCQM without a value set is *direct referenced code*. Current uses of direct referenced codes include birth date and death date because these two concepts are used in many measures. These codes are embedded in the MAT structure so that measure developers do not need to create a direct referenced code or value set for these two concepts. Beginning with implementation of QDM v5.3 and CQL, direct referenced codes will be included directly with the measure logic

and in a new terminology section of the HQMF. The eCQM references any direct referenced codes used in each measure with two exceptions. Previous versions of eCQMs fixed these two codes in the logic; they cannot be further defined by a value set. The fixed codes reference birth date and expired, as shown:

```
"Patient Characteristic Birthdate" is fixed to LOINC code
21112-8

"Patient Characteristic Expired is fixed to SNOMED CT® code
419099009
```

5.15 Supplemental Value Sets Representing Race & Ethnicity

5.15.1 Race & Ethnicity

The eCQM specifications limit the reporting of patient race to the CDC value set "Race" 2.16.840.1.114222.4.11.836:

Code Description

1002-5 American Indian or Alaska Native

2028-9 Asian

2054-5 Black or African American

2076-8 Native Hawaiian or Other Pacific Islander

2106-3 White

2131-1 *Other Race*

To report an individual patient with a single race category in QRDA Category I, place one of the five (5) OMB race category codes (1002-5, 2028-9, 2054-5, 2076-8, and 2106-3) into raceCode. To report an individual patient with more than one race category, one race is reported in raceCode, and additional races should be placed into extension(s) using sdtc:raceCode. As in accordance with the standard, all the race codes placed here are equivalent in priority. For QRDA Category I, Other Race 2131-1 should not be used because missing patient race information should be described using null values (described in the following paragraphs).

For QRDA Category III files, a patient with multiple races should be identified with raceCode category 2131-1 Other Race. This allows patients with multiple races to be expressed in an aggregate document without creating multiple entries for a single patient with multiple races. It should be noted that only QRDA Category III files should use the raceCode 2131-1 Other Race to express a raceCode category.

Similarly, the specifications limit the reporting of ethnicity to the CDC value set "Ethnicity" 2.16.840.1.114222.4.11.837:

2135-2 Hispanic or Latino

2186-5 Not Hispanic or Latino

In addition, the 2015 Cert Rule states the following:

§170.315 (a)(5) *Demographics—*

1. Enable a user to record, change, and access patient demographic data including race, ethnicity, preferred language, sex, sexual orientation, gender identity, and date of birth.

   1. *Race and ethnicity.*

      1. Enable each one of a patient's races to be recorded in accordance with, at a minimum, the standard specified in § 170.207(f)(2) and whether a patient declines to specify race.

      2. Enable each one of a patient's ethnicities to be recorded in accordance with, at a minimum, the standard specified in § 170.207(f)(2) and whether a patient declines to specify ethnicity.

      3. Aggregate each one of the patient's races and ethnicities recorded in accordance with paragraphs (a)(5)(i)(A)(*1*) and (*2*) of this section to the categories in the standard specified in § 170.207(f)(1).

Notably, the Centers for Disease Control and Prevention (CDC) value sets for race and ethnicity do not contain code(s) for "Patient Decline."

To communicate that a demographic element is unknown or that the patient declined to provide the information for race and ethnicity, use the built in "nullFlavor" feature of QRDA designed for this purpose. The nullFlavor feature works for race, ethnicity, preferred language, and other cases where the QRDA calls for a value from a value set and nullFlavor is allowed as specified by the standard.

Normally, one would communicate race in a QRDA like this:

```
<raceCode code="2106-3"
displayName="White"codeSystem="2.16.840.1.113883.6.238"/>
```

Where the value is unknown, one would use the nullFlavor UNK for "Unknown" like this:

```
<raceCode nullFlavor="UNK"/>
```

Where the patient declined to answer, one would use the nullFlavor ASKU for "Asked but Unknown" like this:

```
<raceCode nullFlavor="ASKU"/>
```

5.15.2 ONC Administrative Sex Value Set

Beginning with 2017 performance/reporting, any value set to identify the patient's gender is to use codes from the AdministrativeGender (not AdministrativeSex) code system when specifying birth sex. The actual codes (M and F) did not change. ONC has created a new definition version for all gender value sets in which the code system changed from AdministrativeSex to AdministrativeGender. The value set object identifiers (OID) of the two affected value sets remain the same. The code system does not include the HL7 V2 code "Unknown," which means

the "Administrative Sex" value set (unchanged OID 2.16.840.1.113762.1.4.1) now contains only the codes:

F   Female

M   Male

The code system to be used when representing the gender of the patient is the AdminstrativeGender (OID: 2.16.840.1.113883.5.1) code system. This code system is already used for the ONC Administrative Sex value set required for recording the patient gender in a QRDA Category I. With the value sets for 2017 performance/reporting, the gender-specific value sets used within eCQM logic to identify gender-specific patient populations will also use the AdministrativeGender code system to define the included code in the value set. These value sets previously used the older "AdministrativeSex" code system. Since the actual codes ("M" and "F") are the same in both code systems, the codes included in each gender-specific value set remain the same. With this change, the version of the value set will change. The two value sets affected are:

1. "Female" (OID: 2.16.840.1.113883.3.560.100.2)

2. "Male" (OID: 2.16.840.1.113883.3.560.100.1)

The value set intent is to capture the biologic phenotypic sex that would be captured on the patient's initial birth certificate. If the data is missing, it is not possible to determine the patient sex, or if the patient's birth certificate sex is undetermined, then one should use the nullFlavor "UNK" as described above in race and ethnicity.

The CMS QRDA Implementation Guide provides additional guidance on how to use null values to describe race, ethnicity, and administrative sex data when the response is declined by the patient or is unknown.

5.16 ICD-9 and ICD-10 Codes in Value Sets

5.16.1   Use of Non-Clinical or Administrative Code Systems

Specifications for eCQMs include terminologies in value sets derived from clinical vocabulary standards as well as those originally specified for administrative purposes such as billing and payment or mortality data. As an example, diagnosis value sets contain terms in the standard vocabulary (SNOMED CT) and the transition vocabularies (ICD-9 and ICD-10).

In October 2015, CMS formally retired the use of International Classification of Diseases, Ninth Revision (ICD-9) code systems for billing and reporting purposes. CMS designated a one-year period of transition to complete the phasing out of the ICD-9 content, which ended on October 1, 2016. The eCQMs, however, use ICD-9 codes in multiple ways, including look-back periods or to reference historical data. Therefore, CMS and ONC provided the following guidance to developers:

> For ICD-9 codes in the 2017 measure updates, measure developers were directed to review all ICD-9 codes in measure value sets as with any measure update. For ICD-9 value sets, the expectation is they will be removed if they only pull patients

into the measure based on timing starting from the end of CMS's transition period to ICD-10. Therefore, it is expected that many ICD-9 value sets will remain to represent historical data and that is permitted per a consensus-based decision across the eCQM stakeholder federal agencies and partners. It is not expected that any new ICD-9 value sets will be added, however we are aware of one instance where ICD-9 was added to account for a data element requiring a look-back period. Moving forward, we expect the gradual phasing out of ICD-9 codes in the value sets.

It is recommended that measure implementers carefully review technical release notes and value sets to determine where value set changes may affect their ability to capture data for the 2017 specifications and adjust accordingly.

5.16.2   Value Set Addendum

Based on input from eCQM users requesting that eCQMs include current codes, CMS may release a value set addendum of new codes for use in performance/reporting *after* the initial eCQM annual specification updates are published. Value set addenda only include changes in value sets codes and make neither changes to eCQM logic, nor to value set OIDs (identifiers). Value set addenda and updated supporting materials such as the Binding Parameter Specification document, will be made available through links on the eCQI Resource Center on the EH/CAH measures and EC/EP measures pages. The complete set of addendum value sets (both changed and unchanged) will be made available on the VSAC download page. Should CMS publish an addenda, links to previous versions of value sets and supporting materials will be made available on the 'View Archive' section of the EP/CAH and EC/EP pages of the eCQI Resource Center.

5.17   Display of Human-Readable HQMF

The display of header information in the human-readable HQMF for eCQMs was changed in 2016 by removing populations that are not included in the measure specifications. For proportion measures, references to measure population, measure population exclusions, and measure observations have been removed from the header. For continuous variable measures, references to denominator, denominator exclusions, numerator, numerator exclusions, and denominator exceptions have been removed. The Measure Item Count attribute in the header has been removed from the eCQMs human-readable HQMF published in May 2017 for use in 2018 performance/reporting. This attribute was used to indicate whether an eCQM is an encounter-based or a patient-based measure. This information is now clearly specified through CQL-based measure logic itself.

The human-readable html file of an eCQM is contained in the measure specification package zip file. The human-readable display could also be viewed directly from the measure page for a specific eCQM on the eCQI Resource Center.

6. Measure Guidance – Measure Release Notes

CMS provides measure guidance to assist with understanding and implementation of the new eCQMs. Measure guidance is available in the human-readable HTML and the eCQM HQMF XML files within the measure specification package zip files located on the eCQI Resource Center. The guidance can be found in the measure header, within the inline comments in the measure logic itself, and in the release note section of each individual eCQM posted on the eCQI Resource Center. Guidance should be considered as critical to the correct implementation of the quality measure; however, certification testing and measure reporting will look only for the computable, coded elements present within the measure logic.

The Technical Release Notes are available on the eCQI Resource Center for Eligible Hospitals/Critical Access Hospitals and Eligible Professionals/Eligible Clinicians.

7.   JIRA – Clinical Quality Measure Feedback System

ONC and CMS contractors manage and respond to eCQM stakeholders through the JIRA feedback system. The system supports feedback and questions in all phases of the eCQM life cycle, including development, approval, implementation and updates regarding measure intent, specifications, certification, and standards as well as errors associated with the eCQMs. Most issues related to eCQMs should be reported to the eCQM Issue Tracker; users may also ask questions or raise issues about other eCQM tools and standards. Quality reporting issue trackers include:

- eCQM Issue Tracker – eCQM implementation issues
- Comments on eCQMs under Development – Feedback on proposed HHS eCQMs implementation feasibility
- CQL Issue Tracker – Clinical Quality Language development and implementation issues
- QDM Issue Tracker – Quality Data Model development and implementation issues
- QRDA Issue Tracker – Quality Reporting Document Architecture implementation issues
- Bonnie Issue Tracker – eCQM testing tool issues
- Cypress Issue Tracker – Certification testing tool test cases and implementation issues
- CMS Hybrid Measures – Hybrid measure implementation issues

Visit the ONC JIRA homepage at: https://oncprojectracking.healthit.gov. Information regarding creating a JIRA account, searching for an issue and creating an issue is available on the JIRA 101 page of the system.

An end user must create an account and sign in to create, watch or comment on a issue (ticket). Before reporting a new issue, users should first search JIRA to determine if a similar question has already been reported and addressed. If the issue has been reported, users can "watch" an issue, which allows the user to get updates on the issue.

When reporting a new issue, users should fill out the ticket completely. Select a title that summarizes your issue and describe the issue in the "description" field. CMS/ONC encourages users to add attachments—without Protected Health Information (PHI)—wherever possible to encourage a quick and accurate response. If insufficient information is entered, the issue will be labeled "Pending for clarification" and will not include a response until the user/reporter updates the ticket. An issue in "Solution review" is a proposed solution and should not be considered final until the ticket is "Resolved." Tickets will not be closed until final correction of the identified issue has been completed. There may be delays in responding to issues that require updates to standards and/or feedback from many stakeholders.

If a response is insufficient to answer an issue entered, the reporter can "Reopen" the issue. The reporter should explicitly state how the previous answer did not adequately address the issue. It is appropriate to comment or send an email regarding a missing resolution if there has not been any update or response in more than two (2) weeks and there is no comment from the assignee explaining the delay or when the approximate resolution will be available.

8. CMS Quality Program Helpdesks

Questions on CMS quality and value-based purchasing program reporting requirements should be directed to the specific CMS quality reporting program as follows:

- Hospital Inpatient Quality Reporting (IQR) Program, please contact the Hospital Inpatient Value, Incentives, and Quality Reporting Outreach and Education Support Team at https://cms-ip.custhelp.com or (844) 472-4477

- Medicare and Medicaid Promoting Interoperability Program (previously known as the Medicare and Medicaid EHR Incentive Programs) contact the Quality Net help desk for assistance qnetsupport@hcqis.org or 1-888-734-6433/TTY: 888-734-6563

- *QualityNet* Secure Portal, Pre-Submission Validation Application (PSVA) tool and file-error messages contact the *QualityNet* Help Desk at qnetsupport@hcqis.org or (866) 288-8912

- Quality Payment Program (QPP), contact QPP@cms.hhs.gov or (866) 288-8292/TTY: 1-877-715-6222

- Medicaid Eligible Professionals and Medicaid-only Eligible Hospitals participating with the Medicaid Promoting Interoperability Program (previously known as the Medicaid EHR Incentive Program) should contact their state Medicaid agencies.

Appendix A. Standards and Code Systems

Standards related to the updated eCQM specifications for 2019 reporting/performance:

- C-CDA R2.1 – HL7 CDA R2 Implementation Guide: Consolidated Clinical Document Architecture Templates for Clinical Notes (US Realm) DSTU Release 2.1 (with errata)
- HQMF R1 Normative – HL7 Version 3 Standard: Representation of the Health Quality Measures Format Release 1
- CQL-based HQMF Implementation Guide R2.1 – Clinical Quality Language-based Health Quality Measures Format Implementation Guide Release 1, Standard for Trial Use 2.1
- CQL R1 STU 2 – HL7 Cross-Paradigm Specification: Clinical Quality Language Specification, Release 1
- QRDA-I R1 STU R5 – HL7 CDA® R2 Implementation Guide: Quality Reporting Document Architecture - Category I (QRDA I) ST Release 5 – US Realm
- QRDA-III R1 STU R2.1 – CDA® R2 Implementation Guide: Quality Reporting Document Architecture - Category III (QRDA III) STU Release 2.1 – US Realm
- QDM v5.3 – Quality Data Model
- CMS QRDA IGs – CMS Quality Reporting Document Architecture Implementation Guides (publication of CMS QRDA-I IG for Hospital Quality Reporting expected May 2018 and CMS QRDA-III IG for Eligible Clinicians and Eligible Professionals Programs expected July 2018)

Code system versions used in the eCQM specifications for 2019 reporting/performance:

- AdministrativeGender HL7V3.0_2017-07 – Administrative Gender Value Set Version 3.0
- CDCREC 1.1 – Centers for Disease Control and Prevention Race and Ethnicity Code Set Version 1.1
- CDT 2018 – Current Dental Terminology 2018
- CPT 2018 – Current Procedural Terminology 2018
- CVX 2017-11 – Clinical Vaccine Formulation 2017-11
- HCPCS 2017 – Healthcare Common Procedure Coding System 2017
- ICD-10-CM 2018 – International Classification of Diseases, Tenth Revision, Clinical Modification, 2018
- ICD-10-PCS 2018 – International Classification of Diseases, Tenth Revision, Procedure Coding System, 2018
- LOINC 2.63 – Logical Observation Identifiers Names and Codes 2.63
- RxNorm 2018-01 - A normalized naming system for generic and branded drugs

- SNOMED CT US Edition 2017-09 – A comprehensive and precise health terminology for electronic exchange of clinical health information
- SOP 7.0 – Source of Payment 7.0

Appendix B. Time Interval Definitions and Examples

Table 3. Time Interval Definitions and Examples

Unit	CQL Definition	Examples
Year	Defined as the duration of any time interval which starts at a certain time of day at a certain calendar date of the calendar year and ends at: • The same time of day on the same calendar date of the next calendar year, if it exists • The same time of day on the immediately following calendar date of the next calendar year, if the same calendar date of the next calendar year does not exist. **Note:** When in the next calendar year the same calendar date does not exist, the ISO states that the ending calendar day has to be agreed upon. The above convention is used in CQL as a resolution to this issue.	Month (date 2) < month (date 1): Duration (years) = year (date 2) - year (date 1) - 1 **Example 1:** Date 1: 2012-**03**-10 22:05:09 Date 2: 2013-**02**-18 19:10:03 Duration = year (date 2) - year (date 1) - 1 = 2013 - 2012 - 1 = **0 years** Month (date 2) = month (date 1) and day (date 2) >= day (date 1) Duration (years) = year (date 2) - year (date 1) **Example 2.a:** day (date 1) = day (date 2) Date 1: 2012-03-**10** 22:05:09 Date 2: 2013-03-**10** 22:05:09 Duration = year (date 2) - year (date 1) = 2013 - 2012 = **1 year** *Note: Time of day is important in this calculation. If the time of day of Date 2 were less than the time of day for Date 1, the duration of the time interval would be 0 years according to the definition.* **Example 2.b:** day (date 2) > day (date 1) Date 1: 2012-03-10 22:05:09 Date 2: 2013-03-20 04:01:30 Duration = year (date 2) - year (date 1) = 2013 - 2012 = **year** Month (date 2) = month (date 1) and day (date 2) < day (date 1) Duration (years) = year (date 2) - year (date 1) - 1 **Example 3.a:** Date 1: 2012-02-29 Date 2: 2014-02-28 Duration = year (date 2) - year (date 1) - 1 = 2014 - 2012 - 1 = **1 year**

Unit	CQL Definition	Examples
Year		Month (date 2) > month (date 1) Duration (years) = year (date 2) - year (date 1) **Example 4.a:** Date 1: 2012-*03*-10 11:16:02 Date 2: 2013-*08*-15 21:34:16 Duration = year (date 2) - year (date 1) = 2013 - 2012 - **1 year** **Example 4.b:** Date 1: 2012-*02*-29 10:18:56 Date 2: 2014-*03*-01 19:02:34 Duration = year (date 2) - year (date 1) = 2014 - 2012 = **2 years** *Note: Because there is no February 29 in 2014, the number of years can only change when the date reaches March 1, the first date in 2014 that surpasses the month and day of date 1 (February 29).*
Month	Defined as the duration of any time interval which starts at a certain time of day at a certain calendar day of the calendar month and ends at: ● The same time of day at the same calendar day of the ending calendar month, if it exists ● The same time of day at the immediately following calendar date of the ending calendar month, if the same calendar date of the ending month in the ending year does not exist **Notes:** When in the next calendar year the same calendar date does not exist, the ISO states that the ending calendar day has to be agreed upon. The above convention is used in CQL as a resolution to this issue.	Day (date 2) >= day (date 1) Duration (months) = (year (date 2) - year (date 1)) * 12 + (month (date 2) - month (date 1)) **Example 1.a:** Date 1: 2012-03-01 14:05:45 Date 2: 2012-03-31 23:01:49 Duration = (year (date 2) - year (date 1)) * 12 + (month (date 2) - (month (date 1)) = (2012 - 2012) * 12 + (3 - 3) = **0 months** **Example 1.b:** Date 1: 2012-03-10 22:05:09 Date 2: 2013-06-30 13:00:23 Duration = (year (date 2) - year (date 1)) * 12 + (month (date 2) - (month date 1)) = (2013 - 2012) * 12 + (6 - 3) = 12 + 3 = **15 months** Day (day 2) < day (date 1) Duration (months) = (year (date 2) - year (date 1)) * 12 + (month (date 2) - month (date 1)) - 1 **Example 2:** Date 1: 2012-03-10 22:05:09 Date 2: 2013-01-09 07:19:33 Duration = (year (date 2) - year (date 1)) * 12 + (month (date 2) - month (date 1)) - 1 = (2013 - 2012) * 12 + (1 - 3) - 1 = 12 - 2 - 1 = **9 months**

Unit	CQL Definition	Examples
Weeks	Defined as a duration of any time interval which starts at a certain time of day at a certain calendar day at a certain calendar week and ends at the same time of day at the same calendar day of the ending calendar week. In other words, a complete week is always seven days long.	Duration = [date 2 - date 1 (days)] / 7 **Example 1:** Date 1: 2012-03-10 22:05:09 Date 2: 2012-03-20 07:19:33 Duration = [# days (month (date 1)) - day (date 1) + # days (month (date 1) + 1) + #days (month (date 1) + 2) + ... + # days (month (date 2) - 1) + day (date 2)] / 7 = (20 - 10) / 7 = 10 / 7 = **1 week**
Days	Defined as a duration of any time interval which starts at a certain calendar day and ends at the next calendar day (1 second to 23 hours, 59 minutes, and 59 seconds). The duration in days between two dates will generally be given by subtracting the start calendar date from the end calendar date, respecting the time of day between the two dates.	Time (date 2) < time (date 1) Duration = [date 2 - date 1 (days)] - 1 **Example 1:** Date 1: 2012-01-31 12:30:00 Date 2: 2012-02-01 09:00:00 Duration = 02-01 - 01-31 - 1 = **0 days** Time (date 2) >= time (date 1) Duration = date 2 - date 1 (days) **Example 2:** Date 1: 2012-01-31 12:30:00 Date 2: 2012-02-01 14:00:00 Duration = 02-01 - 01-31 = **1 day**
Hours	Defined as 60 minutes The duration in hours between two dates is the number of minutes between the two dates, divided by 60. The result is truncated to the unit.	**Example 1:** Date 1: 2012-03-01 03:10:00 Date 2: 2012-03-01 05:09:00 Duration = **hour** **Example 2:** Date 1: 2012-02-29 23:10:00 Date 2: 2012-03-01 00:10:00 Duration = **1 hour** **Example 3:** Date 1: 2012-03-01 03:10 Date 2: 2012-03-01 04:00 Duration = **0 hours**
Minutes	Defined as 60 seconds The duration in minutes between two dates is the number of seconds between the two dates, divided by 60. The result is truncated to the unit.	**Example 1:** Date 1: 2012-03-01 03:10:00 Date 2: 2012-03-01 05:20:00 Duration = **130 minutes** **Example 2:** Date 1: 2012-02-29 23:10:00 Date 2: 2012-03-01 00:20:00 Duration = **70 minutes**

Interval Comparisons:

CQL provides a complete set of interval comparison operators:

Figure 4. Interval Comparison Operators

Timing Phrases

CQL also supports timing phrases that make it easier to express precise relationships between intervals using natural language. The before and after operators can have a prefix of start or ends, and a suffix of start or end`. For example:
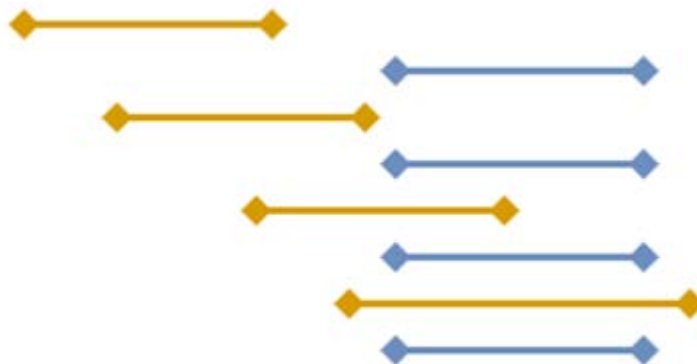
IntervalX starts before start IntervalY

Figure 5. Interval Starts Before Start

The before and after operators can also take an offset that indicates how far away a given relationship should be. The offset can be absolute, indicating that the boundary of the interval

must be on the offset, or it can be relative, indicating that the boundary must be at least on the offset:

IntervalX starts 3 days before start IntervalY

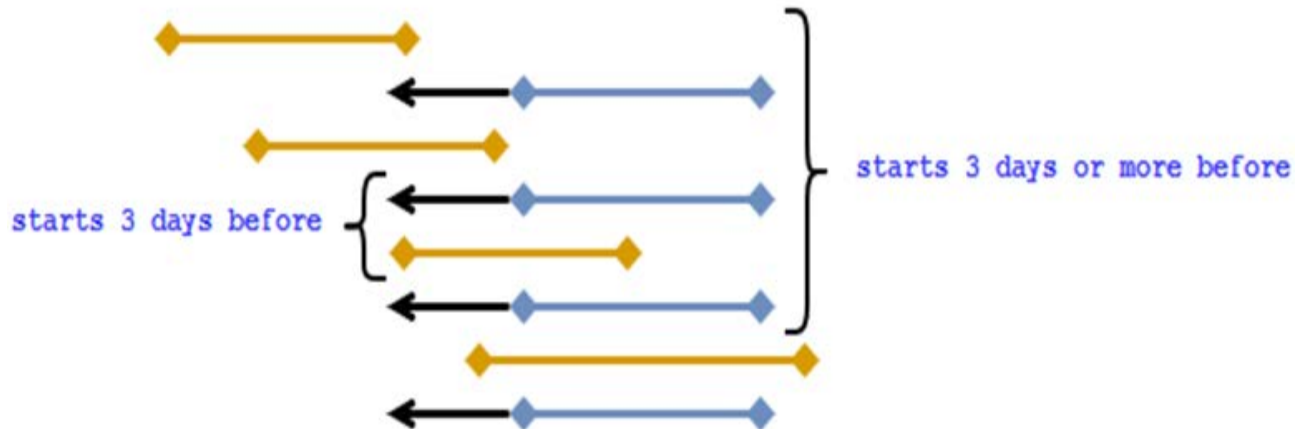IntervalX starts 3 days or more before start IntervalY

Figure 6. Interval Starts Before Start with Offset

You can also specify a range for the boundary relationship using the within..of operator:

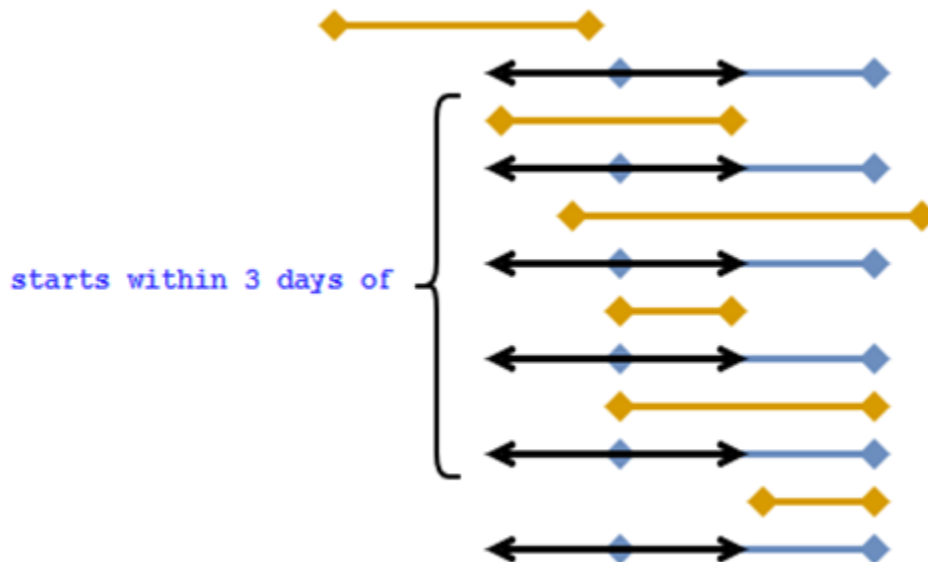IntervalX starts within 3 days of start IntervalY

Figure 7. Interval Starts Within

Acronyms

ACE	Angiotensin-Converting Enzyme
AHRQ	Agency for Healthcare Research and Quality
API	Application Programming Interface
ARB	Angiotensin Receptor Blocker
BPS	Binding Parameter Specification
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare & Medicaid Services
CPT	Current Procedural Terminology
CQL	Clinical Quality Language
CVX	The CVX code is a numeric string that identifies the type of vaccine product administered
DENEX	Denominator Exclusion: A subset of the Denominator that should not be considered for inclusion in the Numerator
DENOM	Denominator: A subset of the IP
DEXCEP	Denominator Exception: A subset of the Denominator
EC	Eligible Clinician
eCQI	Electronic Clinical Quality Improvement
eCQM	Electronic Clinical Quality Measure
ED	Emergency Department
EH	Eligible Hospital
EHR	Electronic Health Record
EP	Eligible Professional
HCPCS	Healthcare Common Procedure Coding System
HCQIS	Healthcare Quality Information System
HL7	Health Level Seven International
HQMF	Health Quality Measures Format
HTML	HyperText Markup Language
ICD	International Classification of Diseases
IP	Initial Population
IQR	Inpatient Quality Reporting

ISO	International Organization for Standardization
LOINC	Logical Observation Identifiers Names and Codes
MAT	Measure Authoring Tool
MIPS	Merit-based Incentive Payment System
NLM	National Library of Medicine
NQF	National Quality Forum
NUMER	Numerator: A subset of the Denominator
NUMEX	Numerator Exclusion
OID	Object Identifier
ONC	Office of the National Coordinator for Health Information Technology
PHI	Protected Health Information
QDM	Quality Data Model
QPP	Quality Payment Program
QRDA	Quality Reporting Document Architecture
SCD	Semantic Clinical Drugs
SI	International System of Units
SNOMED	Systematized Nomenclature of Medicine
SVS	Sharing Value Sets
UHDDS	Uniform Hospital Discharge Data Set
USHIK	United States Health Information Knowledgebase
VSAC	Value Set Authority Center
XML	Extensible Markup Language