



Centers for Medicare & Medicaid Services

Electronic Clinical Quality Measure (eCQM) Logic and Implementation Guidance

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1. Introduction

The Centers for Medicare & Medicaid Services (CMS) provides this guidance document for use with the updated hospital - inpatient, hospital - outpatient, and eligible clinician¹ electronic clinical quality measure (eCQM) specifications. CMS released the eCQM specifications in May 2026 for users and implementers of the eCQMs for calendar year 2027 reporting/performance under CMS's quality reporting and value-based purchasing programs. Please note, however, that the eCQM examples provided throughout this guidance document draw from the eCQM specifications posted for 2026 reporting/performance period.

eCQMs will not be eligible for 2027 reporting until CMS proposes and finalizes them through notice, public comment, and rulemaking for each applicable program. This document conceptualizes eCQM logic and data elements for Quality Data Model (QDM) measures and is intended for implementers. CMS strongly recommends review of this document to understand the intent and operation of each eCQM before implementation.

This document is organized as follows:

- Sections 2 through 4 provide general implementation guidance, including how to conceptualize and address specific logic and data elements during eCQM implementation.
- Section 5 provides information to interested parties on how to use the [Office of the National Coordinator for Health Information Technology \(ONC\) Project Tracking System \(Jira\)](#) to provide feedback; track issues; ask questions about eCQM intent, specifications, certification, and standards; and address issues uncovered during implementation of the eCQMs.
- Section 6 provides contact information for the various eCQM-related CMS help desks.
- The appendices provide information on where to find the standards and code systems used in conjunction with the updated eCQMs as well as examples of timing intervals used in eCQM logic.

For additional information and guidance on implementing eCQM updates for 2027 reporting/performance, please refer to the [eCQM Implementation Checklist](#) and the [tools, resources, and standards](#) used by eCQMs provided on the [Electronic Clinical Quality Improvement \(eCQI\) Resource Center](#).

¹ Please note that this guide formerly referred to “eligible clinician eCQMs” as “EC eCQMs.”

1.1 eCQM Types

CMS classifies eCQMs based on the unit of analysis—patients or episodes—and the method used to compute the score, whether by proportion, continuous variable, ratio, or cohort. This section describes these classifications and provides details on computing eCQMs.

1.2 Population Basis

The Guidance section in the header of each eCQM includes a statement to indicate whether the eCQM is patient-based or episode-based. This section of the guide describes both patient-based and episode-based eCQMs.

1.2.1 Patient-based eCQMs

Patient-based eCQMs evaluate the quality of care for individual patients and assign each patient to one or more eCQM populations. Most eligible clinician eCQMs are patient-based.

All information in the patient record referenced in the eCQM should be considered when computing a patient-based measure. The criteria for including a patient in a population may require data from multiple patient encounters or episodes of care. For example, a patient can receive an initial diagnosis and treatment during one office visit and then have ongoing treatment associated with that same diagnosis during several follow-up visits or episodes of care.

To identify which patients the measured entity should count in a patient-based eCQM, review the Guidance section of the header and the context of the eCQM logic section. For example, in [CMS124v14, Cervical Cancer Screening](#), patients included in the eCQM are females 24–64 years of age by the end of the measurement period with a visit during the measurement period, as defined in the eCQM's initial population (Figure 1.1).

Figure 1.1. Initial Population Example for a Patient-based eCQM

▲ Initial Population

```
AgeInYearsAt(date from  
  end of "Measurement Period"  
  )in Interval[24, 64]  
  and exists ( ["Patient Characteristic Sex": "Female"] )  
  and exists "Qualifying Encounters"
```

1.2.2 Episode-based eCQMs

Episode-based eCQMs evaluate the quality of care provided during a specific episode of care, such as an encounter or hospitalization. Each episode is assessed individually and assigned to one or more eCQM populations. Most hospital - inpatient and hospital - outpatient eCQMs are episode-based eCQMs, and a few eligible clinician eCQMs are episode-based eCQMs.

In an episode-based eCQM, the initial population identifies the episodes of care to be evaluated. Each episode is typically defined by a specific event, such as an encounter, and is referenced in populations of the eCQM, such as the denominator or the numerator.

To identify the encounters or procedures counted in an episode-based eCQM, review the Guidance section of the header and the context of the eCQM logic section. For example, for

[CMS826v3, Hospital Harm - Pressure Injury](#), the unit of analysis is an inpatient hospitalization encounter, as defined in the initial population (Figure 1.2).

Figure 1.2. Initial Population Example for an Episode-based eCQM

<p>▲ Initial Population "Encounter with Age 18 and Older"</p> <p>▲ Encounter with Age 18 and Older ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter where InpatientEncounter.relevantPeriod ends during day of "Measurement Period" and AgeInYearsAt(date from start of InpatientEncounter.relevantPeriod) >= 18</p>

In this example, the initial population includes all inpatient hospitalization encounters that end during a day of the measurement period in which the patient was 18 years of age or older at the start of the encounter.

See footnote for guidance on how to handle swing bed encounters when calculating episode-based eCQMs.²

1.3 eCQM Scoring

1.3.1 Proportion eCQMs

Most of the eCQMs in current CMS reporting programs are proportion measures. A proportion measure calculates the percentage of eligible patients or episodes that meet the criteria for quality (numerator) by the number of eligible cases within a given time frame (denominator) where the numerator cases are a subset of the denominator cases. A complete [list of proportion eCQMs by reporting/performance period](#) can be found on the eCQI Resource Center.

The populations defined by a proportion measure include the following:³

- **Initial population (IP):** The starting group of patients or episodes eligible for inclusion in a measure before denominator and numerator criteria are applied. It establishes the scope of evaluation based on characteristics such as age, diagnoses, procedures, or encounter types occurring during the measurement period.
- **Denominator (DENOM):** The group of patients or episodes used as the lower part of the fraction for rate calculation. It may be the same as the initial population or a smaller subset, depending on the specific goals of the measure.
- **Denominator exclusions (DENEX):** The group of patients or episodes that should be removed from the denominator before checking if they meet the quality criteria of the numerator.

² Swing bed encounters should not be included in episode-based hospital - inpatient eCQMs. Therefore, implementers must work with their electronic health record (EHR) vendors to remove swing bed encounters from measure calculation.

³ Most definitions are also available at the [eCQI Resource Center Glossary](#). Note, these definitions are not eCQM-specific. For more information on how to calculate quality measures, please refer to the Measures Management System (MMS) Hub Measure Calculations guide, saved as a supplemental material on the [MMS Resources and Templates](#) page.

Example: A patient with both legs amputated would be excluded from a measure about foot exams.

- **Numerator (NUMER):** The group of patients or episodes that meet the measure's quality criteria, such as receiving a specific treatment or experiencing a defined outcome. It makes up the upper part of the fraction for rate calculation and describes the clinical action or outcome being measured.
- **Denominator exceptions (DEXCEP):** The group of patients or episodes that should be removed from the denominator only if they did not meet the numerator criteria and had a valid reason for not meeting the numerator criteria. Used only in proportion measures, these exceptions reflect clinical judgement when care was considered but not provided for an appropriate reason.

Valid reasons include:

1. Medical (e.g., allergy or contraindication)
2. Patient (e.g., refusal)
3. System (e.g., unavailable services)

These exceptions prevent unfair scoring when care was not provided for acceptable reasons.

- **Numerator exclusions (NUMEX):** The group of patients or episodes that meet the numerator criteria but should be removed due to specific exclusion rules defined in the measure. Used in proportion and ratio measures.

Example: A planned hospital readmission might be excluded from a measure tracking unplanned readmissions.

To compute a proportion measure:

- Identify the patients or episodes of care in the IP using the initial population criteria.
- Refine the IP by applying denominator criteria to identify the DENOM cases.
- Review DENOM cases against denominator exclusions criteria. If a case meets denominator exclusions criteria, label it as DENEX and remove it from consideration for the NUMER.
- Assess all remaining cases—all DENOM cases that do not meet denominator exclusions criteria—against the numerator criteria. Label all cases meeting the numerator requirements as NUMER.
- Identify cases that do not meet numerator requirements and assess them against denominator exceptions requirements. If a case meets denominator exceptions requirements, then label the case as DEXCEP.
- Identify cases meeting numerator requirements and evaluate them against the numerator exclusions requirements. If a case meets the numerator exclusions, then label the case as NUMEX.

1.3.1.1 Reporting Stratification

Proportion eQMs might also have reporting strata defined for an eQM. Strata are variables defining a subdivision of the eQM populations for reporting, such as reporting separately by age group (for example, 14-19, 20-25). For eQMs, the human-readable document includes a Stratification narrative section in the measure header. If an eQM does not have reporting strata defined, it displays “None” as the default. If an eQM contains reporting stratification data, the measure developer lists each stratum separately. For example, [CMS153v14, Chlamydia Screening in Women](#), contains two strata as stated in the header and noted in Figure 1.3.

Figure 1.3. Reporting Stratification

Stratification	Report a total score, and each of the following strata: Stratum 1: Patients age 16-20 by the end of the measurement period. Stratum 2: Patients age 21-24 by the end of the measurement period.
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In addition, the strata are defined under the Population Criteria and Definition sections of the logic. For brevity, logic for only one stratum is shown below in Figure 1.4.

Figure 1.4. Stratification Logic

<p>▲ Stratification 1</p> <p>AgeInYearsAt(date from end of "Measurement Period") in Interval[16, 20]</p>
--

1.3.1.2 Performance Rate Aggregation

Specific programs may require reporting of performance rates. The performance rate is the number of patients or episodes in the NUMER, accounting for NUMEX, divided by the number of patients or episodes in the DENOM, accounting for DENEX and DEXCEP. Calculate the performance rate using the formula:

$$\text{Performance Rate} = (\text{NUMER} - \text{NUMEX}) / (\text{DENOM} - \text{DENEX} - \text{DEXCEP})$$

Some eQMs have more than one population that are components of the overall calculation of a single performance rate. In this instance, the header specifies the performance rate calculation. Figure 1.5 provides an example of a defined rate aggregation for [CMS145v14, Coronary Artery Disease \(CAD\): Beta-Blocker Therapy-Prior Myocardial Infarction \(MI\) or Left Ventricular Systolic Dysfunction \(LVEF less than or equal to 40%\)](#).

Figure 1.5. Performance Rate Calculation Defined in Header for Multiple Populations

Rate Aggregation	<p>This measure is intended to have one reporting rate, which aggregates the following populations into a single performance rate for reporting purposes:</p> <ul style="list-style-type: none"> - Population 1: Patients with left ventricular systolic dysfunction (LVEF <=40%) - Population 2: Patients with a prior (within the past 3 years) myocardial infarction <p>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)]</p>
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1.3.1.3 Multiple Numerators

Some eCQMs include multiple numerators to measure different levels or durations of care for the same population. In these cases, the same patients or episodes in the denominator are evaluated for potential inclusion in each numerator population separately. Figure 1.6 provides an example of an eCQM, [CMS128v14, Antidepressant Medication Management](#), with multiple numerators. Regardless if any patients in this eCQM meet the conditions for Numerator 1, the measured entity should also evaluate these patients to determine if they also meet the conditions for Numerator 2.

Figure 1.6. Multiple Numerators

Numerator	<p>Numerator 1: Patients who have received antidepressant medication for at least 84 days (12 weeks) of continuous treatment beginning on the IPSP through 114 days after the IPSP (115 total days).</p> <p>Numerator 2: Patients who have received antidepressant medications for at least 180 days (6 months) of continuous treatment beginning on the IPSP through 231 days after the IPSP (232 total days).</p>
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When the eCQM definition includes stratification, the measured entity should report each population in the eCQM definition both without stratification and stratified by each stratification criterion.

1.3.2 Continuous Variable Measures

Continuous variable measures can be patient-based or episode-based measures. A continuous variable is a measure score in which each individual value for the measure can fall anywhere along a continuous scale. Continuous variable measures provide more precise and granular insights into health care quality by capturing a full range of patient outcomes or performance levels, rather than just a binary result. Continuous variable scores can facilitate clearer identification of variations in care. A complete [list of continuous variable eCQMs by reporting/performance period](#) can be found on the eCQI Resource Center.

These measures include the following elements:⁴

- **Initial population (IP):** The starting group of patients or episodes eligible for inclusion in a measure before measure population criteria are applied. It establishes the scope of

⁴ Most definitions are also available at the [eCQI Resource Center Glossary](#). Note, these definitions are not eCQM specific. For more information on how to calculate quality measures, please refer to the MMS Hub Measure Calculations guide, saved as a supplemental material on the [MMS Resources and Templates](#) page.

evaluation based on characteristics such as age, diagnoses, procedures, or encounter types occurring during the measurement period.

- **Measure population (MSRPOPL):** The group of patients or episodes from the initial population that qualify to be assessed by the measure. This may be the same as the initial population or a smaller subset, depending on the specific goals of the measure.

Example: All patients who visited the emergency department during the measurement period.

- **Measure population exclusions (MSRPOPLEX):** The group of patients or episodes that should be removed from the measure population before calculating the measure observations.
- **Measure observations:** The specific calculations performed on each patient or episode in the final measure population (after exclusions).

Example: In [CMS986v5, Malnutrition Care Score](#), the observations calculate whether each eligible adult patient received the appropriate malnutrition care based on their risk level and diagnosis for each of the patient's inpatient hospitalizations during the measurement period.

To compute a continuous variable eCQM, take the following steps:

- Identify the patients or episodes of care in the IP using the initial population criteria.
- Refine the IP by applying measure population criteria to identify the MSRPOPL cases.
- Review MSRPOPL cases against measure population exclusions criteria. If a case meets measure population exclusions criteria, label it as a MSRPOPLEX and remove it from consideration for the measure observations.
- Evaluate each remaining member of the MSRPOPL against each defined measure observation criterion and aggregate the results using the specified operator.

As with proportion eCQMs, continuous variable eCQMs might have stratification requirements. Report performance results without stratification and for each defined stratum separately. The initial population and measure population require specifying the number of patients or episodes falling into each of these populations without stratification as well as those populations stratified by any defined strata.

1.3.3 Ratio Measures

Ratio measures can be either patient-based or episode-based measures. Ratio measures are used to compare two distinct but related sets of data (for example, days with a hyperglycemic event compared to all eligible hospital days). Unlike proportion measures where the numerator is a subset of the denominator, ratio measures use different but related counts to show how often an event occurs in relation to another. This distinction makes ratio measures ideal for assessing the quality of care in ways that cannot be captured by a simple proportion. A complete [list of ratio eCQMs by reporting/performance period](#) can be found on the eCQI Resource Center.

These measures include the following elements:

- **Initial population (IP):** The starting group of patients or episodes eligible for inclusion in a measure. It establishes the scope of evaluation based on characteristics such as age, diagnoses, procedures, or encounter types occurring during the measurement period.
Other measure groups (like the numerator and denominator) are selected from this group. In ratio measures, the numerator and denominator can each have their own separate initial population.
- **Denominator (DENOM):** The group of patients or episodes used to determine the lower part of a ratio.
It can be the same as the initial population or a smaller group based on specific rules. In ratio measures, this is usually a count of opportunities or units of risk, not just patients.
- **Denominator exclusions (DENEX):** The group of patients or episodes that are removed from the denominator based on specific criteria (e.g., clinical appropriateness). In ratio measures, exclusions only apply to the denominator — they do not remove the case from consideration for the numerator population.
- **Numerator (NUMER):** The group of patients or episodes used to determine the upper part of a ratio.
It is the group of patients or episodes that meet the measure’s quality criteria, such as receiving a specific treatment or experiencing a defined outcome.
In ratio measures, the numerator is not a subset of the denominator — it comes directly from the initial population.
- **Numerator exclusions (NUMEX):** The group of patients or episodes that meet the numerator criteria but should be removed due to specific exclusion rules defined in the measure. Used only in proportion and ratio measures.
- **Measure observations:** The calculations performed on cases in the numerator and denominator after exclusions are applied. For example, in [CMS871v5, Hospital Harm - Severe Hyperglycemia](#), the “DenominatorObservations” function computes the number eligible days of the inpatient hospitalizations for patients that meet the initial population/denominator criteria and do not meet denominator exclusions criteria. These are used to produce the final value for reporting. Measure observations may be associated with the denominator or numerator.

The following steps are used to compute a ratio measure denominator:

1. Identify the patients or episodes of care in the IP using the initial population criteria.
2. Refine the IP by applying denominator criteria to identify the DENOM cases. The DENOM may equal the IP.
3. Review DENOM cases against denominator exclusions criteria. If a case meets denominator exclusions criteria, label it as a DENEX and remove it from the DENOM.
4. Evaluate each remaining member of the DENOM (for example, all cases that meet the DENOM and *not* DENEX) against the defined measure observation criterion for the denominator and aggregate the results using the specified operator.

The following steps are used to compute a ratio measure numerator:

1. Identify the patients or episodes of care in the IP using the initial population criteria.

2. Refine the IP by applying numerator criteria to identify the NUMER cases.
3. Review NUMER cases against numerator exclusions criteria. If a case meets numerator exclusions criteria, label it as a NUMEX and remove it from the NUMER.
4. Evaluate each remaining member of the NUMER (for example, all cases that meet the NUMER and *not* NUMEX) against the defined measure observation criterion for the numerator and aggregate the results using the specified operator.

Aggregate scores for ratio measures can be more than just the counts of cases in each population. In addition to the identification of measure population(s), ratio measures can define observations on cases falling into various populations and then aggregate these individual observations according to aggregation rules specific to each measure.

In ratio measures, for each population, the measure developer should use individual observations (for example, measurements or calculations) for denominator and numerator cases, and then use them to calculate the aggregate ratio:

$$\text{Ratio: Aggregate NUMER} / \text{Aggregate DENOM}$$

Calculate the aggregate DENOM using individual observations for all cases in the DENOM and not in the DENEX and calculate the aggregate NUMER using individual observations for all cases in the NUMER and not in the NUMEX. For more detailed examples of ratio measure calculations, please reference the Measures Management System (MMS) Hub Measure Calculations guide, saved as a supplemental material on the [MMS Resources and Templates](#) page.

Unlike proportion and continuous variable measures, ratio measures cannot apply stratification requirements unless the numerator and denominator are pulled from the same initial population.

1.4 Hybrid Measures

Hybrid measures are quality measures merging data elements from two or more sources to calculate measure results (for example, electronic health record [EHR] and claims data). These measures require updates to both the electronic specifications and claims-based specifications, available on [QualityNet](#). For more information on hybrid measures, please see the [hybrid measures subsection](#) of the eCQI Resource Center.

1.5 Program Candidate eCQMs

Program candidate eCQMs are not eligible for CMS quality reporting until CMS proposes and finalizes them through notice-and-comment rulemaking for each applicable program. Program candidate measures can be found on the eCQI Resource Center website in designated [Hospital - Inpatient](#), [Hospital - Outpatient](#), and [Eligible Clinician](#) subsections by filtering on the reporting/performance period and “Program Candidate eCQMs.”

2. Clinical Quality Language Measure Logic

eCQMs use Clinical Quality Language (CQL) logic and the QDM to harmonize standards between clinical decision support and eCQM reporting. CQL is a clinically focused, high-level query language that can express sophisticated eCQM logic. A significant feature of CQL is its use of libraries, which are collections of CQL definitions or function statements that eCQM and clinical decision support artifact developers can share across and between eCQMs and decision support rules. The use of shared functions and definitions results in greater consistency across eCQMs and enables developers to reuse the same statements.

Several Health Level Seven International (HL7[®]) implementation guides (IGs) and related resources provide direction on using CQL expressions and QDM data elements in the eCQM via the Health Quality Measure Format (HQMF). The following resources are primary sources for interpreting eCQM representation:

- [HL7 Version 3 Implementation Guide: Clinical Quality Language \(CQL\)-based Health Quality Measure Format \(HQMF\), Release 1, Standard for Trial Use 4.1—US Realm](#)
- [Clinical Quality Language Specification, Release 1 Mixed Normative/Trial-Use \(CQL 1.5\)](#)
- [CQL Formatting and Usage Wiki](#)
- [QDM v5.6](#)
- [QDM-based CQL Style Guide](#)

Subsections 2.1 through 2.5 provide an overview of this material, including common logic expressions and proper usage.

Visit the [CQL page](#) on the eCQI Resource Center for additional information and education.

2.1 Using CQL Logic to Evaluate QDM Elements

An eCQM defines populations—such as the denominator and numerator—by combining QDM data elements with CQL logic to create structured expressions. These expressions define the criteria for membership in each population based on the intent of the eCQM.

As shown in Figure 2.1, this definition statement establishes the global criteria for an inpatient encounter.

Figure 2.1. Sample Definition Statement

<p>▲ Inpatient Encounter</p> <pre>["Encounter, Performed": "Encounter Inpatient"] EncounterInpatient where EncounterInpatient.relevantPeriod ends during day of "Measurement Period"</pre>

The first part of this definition statement, enclosed in brackets, references a QDM datatype (“Encounter, Performed”) and a value set indicating the specific codes meeting encounter criteria for this eCQM (“Encounter Inpatient”). The combination of a QDM datatype and a value set defines a QDM data element, which describes clinical information. The QDM datatype, such as “Encounter, Performed;” “Procedure, Performed;” or “Medication, Order;” provides context for the higher-level clinical concept, or QDM category, of clinical information being referenced,

such as encounter, procedure, or medication. Additional data, or attributes, may be necessary to meet the needs of the eCQM. QDM specifies a set of attributes allowable for each QDM datatype. For example, *dosage* and *supply* are attributes available for “Medication, Order.” All QDM datatypes include a *code* attribute with a value set or direct reference code. The logic statements do not explicitly call out the code attribute but invoke it when filtering against the value set as in [“Encounter, Performed” : “Encounter Inpatient”]. For detailed descriptions of the QDM, including all QDM datatypes and related attributes, please refer to [QDM v5.6](#).

This CQL expression shown in Figure 2.1 also describes the timing elements to determine whether the end of the specified encounter occurred during the measurement period. By referencing this entire expression as a CQL definition, in this case called “Inpatient Encounter,” the eCQM can refer to that definition without repeating all the details.

The [CQL Formatting and Usage Wiki](#) contains additional information regarding the use of CQL and QDM in [Authoring Measures in CQL](#). Sections 2.2 through 2.5 below provide a summary of that content, focusing on interpreting measures written in CQL.

2.2 Understanding CQL Basics

CQL is a high-level query language that serves to write expressions that determine *what* data to identify or return rather than *how* to retrieve or return them. How to return the data is part of the implementation of an eCQM, and the measured entity can accomplish it 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 many of those details, enabling implementer use of the logic expressed by CQL queries in a broad variety of implementation environments to achieve the same result.

Several basic elements make up CQL expressions:

- Values: Within CQL, the term value refers to a piece of data of some type.
 - Examples: The number 5, or the quantity 5 'mm[Hg]'
- Operators: An entity used to perform operations.
 - Examples: “+”, “-“, “and”, “or”, “intersect”, and “union”
- Functions: Prebuilt actions that perform calculations, manipulate data, and return results, usually based on input arguments.
 - Examples: CalculateAgeInYears(birthDate) and First(*argumentList*<*T*>)
- Identifiers: The names that authors assign to individual CQL expressions so they can be referred to in other expressions and/or measure specifications.
 - Examples: “Inpatient Encounter”

Measure specification logic can combine these basic elements to express criteria and then label them with identifiers so they can either define additional criteria or define a top-level population.

When the members of an eCQM population are patients, measure developers express the population criteria as a yes or no test to determine whether the patient is in or out of each population. As shown in Figure 2.2, the definition of “Initial Population” for [CMS2v15, Preventive Care and Screening: Screening for Depression and Follow-Up Plan](#) is:

Figure 2.2. Example with Boolean Return**▲ Initial Population**

```
"Patient Age 12 Years or Older at Start of Measurement Period"
and exists ( "Qualifying Encounter During Measurement Period" )
```

For this example, the initial population includes patients whose birthdate indicates they were 12 years of age or older at the start of the measurement period, and the patient has a qualifying encounter.

In patient-based eCQMs, measure developers define each population, such as the initial population, denominator, or numerator, by criteria resulting in a Boolean—yes or no—return; however, there could be other definitions in the eCQM that return lists. “Qualifying Encounter During Measurement Period” is one such definition, which returns a list of encounter data. In Figure 2.3, the *relevantPeriod* indicates the start and end times for the qualifying encounter.

Figure 2.3. Example with List Return**▲ Qualifying Encounter During Measurement Period**

```
( ["Encounter, Performed": "Encounter to Screen for Depression"]
union ["Encounter, Performed": "Physical Therapy Evaluation"]
union ["Encounter, Performed": "Telephone Visits"] ) QualifyingEncounter
where QualifyingEncounter.relevantPeriod during day of "Measurement Period"
```

2.3 Libraries

CQL libraries are collections of expressions, functions, and declarations that implement measure logic. Each eCQM contains a primary CQL library defining the criteria used by the populations of the eCQM. The HQMF document references the CQL library, which contains expressions defining measure populations. Measures may also include additional libraries other than the primary library.

Libraries can contain the following:

- Expression definitions, such as “Inpatient Encounter”
- Terminologies, such as references to code systems, value sets, concepts, and codes.
- Functions, such as “Global.NormalizeInterval(pointInTime DateTime, period Interval<DateTime>)”

Once an eCQM includes a reference to a library, the eCQM can subsequently reference components of that library throughout the eCQM. In Figure 2.4, the definition for one component of the denominator exclusions criteria in [CMS108v14, Venous Thromboembolism Prophylaxis](#) is “Encounter Less Than 2 Days.”

Figure 2.4. Use of Libraries in Definitions**▲ Encounter Less Than 2 Days**

```
VTE."Encounter with Age Range And Without VTE Diagnosis Or Obstetrical Conditions" QualifyingEncounter
where Global."LengthInDays" ( QualifyingEncounter.relevantPeriod ) < 2
```

This example defines inpatient hospitalizations with a qualifying encounter when the length of stay is less than two days, referring in the logic to the “Global.LengthInDays” function. The

“Global” in this function name refers to a library used by many of the eCQMs that share definitions and functions, such as “LengthInDays.” eCQMs can also use definitions and functions contained in the Venous Thromboembolism (VTE) library related to VTE encounters and diagnoses, including the “VTE.Encounter with Age Range and without VTE Diagnosis or Obstetrical Conditions” definition used in this example.

For more information on libraries, refer to the Using Libraries to Share Logic section (Chapter 2—Author’s Guide) of the [CQL specification](#).

2.4 Queries

A central construct in CQL is the query, a specific type of expression enabling easy and precise expression of relationships between data. Queries in CQL are clause based, which means they use different types of clauses depending on what operations the logic performs on the data.

The general structure of a CQL query:

```
<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:

```
[“Encounter, Performed” : “Office Visit”] Encounter
```

Here, the source is a reference to “Office Visit,” which is an expression returning a list of encounters performed with a code in the “Office Visit” value set. “Encounter” is the alias. The alias allows reference to the elements of the source anywhere within the query. Because this simple query does not have any clauses, it simply returns the same result as the source.

2.4.1 Where Clause

The “where” keyword introduces a “where” clause, which enables the user to filter the results of the source, as shown in Figure 2.5 from [CMS124v14, Cervical Cancer Screening](#).

Figure 2.5. Where Clause

```

▲ Qualifying Encounters
( ["Encounter, Performed": "Office 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": "Telephone Visits"]
  union ["Encounter, Performed": "Virtual Encounter"] ) ValidEncounters
where ValidEncounters.relevantPeriod during day of "Measurement Period"
```

This query returns only those encounters from the source whose *relevantPeriod* is during a day of the Measurement Period. The “where” clause enables measure developers to filter the query using conditions that reference aliases defined earlier, such as “ValidEncounters”. Every

encounter performed in the “union” query source evaluates the condition in the “where” clause, and the result then includes only those encounters for which the condition evaluates to true.

2.4.2 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 simple by using “with” and “without” keywords. The “with” keyword can serve to describe cases that measured entities should consider only if a related data item is present. The example query, as shown in Figure 2.6 from [CMS146v14, Appropriate Testing for Pharyngitis](#), limits the emergency department (ED) or ambulatory encounters returned to only those starting three days or less on or before the day that the antibiotic was ordered. The “such that” clause specifies the relationship condition using the primary and related query sources, which is expressed here as alias “EDOrAmbulatoryVisit” as primary and “AntibioticOrdered” as related.

Figure 2.6. Such That Example

```

▲ Encounter With Antibiotic Ordered Within Three Days
"Qualifying Encounter" EDOrAmbulatoryVisit
  with ["Medication, Order": "Antibiotic Medications for Pharyngitis"] AntibioticOrdered
  such that ( start of EDOrAmbulatoryVisit.relevantPeriod ) 3 days or less on or before day of
  AntibioticOrdered.authorDate-time

```

The “without” keyword can serve to describe cases that measured entities should consider only if a particular data item is *not* present. As shown in Figure 2.7, the numerator definition in [CMS154v14, Appropriate Treatment for Upper Respiratory Infection \(URI\)](#) is:

Figure 2.7. Without Clause Example

```

▲ Numerator
"Encounter with Upper Respiratory Infection" EncounterWithURI
  without ["Medication, Order": "Antibiotic Medications for Upper Respiratory Infection"]
  OrderedAntibiotic
  such that OrderedAntibiotic.authorDatetime 3 days or less on or after start of
  EncounterWithURI.relevantPeriod
return EncounterWithURI

```

This query limits the encounters returned to only those that did *not* have a medication order for an antibiotic medication for upper respiratory infection. Similar to the “with” clause, the “without” clause uses “such that” to describe the condition of the relationship.

2.5 Timing Calculations

Assessing the relative timing of events within a patient’s EHR is an essential part of computing eCQMs. To enable the unambiguous interpretation of the eCQMs, it is necessary to clearly define computation of time intervals. A simple expression such as “the treatment must occur within 3 days of the diagnosis” has many possible interpretations, including that the treatment must occur within 72 hours of the diagnosis or that the treatment must happen within 3 business days of the diagnosis.

The International Organization for Standardization 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 [Clinical Quality Language Specification, Release 1 Mixed Normative/Trial-Use \(CQL 1.5\)](#).

To determine the length of time between two dates, CQL provides two approaches: duration, the number of whole periods between two dates, and difference, the number of period boundaries crossed between two dates. The expression of each period represents a time unit, such as hours, days, or months. These approaches provide options to correctly express timing relationships for implementation of measures. For example, in hospital - inpatient and hospital - outpatient eCQMs, the recommended timing pattern for initial population criteria is an encounter that “ends during a day of the “Measurement Period.”” The use of “ends” provides a single point of time comparison within the measurement period so the receiving systems can provide reports on a quarterly basis, while “day of” specifies day precision to avoid time zone offset and millisecond issues. In contrast, *dateTime* precision might result in applying a time zone offset adjustment, for example.

[Appendix B](#) of this document includes more information on time intervals and examples, as does [Appendix H of the CQL specification](#).

2.5.1 Duration

CQL provides specificity when calculating duration. Conceptually, the calculation is performed considering two dates or times on a timeline and counting the number of whole periods (for example, years, days, hours) fitting on the timeline between the two dates or times.

2.5.2 Difference

Difference calculations are achieved by truncating the date or time values at the next level of precision and then performing the corresponding duration calculation on the truncated values.

To illustrate the difference:

Date 1: 2021-12-31

Date 2: 2022-01-01

Duration In Years: Years between Date 1 and Date 2 = 0

Difference In Years: Difference in Years between Date 1 and Date 2 = 1

The Duration In Years expression returns zero because a full year has not passed between the two dates, but the Difference In Years expression returns 1 because the one-year boundary was crossed between the two truncated dates—2021 and 2022. Please note that the difference boundary at day precision (that is, date) is midnight.

2.5.3 Intervals

CQL supports intervals of numbers and date or time values using a standard mathematical notation to indicate open and closed. Brackets indicate a closed endpoint, and parentheses indicate an open endpoint. An open interval boundary excludes the endpoint and a closed interval boundary includes it. For example, “Interval[5, 10)” includes the point 5 but excludes the point 10. For more information, please see Operating on Intervals in the [Author’s Guide of the Clinical Quality Language Specification](#).

Intervals use a set of comparison operators such as “A during B, A overlaps B”, or “A includes B.” Precise relationships between intervals use natural language timing phrases such as “A starts before start B” or “A starts 1 day or less after end B.”

The unit expressing a time interval or its duration could depend on the necessary level of accuracy for the purposes of measurement. Measure developers select the time unit to use according to the level of granularity required to meet the intent of the measure.

3. Data Elements and Value Sets

eCQMs build data elements from the categories, datatypes, and attributes in the QDM. Additional reference material can be found at [QDM - Quality Data Model](#) section of the eCQI Resource Center.

3.1 eCQM Data Element Repository

The [eCQM Data Element Repository \(DERep\)](#) provides additional clarification for all data elements associated with published and tested eCQMs used in CMS quality reporting programs, along with the definitions and clinical focus for each data element. An end user can filter information by data element, eCQM, [QDM attribute](#), [QDM category](#), [QDM datatype](#), or [QDM entities](#).

3.2 Value Set Location and Tools

[Value sets](#) are lists of unique coded identifiers with names, called descriptors, for groupings of clinical and administrative concepts selected from standard code systems. They serve to define a set of concepts (for example, “diabetes” or “clinical visit”) identifying selected populations and satisfying measure criteria in eCQMs. Value sets can be found at the [Value Set Authority Center \(VSAC\)](#), which is maintained by the National Library of Medicine (NLM) in collaboration with CMS. The VSAC provides access to all official versions of value set content contained in the eCQM specifications. The value sets used in eCQMs and available in the VSAC can either directly contain code system members or reference other value sets, called a grouping value set. The VSAC also provides value set authoring capabilities for registered value set authors and updates value set content based on each new version of the underlying code systems, such as Current Procedural Terminology (CPT); International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM); Systematized Nomenclature of Medicine–Clinical Terms (SNOMED CT); or Logical Observation Identifiers Names and Codes (LOINC) used in value sets.

The NLM has an application programming interface (API) to the VSAC content in addition to a web interface. The API documentation is available on the VSAC on the [VSAC API Resources](#) page.

The VSAC also links to [downloadable value set content](#) used in current and previous eCQM release sets. These downloads are available in both Excel and Extensible Markup Language (XML) files. There are three options for the value set downloadable files for each reporting/performance period: files sorted by CMS ID, files sorted by value set name, and files sorted by QDM category. These workbooks provide additional detail about each value set, including code system identifiers and versions. Please note that in files sorted by CMS ID and value set name, column F (QDM Category) is blank for value sets used only for QDM attributes, because an attribute may be used by more than one QDM category. The download sorted by QDM category does not contain any value sets used only for QDM attributes.

The value set spreadsheets do not include the direct reference codes used in eCQMs. To obtain a separate listing of those codes, users must select the “Direct Reference Codes Specified within eCQM HQMF files Published *Month DD, YYYY*” Excel file download.

The VSAC provides three additional resources:

- The binding parameter specification documents the information used to create the value set expansions made available for an annual release or addendum. The binding parameter specification 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 datatype.
- A list of retired and legacy codes in eCQM value sets published in a value set release.
- A list of the code system versions used in eCQM value sets published in a value set release.

Access to value set details in the VSAC requires a free [Unified Medical Language System® Metathesaurus License](#). Any use of value sets must be consistent with the licensing requirements and copyright protections covered by this license.

3.3 Direct Reference Codes

A direct reference code is a single code identified in the measure itself that specifies QDM data elements in measure logic rather than utilizing single-code value sets. The use of direct reference codes prevents using an alternative identifier for a code system concept and eliminates additional implementation work to unpack the value set. These codes display directly within the measure logic and in the Terminology section of the HQMF. Some value sets containing only one code, however, are appropriate in the following circumstances:

- When authoring a value set, only one code exists but there is a reasonable expectation the measure developer may consider additional codes added to the terminology to represent the intent of the value set.
- A value set initially contained multiple codes, but all except one was retired by the code system or systems. Because the measure might have to allow look-back, the value set remains valid with only one active code.

As shown in Figures 3.1 and 3.2, direct reference codes are found in [CMS124v14, Cervical Cancer Screening](#), in which individual codes within the CQL logic reference a discharge to home for hospice care, a discharge to a healthcare facility for hospice care, a hospice care assessment, and a yes response to an assessment. The measure's Terminology section lists each of these codes.

Figure 3.1. Direct Reference Codes

▲ Hospice.Has Hospice Services

```

exists ( ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  where ( InpatientEncounter.dischargeDisposition ~ "Discharge to home for hospice care
(procedure)"
    or InpatientEncounter.dischargeDisposition ~ "Discharge to healthcare facility for hospice care
(procedure)"
  )
  and InpatientEncounter.relevantPeriod ends during day of "Measurement Period"
)
or exists ( ["Encounter, Performed": "Hospice Encounter"] HospiceEncounter
  where HospiceEncounter.relevantPeriod overlaps day of "Measurement Period"
)
or exists ( ["Assessment, Performed": "Hospice care [Minimum Data Set]" ] HospiceAssessment
  where HospiceAssessment.result ~ "Yes (qualifier value)"
  and Global."NormalizeInterval" ( HospiceAssessment.relevantDatetime,
HospiceAssessment.relevantPeriod ) overlaps day of "Measurement Period"
)
or exists ( ["Intervention, Order": "Hospice Care Ambulatory"] HospiceOrder
  where HospiceOrder.authorDatetime during day of "Measurement Period"
)
or exists ( ["Intervention, Performed": "Hospice Care Ambulatory"] HospicePerformed
  where Global."NormalizeInterval" ( HospicePerformed.relevantDatetime,
HospicePerformed.relevantPeriod ) overlaps day of "Measurement Period"
)
or exists ( ["Diagnosis": "Hospice Diagnosis"] HospiceCareDiagnosis
  where HospiceCareDiagnosis.prevalencePeriod overlaps day of "Measurement Period"
)
)

```

Figure 3.2. Terminology Aligned with Direct Reference Codes from Figure 3.1

Terminology

- code "Discharge to healthcare facility for hospice care (procedure)" ("SNOMEDCT Code (428371000124100)")
- code "Discharge to home for hospice care (procedure)" ("SNOMEDCT Code (428361000124107)")
- code "Female (finding)" ("SNOMEDCT Code (248152002)")
- code "Functional Assessment of Chronic Illness Therapy — Palliative Care Questionnaire (FACIT-Pal)" ("LOINC Code (71007-9)")
- code "Hospice care [Minimum Data Set]" ("LOINC Code (45755-6)")
- code "Yes (qualifier value)" ("SNOMEDCT Code (373066001)")

The tilde (~) seen in the CQL in Figure 3.1 represents the equivalence operator, which returns “true” if two arguments are equivalent in value, or if they are both “null”; the operator returns “false” otherwise. For more information on the equivalence operator (~), the inequivalence operator (!~), the equal operator (=), and the not equal operator (!=), visit [Appendix B - CQL Reference of the CQL Specification](#).

3.4 QDM Category and Code System

CMS’s MMS Hub published a recommended vocabularies document, saved as a supplemental material on the [MMS Resources and Templates](#) page, with the ONC-Health Information Technology Standards Committee outlining recommended code systems for each QDM category.⁵ Measure developers link datatypes to a value set, grouping value set, or a direct

⁵ The committee made these recommendations in 2012 and 2015 using program information and language current at the time, and the recommendations are consistent with the [Interoperability Standards Advisory](#).

reference code, complying with these recommendations when authoring measures.

Downloadable resources of value sets by QDM category are also available on the [VSAC on the Download tab](#).

Some measures combine different options, or definitions, to express instances of a single QDM datatype within the logic. As shown in Figure 3.3, qualifying encounters exist in the initial population for [CMS131v14, Diabetes: Eye Exam](#).

Figure 3.3. Definition Using Multiple Data Elements to Address Terminology Requirements

▲ Qualifying Encounters

```
( ["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"]
  union ["Encounter, Performed": "Telephone Visits"] ) ValidEncounters
where ValidEncounters.relevantPeriod during day of "Measurement Period"
```

In this example, the seven encounters all use the same QDM datatype (“Encounter, Performed”), and each binds a grouping value set and the logic (“union”) to express these encounter types that meet the measure criteria. Together, these seven encounters provide codes covering the recommended code system, SNOMED CT, as well as the native capture terminologies (formerly referred to as “transition code systems”), CPT, and Healthcare Common Procedure Coding System (HCPCS).

CMS encourages users of the eQMs updated for 2027 reporting/performance to suggest additions and deletions to data elements, both within value sets and between code systems. Users can submit their suggestions via the [ONC Project Tracking System \(Jira\) QDM Issue Tracker](#).

3.5 Drug Representations Used in Value Sets

Value sets referring to specific non-vaccine, prescribable medications use generalized drug concepts, such as [RxNorm Semantic Clinical Drugs \[SCDs\]](#). Health information technology (HIT) vendors or measured entities report the drug entities in patient data using the generalized drug concepts included in the defined value sets. These concur with CMS’s guidance regarding the preferred use of generalized drug concepts. eQIM implementers should use the relationships found in [RxNorm](#) to support mapping between specific drug entities found in patient records to those found in the provided value sets. If mapping is conducted, implementers should maintain documentation in case of a CMS audit. Administered vaccines are currently represented in value sets using [Clinical Vaccine Formulation \(CVX\)](#) codes.

3.6 Discharge Medications

The use of the “Medication, Discharge” QDM datatype has a very specific meaning in hospital - inpatient eQIMs. This designation refers to medications reconciled in the clinical environment and documented on the patient’s discharge medication list. **“Medication, Discharge” events are not equivalent to medications that happen to be active at the time of discharge.** Discharge medications represent those medications the patient should be taking in the next setting of care, generally used for discharges to home. These discharge medications will be the same as the

subsequent home medication list resulting from medication reconciliation in the ambulatory patient medical record. This reconciled medication list may be different from the ambulatory medication list existing before admission to the hospital since the discharge medication list will account for new clinical considerations identified during the hospitalization.

Figure 3.4 is an example of measure logic for “Medication, Discharge” in [CMS104v14, Discharged on Antithrombotic Therapy](#), in which the numerator logic contains the [“Medication, Discharge”: “Antithrombotic Therapy for Ischemic Stroke”] data element and refers to the presence of an antithrombotic therapy on the discharge medication list of the ischemic stroke encounter.

Figure 3.4. Discharge Medication Example

<p>▲ Numerator</p> <p>TJC."Ischemic Stroke Encounter" IschemicStrokeEncounter with ["Medication, Discharge": "Antithrombotic Therapy for Ischemic Stroke"] DischargeAntithrombotic such that DischargeAntithrombotic.initialtime during IschemicStrokeEncounter.relevantPeriod</p>

HIT vendors and measured entities generating Quality Reporting Document Architecture (QRDA) Category I output will have to generate “Medication, Discharge” events for all medications on the discharge list with appropriate time stamps to enable the correct function of measure logic.

3.7 Allergies to Medications and Other Substances

Allergy value sets referenced in eQMs contain appropriate codes from RxNorm aligned with ingredient-level concepts. Users can use RxNorm relationships to link ingredients to the specific drug entities that could occur in patients’ records. eQMs generally express reactions that may occur, such as rash or wheezing, using appropriate SNOMED CT codes representing the conditions.

This means that value sets used by eQMs to identify medication allergens for the QDM datatype “Allergy/Intolerance” use RxNorm ingredient-type concepts. These concepts only identify the ingredient and not the form or strength, and they have the RxNorm term type consistent with ingredient-level identifiers. If the EHR does not record patient allergy and intolerance data using an RxNorm ingredient-type concept, measured entities will have to use RxNorm relationships to identify the correct ingredient concept for the drug concept used in the EHR.

eQm developers can add SNOMED CT drug class concepts to represent medication allergens. If a drug class concept is appropriate for use in the measure, the following should apply:

- eQm specifications will only include SNOMED CT drug class concepts when a general drug class concept is expected to be found in patient records as an indication that the patient is considered allergic to all drugs in the class.
- Implementers should keep in mind that when using a drug class concept to represent a measure exclusion or exception, the patient should receive no drug in the class for expected therapy.
- eQm specifications will include review of all defined drugs in the class when choosing to include the SNOMED CT drug class concept and will define an RxNorm allergy value

set with the specific ingredient (IN) and precise ingredient (PIN) term types drug ingredients representing the drug class.

- Some value sets group both the RxNorm ingredient-type allergy value set and the SNOMED CT drug class allergy value set into one grouping value set referenced by the eCQM.
- Value sets used to identify nonmedication allergy-inducing entities use concepts found in the SNOMED CT substance semantic types.

3.8 Principal Diagnosis in Inpatient Encounters

In EHRs, the principal diagnosis is defined as the condition established to be chiefly responsible for the admission of a patient to the hospital for care according to the Uniform Hospital Discharge Data Set definition.

QDM v5.6 adds the attribute *rank* with an integer value. A principal diagnosis is the encounter-related billing diagnosis with a *rank* of 1. For example, logic identifying a principal diagnosis with a *rank* of 1 in [CMS108v14: Venous Thromboembolism Prophylaxis](#), is depicted in Figure 3.5.

Figure 3.5. Principal Diagnosis Example

▲ Encounter With Principal Diagnosis Of Mental Disorder Or Stroke

VTE."Encounter With Age Range And Without VTE Diagnosis Or Obstetrical Conditions" Qualifying Encounter
 where exists (QualifyingEncounter.diagnoses EncounterDiagnoses
 where EncounterDiagnoses.rank = 1
 and (EncounterDiagnoses.code in "Mental Health Diagnoses"
 or EncounterDiagnoses.code in "Hemorrhagic Stroke"
 or EncounterDiagnoses.code in "Ischemic Stroke"
)
)

eCQM requests for all encounter-related diagnoses, regardless of rank, use the encounter attribute *diagnosis*. Note that, by definition, a principal diagnosis must be present at the time of the initiation of the encounter. The attribute *diagnosis* does not specify the exact timing relationship. Therefore, to express the timing relationship of a specific diagnosis with an encounter, the eCQM must use the QDM datatype “Diagnosis” to associate with the “Encounter, Performed”, that is, onset at the start or end of the episode of care. The admission or discharge diagnoses recorded by the measured entity should not substitute for the principal diagnosis unless it is concordant with the principal diagnosis as defined by CMS.

Several hospital eCQMs use Present on Admission (POA) indicators, as found in a hospital’s billings/claims system, to identify diagnoses present at the time of inpatient admission. POA indicators, defined below, can be used to differentiate conditions present at the time of hospital admission from those conditions that develop during a patient’s hospitalization.

- POA Indicator of Y = Yes (Diagnosis was present at time of inpatient admission.)
- POA Indicator of N = No (Diagnosis was not present at time of inpatient admission.)
- POA Indicator of W = Clinically undetermined

- POA Indicator of U = Documentation insufficient to determine if the condition was present at the time of inpatient admission

The *presentOnAdmissionIndicator* attribute can be used with a value set or direct reference code that represents one or multiple POA indicators. For example, [CMS1017v2: Hospital Harm - Falls with Injury](#), depicted in Figure 3.6, identifies falls where a major injury occurred where the major injury was *not* present on admission, as indicated by the *presentOnAdmissionIndicator* attribute with a PresentOnAdmission code of “N” or “U” in the “Not Present On Admission or Documentation Insufficient to Determine” value set.

Figure 3.6. POA Indicators Example

```

▲ Encounter where a Fall and Major Injury Occurred
"Encounter where a Fall Occurred" FallOccurred
where exists FallOccurred.diagnoses MajorInjury
where MajorInjury.code in "Major Injuries"
and ( MajorInjury.presentOnAdmissionIndicator in "Not Present On Admission or Documentation
Insufficient to Determine"
or MajorInjury.presentOnAdmissionIndicator is null
)

```

3.9 Medical Reason, Patient Reason, System Reason

Capturing evidence in EHRs of an intentional decision to refrain from performing an activity and the rationale can be challenging. Some eCQMs seek to retrieve evidence using the QDM attribute, *negationRationale*. eCQMs use value sets to specify medical reason, patient reason, and/or system reason why a particular performance activity did not happen. For example, a medical reason for exception may include a rare but relevant comorbidity that could not be anticipated by the measure developer to create an explicit exclusion based on the condition. A patient reason for exception from denominator criteria may include religious preference.

If a patient or episode meets a measure’s denominator exceptions criteria, the measured entity must translate the specific reason for the exception to a code from the value set or the direct reference code that is used to specify the measure’s denominator exceptions criteria. The measured entity should retain supporting documentation of the specific reason that the patient or episode met the denominator exceptions criteria, as CMS may expect the measured entity to demonstrate relevant justification if audited.

For example, [CMS2v15: Preventive Care and Screening: Screening for Depression and Follow-Up Plan](#) excepts patients from the denominator who are not screened for depression based on a medical reason, as depicted in Figure 3.7.

Figure 3.7. Denominator Exceptions Example

```

▲ Denominator Exceptions
( exists "Medical or Patient Reason for Not Screening Adolescent for Depression"
and not "Has Adolescent Depression Screening"
)
or ( exists "Medical or Patient Reason for Not Screening Adult for Depression"
and not "Has Adult Depression Screening"
)

```

▲ Medical or Patient Reason for Not Screening Adult for Depression

```
[ "Assessment, Not Performed": "Adult depression screening assessment" ] NoAdultScreen
with "Qualifying Encounter During Measurement Period" QualifyingEncounter
such that NoAdultScreen.authorDatetime during day of QualifyingEncounter.relevantPeriod
where ( NoAdultScreen.negationRationale ~ "Depression screening declined (situation)"
or NoAdultScreen.negationRationale in "Medical Reason"
)
```

If a patient met this measure’s denominator exceptions criteria of not being screened for depression based on a medical reason, the measured entity would need to only report a code from the “Medical Reason” (OID: 2.16.840.1.113883.3.526.3.1007) value set, such as “Procedure not indicated (situation).” The measured entity should confirm, however, that there is a legitimate medical reason for exception and should document specific information on the medical reason in case of a CMS audit.

3.10 Activities That Were “Not Done”

Measure developers may use a negation attribute to identify situations in which an expected action did not occur (for example, the measured entity did not place or administer an order or did not observe a finding for a documented reason). The approach in CQL logic requires negation against the entire value set by providing a nullFlavor code and the value set object identifier (OID) in a QRDA Category I file to indicate “not done.”

Thus, measured entities should not arbitrarily select one specific action referenced by a value set to indicate the action not taken but should instead indicate they did not take *any* actions referenced in the value set. This approach applies to all QDM datatypes using *negationRationale* to describe activities “not done for a reason” and when the eCQM specification for “not done” references a value set instead of a direct reference code. It does not change the expression of negation in the HQMF, but 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 nullFlavor in this context is to specify that the measured entity intentionally did not do *all* the activities in the value set. It is not appropriate for a measured entity to certify that a clinician did not perform an activity using negation unless the measured entity intentionally did not order or perform the activity in question and documented a justification.

Figure 3.8 shows an example of logic expressing an activity “not done” in CQL from [CMS108v14, Venous Thromboembolism Prophylaxis](#).

Figure 3.8. Example of “Not Done” in CQL

▲ No Mechanical Or Pharmacological VTE Prophylaxis Due To Patient Refusal

```
( "No VTE Prophylaxis Medication Administered or Ordered"
union "No Mechanical VTE Prophylaxis Performed or Ordered" ) NoVTEProphylaxis
where NoVTEProphylaxis.negationRationale in "Patient Refusal"
```

▲ No VTE Prophylaxis Medication Administered Or Ordered

```
[ "Medication, Not Administered": "Low Dose Unfractionated Heparin for VTE Prophylaxis" ]
union [ "Medication, Not Administered": "Low Molecular Weight Heparin for VTE Prophylaxis" ]
union [ "Medication, Not Administered": "Injectable Factor Xa Inhibitor for VTE Prophylaxis" ]
union [ "Medication, Not Administered": "Warfarin" ]
union [ "Medication, Not Administered": "Rivaroxaban for VTE Prophylaxis" ]
```

```

union ["Medication, Not Ordered": "Low Dose Unfractionated Heparin for VTE Prophylaxis"]
union ["Medication, Not Ordered": "Low Molecular Weight Heparin for VTE Prophylaxis"]
union ["Medication, Not Ordered": "Injectable Factor Xa Inhibitor for VTE Prophylaxis"]
union ["Medication, Not Ordered": "Warfarin"]
union ["Medication, Not Ordered": "Rivaroxaban for VTE Prophylaxis"]

```

Figure 3.9 shows how the same “not done” scenario is represented in a QRDA I file. In this example the nullFlavor=“NA” attribute indicates that none of the actions in the referenced value set (sdtc:valuset) were performed.⁶

Figure 3.9. Corresponding QRDA I: Example of “Not Done” for QDM Element Defined with Value Set

```

<!--Medication not administered, patient refusal: Drug declined by
patient - reason unknown. No "Low Dose Unfractionated Heparin for VTE
Prophylaxis" were administered -->
<substanceAdministration classCode="SBADM" moodCode="EVN"
negationInd="true">
  <templateId root="2.16.840.1.113883.10.20.22.4.16" extension="2014-
06-09"/>
  <templateId root="2.16.840.1.113883.10.20.24.3.42" extension="2022-
08-01"/>
  <id root="48cb49dc-2bf7-43e9-9824-8538665158f8" />
  <statusCode code="completed"/>
  ...
  <consumable>
<manufacturedProduct classCode="MANU">
  <templateId root="2.16.840.1.113883.10.20.22.4.23"
extension="2014-06-09"/>
  <manufacturedMaterial>
    <code nullFlavor="NA"
sdtc:valueSet="2.16.840.1.113883.3.464.1003.196.12.1001">
      <originalText>None of the value set: Antibiotic Medications
for Pharyngitis</originalText>
    </code>
  </manufacturedMaterial>
</manufacturedProduct>
</consumable>
  <entryRelationship typeCode="RSON">
  <observation classCode="OBS" moodCode="EVN">
  <templateId root="2.16.840.1.113883.10.20.24.3.88"
extension="2017-08-01" />
  <code code="77301-0"
codeSystem="2.16.840.1.113883.6.1"
displayName="Reason care action performed or not"
codeSystemName="LOINC" />
  <value xsi:type="CD" code="182897004" codeSystem="2.16.840.1.113883.6.96"
displayName="Drug declined by patient - side effects
(situation)"
codeSystemName="SNOMED CT"/>
  </observation>
</entryRelationship>
</substanceAdministration>

```

⁶ From [2026 CMS QRDA HQR IG](#).

Measured entities using these concepts must have a documented reason for patient exceptions in their EHRs and must demonstrate the relevant justification if audited by CMS.

A direct reference code could also serve to specify QDM data elements in measure logic rather than creating value sets. For “not done” eCQM logic specified using value sets, use the same approach described previously when the item is “not done.” To specify “not done” eCQM logic using a direct reference code, the measured entity should directly negate the direct reference code itself. For calendar year 2027 reporting, the 2027 [CMS QRDA I IG](#) and the [HL7 QRDA I Category 1 Standard for Trial Use \(STU\) 5.3 with errata](#) provide 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 using a direct reference code.

3.11 Entities

Entities represent concepts that can serve to specify details about the patient, a person related to the patient, a practitioner, an organization, or a location. They are not QDM datatypes or attributes. An eCQM can use these entities to provide further information required for an individual or organization to meet the eCQM’s criteria.⁷

- Patient refers to an individual receiving health care services.
- Related person is someone involved in the care of a patient but not the direct target of care; this entity includes an identifier and a relationship (for example, mother to a newborn infant).
- Practitioner is a person with formal responsibility to provide health care with an ability to reference an identifier, role, qualification, or specialty.
- Organization is a grouping of people or organizations with a common purpose and includes identifier and datatype attributes.
- Location is information about a physical place and includes identifier and *locationType* attributes.

Full definitions of the five entities and their attributes as well as technical details are available in [QDM v5.6](#). For information on the versions of standards used in eCQMs for each reporting/performance period, please visit the [eCQI Resource Center eCQM Standards and Tools Versions](#) page.

3.12 Supplemental Value Sets

Supplemental value sets are used in eCQMs to capture categories such as race, ethnicity, sex, and payer that are not essential to the functioning of the measure.

⁷ For additional information, go to [QDM v5.6](#).

3.12.1 Race and Ethnicity

The eCQM specifications limit the reporting of patient race to the Centers for Disease Control and Prevention’s (CDC’s) value set “Race” (OID: 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, measured entities report one of the five U.S. Office of Management and Budget race category codes (1002-5, 2028-9, 2054-5, 2076-8, and 2106-3) in raceCode. To report an individual patient with more than one race category in QRDA Category I, the measured entity reports one race in raceCode and additional races using sdct:raceCode. In accordance with the standard, all the race codes placed here are equivalent in priority. Users should not use QRDA Category I, *Other Race* 2131-1, because null values are not appropriate to represent missing patient race information, as described below.

For QRDA Category III files, users should identify a patient with multiple races using code: 2131-1 *Other Race*. This enables measured entities to report patients with multiple races in an aggregate document without creating multiple entries for a single patient with multiple races. Only QRDA Category III files should use code 2131-1 *Other Race* to express patients with multiple races in the value element within the race supplemental data element.

Similarly, the specifications limit the reporting of ethnicity to the CDC value set “Ethnicity” (OID: 2.16.840.1.114222.4.11.837):

Code Description

2135-2 Hispanic or Latino

2186-5 Not Hispanic or Latino

The [2024 Health Data, Technology, and Interoperability: Certification Program Updates, Algorithm Transparency, and Information Sharing \(HTI-1\) rule](#)⁸ requires HIT developers certified under the Health IT Certification Program to the “patient demographics and observations” certification criterion to do the following:

§170.315 (a)(5) *Patient demographics and observations*

Enable a user to record, change, and access patient demographic and observations data including race, ethnicity, preferred language, sex...name to use...and date of birth.

⁸ CMS will work to maintain operational alignment with any future interoperability rule updates published by ONC.

§170.315 (a)(5)(A) *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)(3) 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)(3) and whether a patient declines to specify ethnicity.

Notably, the CDC value sets for race and ethnicity do not contain code(s) for situations where a patient declined to provide race or ethnicity. To communicate that a demographic element is unknown or the patient declined to provide the information for race and ethnicity, use the built-in nullFlavor feature of QRDA. The nullFlavor feature works for race, ethnicity, preferred language, and other cases in which the QRDA calls for a value from a value set and allows the nullFlavor as specified by the standard.

Generally, QRDA represents race as:

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

When the value is unknown, use the nullFlavor UNK for "Unknown:"

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

When the patient declines to specify, use the nullFlavor ASKU for "Asked but Unknown:"

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

3.12.2 Sex

eCQMs identify a patient's sex using SNOMED CT codes from the "Federal Administrative Sex" (OID: 2.16.840.1.113762.1.4.1021.121) value set. For reporting/performance year 2027, this extensional value set contains the following values:

Code Description

248152002 Female (finding)

248153007 Male (finding)

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

3.13.1 Use of Nonclinical or Administrative Code Systems

Specifications for eCQMs include terminologies in value sets derived from clinical vocabulary standards and 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 native capture terminologies (ICD-10-CM/PCS). A complete list of value sets and direct reference codes used in eCQMs is available for download on the [VSAC Download tab](#).

CMS formally retired the use of the ICD-9-CM code system for billing and reporting purposes. eCQM implementers should carefully review technical release notes and value sets posted to the eCQI Resource Center to determine the areas in which value set changes might affect their ability to capture data for the 2027 reporting/performance period and adjust accordingly.

3.14 Display of Human-Readable HQMF

The measure specification package file contains the human-readable Hypertext Markup Language (HTML) file of an eCQM. Users can also view the human-readable display directly on the eCQM page for a specific eCQM on the [eCQI Resource Center](#).

4. eCQM Guidance

CMS provides eCQM guidance to help users understand and implement eCQMs. This guidance is available in the human-readable HTML and the eCQM HQMF XML in the measure specification package zip files located on the [eCQI Resource Center](#). On this site, select one of the following three criteria to view program-specific measures, organized by reporting period:

- [Eligible Clinician eCQMs](#)
- [Hospital - Inpatient eCQMs](#)
- [Hospital - Outpatient eCQMs](#)

Guidance is available in the eCQM header and in the technical release notes of each eCQM posted on the eCQI Resource Center. This guidance is critical to the correct implementation of the eCQM. The technical release notes, which describe changes to measures between different versions, are also available on the [eCQI Resource Center](#).

5. ONC Project Tracking System (Jira)

CMS contractors manage and respond to eCQM interested parties through the ONC [Project Tracking System \(Jira\)](#). This system supports feedback and questions that apply to all phases of the eCQM life cycle, including development, approval, implementation, and updates regarding eCQM intent, specifications, certification, standards, and errors. Interested parties should report issues and questions about eCQM specifications on Jira. Interested parties can also ask questions or raise issues about eCQM tools and standards in different projects within Jira. Quality reporting issue trackers found on Jira include the following:

- [CMS Hybrid Measures](#)—CMS hybrid measure issues and questions
- [CQL Issue Tracker](#)—CQL development, implementation, and standards issues
- [CYPRESS Issue Tracker](#)—Certification testing tool test cases and implementation issues
- [eCQM Issue Tracker](#)—eCQM implementation and value sets issues
- [eCQM Known Issues](#)—Implementation information on eCQMs with known implementation issues or with technical issues for which a solution is under development but not yet available in a published eCQM specification
- [MADiE Issue Tracker](#)—eCQM development and testing tool issues
- [QDM Issue Tracker](#)—QDM development and implementation issues. The [QDM Known Issues](#) page (not in Jira) also provides guidance for eCQM developers and implementers on interpreting QDM attributes located on the CQL Formatting and Usage Wiki.
- [QRDA Issue Tracker](#)—QRDA implementation issues
- [QRDA Known Issues Dashboard](#)—Implementation information for QRDA IGs or supporting documents with known technical issues for which a solution is under development but not yet published.
- [USCDI+ Quality Tracker](#)—Feedback on draft USCDI+ Quality data element list

A user must create an account to submit, watch, or comment on an issue. Before reporting a new issue, eCQM interested parties should first search the applicable Jira project to determine whether a similar question has been previously submitted and addressed. If someone previously reported a similar issue, interested parties can follow the issue and receive updates.

When reporting a new issue, interested parties should fill out the ticket completely, selecting a title summarizing the issue, describing the issue in the description field, including the measure name and version number when applicable, and selecting an appropriate issue type. CMS encourages interested parties to add attachments—though never any that include protected health information—to facilitate a quick and accurate response. If interested parties enter insufficient information, the assignee will be unable to provide a response until the interested party updates the ticket. If the interested party does not provide clarifying information within 10 business days of submitting the initial inquiry, the administrator will close the ticket. Once the assignee provides a solution, the assignee will update the ticket to a status of “Closed.” Please note, there may be delays in responding to issues requiring feedback from more than one team or assignee.

If a response is insufficient to answer an issue, the interested party may add a comment to the existing issue and explicitly state how the previous answer did not adequately address the issue,

citing any previous ticket numbers if applicable. It is appropriate to comment regarding a missing resolution if there has not been any update or response in more than 10 business days and there is no comment from the assignee explaining the delay or when the resolution will be available.

6. CMS Quality Program Helpdesks

Questions regarding CMS quality and value-based purchasing program reporting requirements can be addressed to the following Helpdesks.

Table 6.1. Helpdesk Contact Information for CMS Quality Reporting Programs

CMS Quality Reporting Program	Helpdesk Contact Info
Hospital Inpatient Quality Reporting (IQR) and PPS-Exempt Cancer Hospital Quality Reporting (PCHQR)	Hospital Inpatient Support Team Quality Question and Answer Tool (844) 472-4477
Hospital Outpatient Quality Reporting (OQR) and Rural Emergency Hospital Quality Reporting (REHQR)	Hospital OQR Support Quality Question and Answer Tool (866) 800-8756
Quality Payment Program (QPP)	QPP Service Center QPP@cms.hhs.gov (866) 288-8292
Medicare Promoting Interoperability (formerly EHR Incentive) Program QualityNet reporting and data uploads	QNetSupport@cms.hhs.gov (866) 288-8912

Version History

Version	Date	Author/Owner	Description of Change
1.13	May 5, 2017	CMS/ONC (MITRE)	<ul style="list-style-type: none"> • Updated language in Introduction to include Merit-based Incentive Payment System 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 <p>Section 2:</p> <ul style="list-style-type: none"> • 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 <p>Section 3:</p> <ul style="list-style-type: none"> • Modified introductory paragraph in Section 3 • Removed Tables 1 and 2, Eligible Clinician eCQM Types and Versions and Eligible Hospital eCQM Types and Versions <p>Section 4:</p> <ul style="list-style-type: none"> • 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 <p>Section 6:</p> <ul style="list-style-type: none"> • Updated language in subsection 6.1—USHIK • 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 B <ul style="list-style-type: none"> • Updated table number for Table 3 Time Interval Definitions and Examples • Updated acronym list
2.0	May 4, 2018	CMS (MITRE)	<ul style="list-style-type: none"> • Updates and edits resulting in version 2.0 for release
3.0	May 3, 2019	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Revised text based on input from interested parties and external reviewers • Updated acronym list
4.0	May 2020	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Revised text based on input from interested parties and external reviewers • Updated acronym list
5.0	May 2021	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Removed measure tables • Revised text based on input from interested parties and external reviewers • Added section on hybrid measures, Program Candidate measures, and telehealth information • Added reference to eCQM and QRDA Known Issue trackers
6.0	May 2022	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Revised text based on input from interested parties and external reviewers
7.0	May 2023	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Revised text based on input from interested parties and external reviewers

Version	Date	Author/Owner	Description of Change
8.0	May 2024	CMS (Mathematica)	<ul style="list-style-type: none"> • Added section related to ratio measures • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Revised text based on input from interested parties and reviewers • Updated acronym list • Revised all instances of “pre-rulemaking” to “program candidate” • Made revisions for clarity throughout • Moved to active voice • Replaced the term “stakeholders” with “interested parties”
9.0	May 2025	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Revised text based on input from interested parties and reviewers • Made revisions for clarity throughout • Updated section on ratio measures to align with MMS Hub resources • Removed appendix with specific standards and code systems used in updated eCQMs and directed readers to eCQI Resource Center
10.0	May 2026	CMS (Mathematica)	<ul style="list-style-type: none"> • Updated measure examples, figures, hyperlinks, and versions of standards referenced throughout • Updated definitions of measure population criteria for clarity • Made revisions for clarity throughout • Revised text based on input from interested parties and reviewers • Provided links to lists of eCQMs by type (proportion, continuous variables, ratio)

Appendix A. Standards and Code Systems

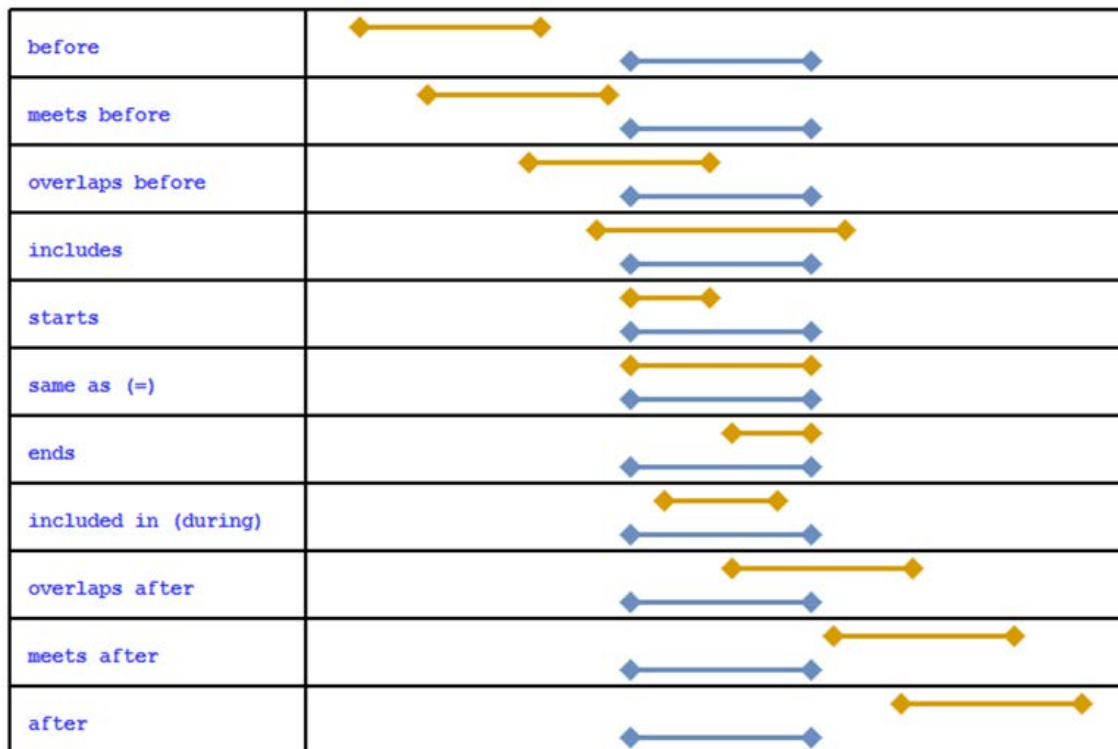
The standards and code systems used in the updated eCQM specifications for the 2027 reporting/performance period can be found on the [eCQI Resource Center's Standards and Tools Versions Table](#) or in the [eCQMs Annual Update Pre-Publication Document for the 2027 Reporting/Performance Period](#).

Appendix B. Time Interval Definitions and Examples

Interval Operators

The CQL standard provides a complete set of interval comparison operators (Figure B.1).

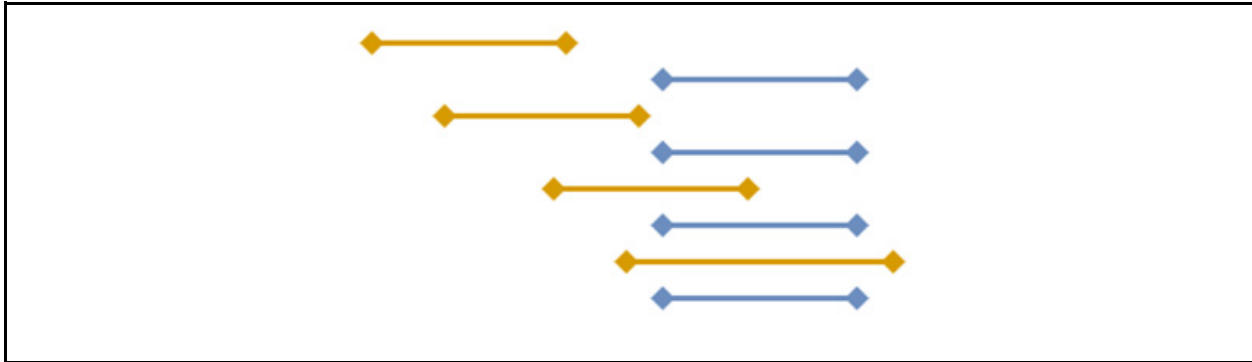
Figure B.1. Interval Comparison Operators



Timing Phrases

The CQL standard also supports timing phrases (Figure B.2) to make it easier to express precise relationships between intervals using natural language. The before and after operators can have a prefix of starts or ends and a suffix of start or ends. For example:

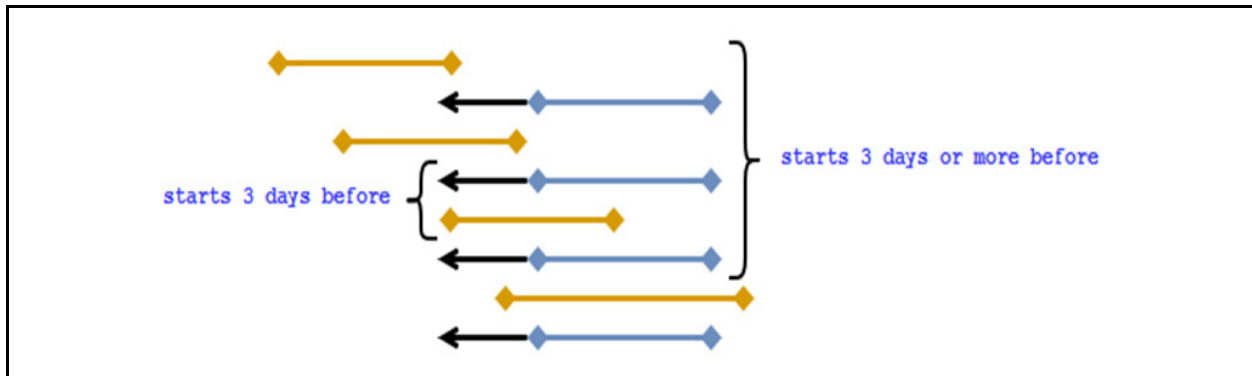
Interval X starts before start Interval Y

Figure B.2. Interval Starts before Start

The before and after operators can also take an offset indicating how far away a given relationship should be. The offset can be absolute, indicating the boundary of the interval must be on the offset, or it can be relative, indicating the boundary must be at least on the offset (Figure B.3):

Interval X starts 3 days before start Interval Y

Interval X starts 3 days or more before start Interval Y

Figure B.3. Interval Starts before Start with Offset

You can also specify a range for the boundary relationship using the within...of operator, as shown in Figure B.4:

Interval X starts within 3 days of start Interval Y

Figure B.4. Interval Starts Within

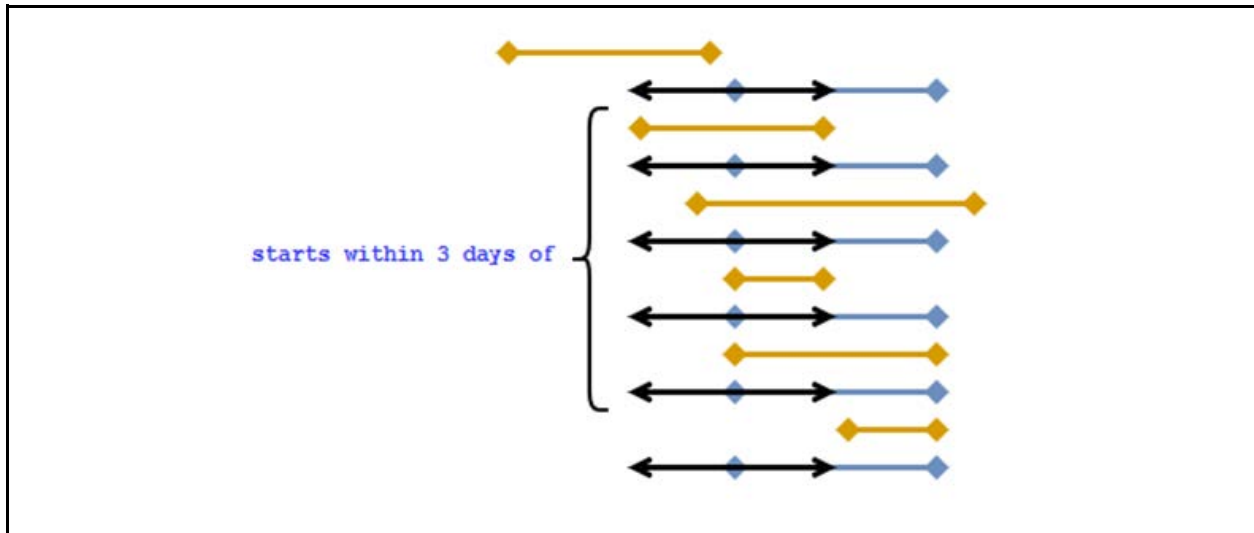


Table B.1. Time Interval Definitions and Examples⁹

Unit	CQL definition	Examples
Year	<p>Defined as the duration of any time interval starting at a certain time of day, at a certain calendar date of the calendar year, and ends at:</p> <ul style="list-style-type: none"> The same time of day on the same calendar date of the next calendar year, if it exists <p>OR</p> <ul style="list-style-type: none"> 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 <p>Note: If, in the next calendar year, the same calendar date does not exist, the International Organization for Standardization states the ending calendar day has to be agreed upon. CQL uses this convention.</p>	<p>Month (date 2) < month (date 1): Duration (years) = year (date 2) - year (date 1) - 1</p> <p>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</p> <p>Month (date 2) = month (date 1) and day (date 2) >= day (date 1) Duration (years) = year (date 2) - year (date 1)</p> <p>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</p> <p>Note: Time of day is important in this calculation. If the time of day of date 2 was less than the time of day for date 1, the duration of the time interval would be 0 years according to the definition.</p> <hr/> <p>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 = 1 year</p> <p>Month (date 2) = month (date 1) and day (date 2) < day (date 1) Duration (years) = year (date 2) - year (date 1) - 1</p> <p>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</p>

⁹ For more detail on time interval calculations, please reference Appendix H of the CQL Specification: <https://cql.hl7.org/15-h-timeintervalcalculations.html>

Unit	CQL definition	Examples
		<p>Month (date 2) > month (date 1) Duration (years) = year (date 2) - year (date 1)</p> <p>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</p> <p>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</p> <p>Note: Because there was 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).</p>
Month	<p>Defined as the duration of any time interval that starts at a certain time of day at a certain calendar day of the calendar month and ends at:</p> <p>The same time of day at the same calendar day of the ending calendar month, if it exists</p> <p>OR</p> <p>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</p> <p>Note: If, in the next calendar year, the same calendar date does not exist, the International Organization for Standardization states that the ending calendar day has to be agreed upon. CQL uses this convention.</p>	<p>Day (date 2) >= day (date 1) Duration (months) = (year (date 2) - year (date 1)) * 12 + (month (date 2) - month (date 1))</p> <p>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</p> <p>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</p> <p>Day (date 2) < day (date 1) Duration (months) = (year (date 2) - year (date 1)) * 12 + (month (date 2) - month (date 1)) - 1</p> <p>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</p>
Weeks	<p>Defined as a duration of any time interval starting 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.</p>	<p>Duration = [date 2 - date 1 (days)] / 7</p> <p>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</p>

Unit	CQL definition	Examples
Days	<p>Defined as a duration of any time interval starting at a certain calendar day and ends at the next calendar day (1 second to 23 hours, 59 minutes, and 59 seconds).</p> <p>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.</p>	<p>Time (date 2) < time (date 1) Duration = [date 2 - date 1 (days)] - 1</p> <p>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</p> <p>Time (date 2) >= time (date 1) Duration = date 2 - date 1 (days)</p> <p>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</p>
Hours	<p>Each hour is 60 minutes.</p> <p>The duration in hours between two dates is the number of minutes between the two dates divided by 60. The unit truncates the result.</p>	<p>Example 1: Date 1: 2012-03-01 03:10:00 Date 2: 2012-03-01 05:09:00 Duration = 1 hour</p> <p>Example 2: Date 1: 2012-02-29 23:10:00 Date 2: 2012-03-01 00:10:00 Duration = 1 hour</p> <p>Example 3: Date 1: 2012-03-01 03:10 Date 2: 2012-03-01 04:00 Duration = 0 hours</p>
Minutes	<p>Each minute is 60 seconds. The duration in minutes between two dates is the number of seconds between the two dates divided by 60. The unit truncates the result.</p>	<p>Example 1: Date 1: 2012-03-01 03:10:00 Date 2: 2012-03-01 05:20:00 Duration = 130 minutes</p> <p>Example 2: Date 1: 2012-02-29 23:10:00 Date 2: 2012-03-01 00:20:00 Duration = 70 minutes</p>

Acronyms

API	application programming interface
CAD	coronary artery disease
CDC	Centers for Disease Control and Prevention
CM	Clinical Modification
CMS	Centers for Medicare & Medicaid Services
CPT	Current Procedural Terminology
CQL	Clinical Quality Language
CVX	Clinical Vaccine Formulation
DENEX	denominator exclusions
DENOM	denominator
DERep	Data Element Repository
DEXCEP	denominator exceptions
EC	eligible clinician
eCQI	Electronic Clinical Quality Improvement
eCQM	electronic clinical quality measure
ED	emergency department
EHR	electronic health record
HCPCS	Healthcare Common Procedure Coding System
HHS	Department of Health and Human Services
HIT	health information technology
HL7	Health Level Seven International
HQMF	Health Quality Measure Format
HTML	Hypertext Markup Language
ICD	International Classification of Diseases
IG	implementation guide
IN	ingredient (RxNorm term type)
IP	initial population
IPSD	index prescription start date
IQR	Inpatient Quality Reporting
ISO	International Organization for Standardization

LVEF	left ventricular ejection fraction
LOINC	Logical Observation Identifiers Names and Codes
MADiE	Measure Authoring Development Integrated Environment
MI	myocardial infarction
MIPS	Merit-based Incentive Payment System
MMS	Measures Management System
MSRPOPL	measure population
MSRPOPLEX	measure population exclusions
NLM	National Library of Medicine
NUMER	numerator
NUMEX	numerator exclusions
OID	object identifier
ONC	Office of the National Coordinator for Health Information Technology
OQR	Outpatient Quality Reporting
PIN	precise ingredient (RxNorm term type)
PCS	Procedure Coding System
QDM	Quality Data Model
QPP	Quality Payment Program
QRDA	Quality Reporting Document Architecture
SNOMED CT	Systematized Nomenclature of Medicine Clinical Terms
VSAC	Value Set Authority Center
XML	Extensible Markup Language