# Introduction

## Conventions

### Namespaces

XML examples in this document use the following namespace prefixes. When no namespace prefix is present, the namespace is assumed to be "urn:hl7-org:v3" which is the HL7 Version 3 namespace used by the HQMF specification.

|  |  |  |
| --- | --- | --- |
| Prefix | Namespace | Description |
| (none) | urn:hl7-org:v3 | HQMF |
| xi: |  | Xinclude |
| xsi: |  | XML Schema |
| xsl: |  | XSLT |

# Overview

## Measure Parameters

Three parameters impact how a query is evaluated. These are recorded in the <controlVariable> element of the <QualityMeasureDocument> using the <measurePeriod> element. The <value> element of the <measurePeriod> is of the IVL\_TS data type. To define a query that will later be instantiated, the <width> element must be specified. This defines the default width of the time period over which the query is to be performed.

When used as input to a query, the <measurePeriod> element must fully specify the time period. The <low> and <high> elements are required, and must contain values which indicate the start and end dates of the measure period respectively. Throughout the query specification the start, end and duration of the measure period are accessible through the variables named MeasurePeriod.low, MeasurePeriod.width and MeasurePeriod.high respectively.

The <controlVariable> element may contain a <localVariableName> element, but it must always contain the value MeasurePeriod if it is present.

### Rationale

The measure time period affects which elements can possibly be accessed during query, and should be available to systems to enable them to optimize for the time period.

### Examples

The example below shows how an HQMF document would define the measure period for a query that could be executed at some time in the future. The start date and end date for the query are not specified because until the query is executed, the values are not known.

<controlVariable>

<!-- The following element is purely optional, but if included, must appear as shown below -->

<localVariableName>MeasurePeriod</localVariableName>

<measurePeriod><value><width value='1' unit='a'/></value></measurePeriod>

</controlVariable>

The following example shows how the previously mentioned query must be submitted for execution. Note the change in how <measurePeriod> is recorded, using the actual dates appropriate for the query.

<controlVariable>

<measurePeriod>

<value>

<low value='20110101'/>

<high value='20111231'/>

</value>

</measurePeriod>

</controlVariable>

### Events are Limited to the Measurement Period by Default

The assumption for all query criteria is that the events being considered are limited to those that occur within the measure period time frame unless otherwise indicated. This time frame is part of the context of the query, and is specified in the measure parameters described above.

#### Rationale

In evaluating a query a system could search for it over all possible events known or limit the evaluation to those events occurring within a particular time frame. It many queries, it is extremely common to limit the query to events within a specific time frame. Using a default time boundary limits the search space and improves the readability of specifications by avoiding unnecessary repetition of the time context. An event can be constrained to occur within a time frame different from the default by specifying that time frame (see Timing Constraints).

## Value Sets

Value sets may be defined in <valueSet> elements appearing beneath the <definition> element of the <QualityMeasureDocument>.

The <id> element provides the identifier for the value set, and is required.

The <title> element may be present to provide a human readable name for the value set.

The <text> element if present contains either an XML representation of a value set according to the schema used with IHE SVS profile, or a reference to a URL endpoint where that XML can be retrieved, or both.

The <value> elements, if present, each contain a single code value appearing in the value set.

### Rationale

Queries often need to select patients based on enumerated features of demographics, encounters, medications or other criterion that span a range of coded values. In order to fully specify the query, the contents of these value sets must be accessible to the information systems performing the query.

### Examples

The example below shows a value set being defined internally within the query.

<definition>

<valueSet>

<id root='1.2.840.10008.6.1.308'/>

<title>Common Anatomic Regions Context ID 4031</title>

<value code="T-D4000" displayName="Abdomen" codeSystem="2.16.840.1.113883.6.5"/>

<value code="R-FAB57" displayName="Abdomen and Pelvis" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-15750" displayName="Ankle joint" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-280A0" displayName="Apex of Lung" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-D8200" displayName="Arm" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-60610" displayName="Bile Duct" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-74000" displayName="Bladder" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-04000" displayName="Breast" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-26000" displayName="Bronchus" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-12770" displayName="Calcaneus" codeSystem="2.16.840.1.113883.6.5"/>

<value code="T-11501" displayName="Cervical spine" codeSystem="2.16.840.1.113883.6.5"/>

</valueSet>

</definition>

The example below shows a value set source being identified using SVS.

<definition>

<valueSet>

<id root='1.2.840.10008.6.1.308'/>

<text><

reference value='https://example.com/RetrieveValueSet?id=1.2.840.10008.6.1.3'/

></text>

</valueSet>

</definition>

The last example below shows a value set source being identified using the SVS schema.

<definition>

<valueSet>

<id root='1.2.840.10008.6.1.308'/>

<text><

reference value='https://example.com/RetrieveValueSet?id=1.2.840.10008.6.1.3'/

>

<RetrieveValueSetResponse xmlns="urn:ihe:iti:svs:2008">

<ValueSet id="1.2.840.10008.6.1.308" displayName="Common Anatomic Regions Context ID 4031"

version="20061023">

<ConceptList xml:lang="en-US">

<Concept code="T-D4000" displayName="Abdomen" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="R-FAB57" displayName="Abdomen and Pelvis" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-15750" displayName="Ankle joint" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-280A0" displayName="Apex of Lung" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-D8200" displayName="Arm" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-60610" displayName="Bile Duct" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-74000" displayName="Bladder" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-04000" displayName="Breast" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-26000" displayName="Bronchus" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-12770" displayName="Calcaneus" codeSystem="2.16.840.1.113883.6.5"/>

<Concept code="T-11501" displayName="Cervical spine" codeSystem="2.16.840.1.113883.6.5"/>

</ConceptList>

</text>

</valueSet>

</definition>

## Data Element Criteria

The fundamental unit of evaluation for a query is a criteria element. These can be found in <entry> elements appearing in the <DataCriteriaSection> element of a <component> in the <QualityMeasureDocument>. Criteria are represented using <actCriteria>, <encounterCriteria>, <observationCriteria>, <procedureCriteria>, <substanceAdministrationCriteria> and <supplyCriteria> elements. The different element names represent different kinds of patient information.

Each of the criteria elements contain a number of elements that may be present to filter the selected data elements of interest. The criteria elements are used later in the <populationCriteriaSection> to describe how different sets of information can be combined to select patients meeting the requirements of the query. Therefore, every top level criteria element should have an <id> element so that it can be referenced later. Descendant criteria need not have an <id> element if those criteria are not referenced elsewhere.

### Definitions

Each leaf criterion must contain a <definition> element that contains a reference of the appropriate type. This reference points to the definition of the data element which represents the type of information being sought. For example, a leaf <observationCriteria> element will contain an <observationReference moodCode='DEF'> element that identifies the type of observation being accessed.

#### Rationale

A mechanism is needed to link events back to the tables and columns or the object model of the system performing the query. The <definition> element provides that linkage. This enables systems transforming the query into executable statements to map the query criteria to the relevant objects.

The following table demonstrates the identifiers that must be used in these definitions:

|  |  |
| --- | --- |
| Type of Information | Identifier |
| Demographics | <id root='…' extension='Demographics'/> |
| Problems | <id root='…' extension='Problems'/> |
| Allergies | <id root='…' extension='Allergies'/> |
| Medications | <id root='…' extension='Medications'/> |
| Immunizations | <id root='…' extension='Immunizations'/> |
| Procedures | <id root='…' extension='Procedures'/> |
| Encounters | <id root='…' extension='Encounters'/> |
| Diagnostic Results | <id root='…' extension='Results'/> |
| Vital Signs | <id root='…' extension='Vitals'/> |

The root attribute is the same for all of these identifiers, and identifies information items in the S&I Framework model as it is accessed by Query Health. The root attribute must always be:

The definitions for these items must appear in the <dataCriteriaSection>. Appendix A lists

### Demographics

In order to represent the demographic criteria so that it can be used in query criteria, these must be represented as observations about the patient using the <observationCriteria> element. The demographic being queried is identified in the <code> element of the <observationCriteria> element. The particular value of that demographic data item is constrained in the <value> element of the <obserationCriteria> element.

The following value set of SNOMED codes must be supported by systems implementing the Query Health specifications to support queries based on patient demographics.

|  |  |  |  |
| --- | --- | --- | --- |
| **Concept** | **SNOMED CT Code** | **Preferred Name** | **Data Type** |
| Age | 424144002 | Current Chronological Age | IVL\_PQ |
| Birth Date | 184099003 | Date of Birth | IVL\_TS |
| Date of Death | 399753006 | Date of Death | IVL\_TS |
| Gender | 263495000 | Gender | CE or ST |
| Race | 103579009 | Race | CE or ST |
| Ethnicity | 364699009 | Ethnic Group | CE or ST |
| Marital Status | 125680007 | Marital Status | CE or ST |
| Religious Preference | 160538000 | Religious Affiliation | CE or ST |
| Birth Place | 169812000 | Place of Birth | ADDR |
| Address | 184097001 | Patient Address | ADDR |
| Postal Code | 184102003 | Patient Postal Code | CE or ST |
| City | 433178008 | City of Residence | CE or ST |
| State | N/A | State/Province of Residence | CE or ST |
| Country | 416647007 | Country of Residence | CE or ST |
| County | 432407003 | County of Residence | CE or ST |
| Street Address | 398099009 | Street Address | ST |

#### Values

The <value> element is where the constraints on the possible values of the demographic data element are recorded. The data type of the value element is recorded in the xsi:type attribute and must be recorded as shown in the Data Type column for each of the demographic items.

When a query constraint specifies a numeric range (as for age), the IVL\_PQ data type must be used, and the range expressed using the <low> and <high> elements beneath the <value> element.

<observationCriteria>

<id root='…' />

<code code='424144002' displayName='Age'   
 codeSystem='2.16.840.1.113883.6.96' codeSystemName='SNOMED-CT'/>

<value xsi:type='IVL\_PQ'>

<low value='17' unit='a'/>

<high value='64' unit='a'/>

</value>

…

</observationCriteria>

When a query constraint specifies a time range (as for date of birth or death), the IVL\_TS data type must be used. Again, the range is expressed using the <low> and <high> elements beneath the <value> element

Queries against a location may specify the location parameters using the ADDR data type.

#### Rationale:

There are several possible ways to represent demographics of the patient in HQMF. Most demographics can be represented using coded values on the patient participation, but in order to query by geographic criteria, these values would not be able to be constrained to a specific value set. Thus, one could ask for patients in a single postal code, city, or state, but could not ask for patients living in a wider geographic region made up of several states or postal codes. Also, it is not possible to ask for patients within a specific age group, or range of birth or death dates because these are limited to the timestamp data type. To address these issues, demographics are queried upon using the <observationCriteria> element.

#### Notes on Age

The chronological age of the patient varies over time and depends upon the time context. When age is evaluated independently from any other event, it is assumed to be age at any time during the measure period. The unit attribute should be reported using terms from the table below, using years, months, weeks, days or hours as appropriate.

|  |  |
| --- | --- |
| **Term** | **Description** |
| a | Year |
| mo | Month |
| wk | Week |
| d | Day |
| h | Hour |

#### Examples

For example, to perform a query on patients whose county of residence is Norfolk (as encoded in some coding system), you would record the criteria as follows:

<observationCriteria>

<code code='432407003' codeSystem='2.16.840.1.113883.6.96'/>

<value xsi:type='CE' code='Norfolk' codeSystem='…'/>

</observationCriteria>

A similar query on several regions would include

<observationCriteria>

<code code='432407003' codeSystem='2.16.840.1.113883.6.96'/>

<value xsi:type='CE' valueSet='…'/>

</observationCriteria>

### Problems and Allergies

The <observationCriteria> element is used to record information about a patient’s problems or allergies. The <value> element of the <observationCriteria> must be coded concept that identifies the problem or allergy of interest.

### Diagnostic Results

### Procedures

### Encounters

### Medications and Immunizations

## Orders, Past and Scheduled Future Events

## Demographics

## Timing Constraints

It is very common to temporally constrain the events of interest to the measurement period in some way. For example, NQF Measure 59 evaluates whether the most recent HbA1C measure taken during the measurement period is greater than 9%. That same measure allows a diagnosis of Steroid induced diabetes to be used as a Denominator exception when that diagnosis is found to be active within 2 years prior to the measurement end date (or one year prior to the measurement start date, since the measure period is one year). There are other cases where a measure may want to evaluate an event that occurs during a specific kind of encounter or procedure.

In order to support these temporal constraints, a criterion must be associated to the event which temporally constrains it using the <temporallyRelatedInformation> element.

In the XML representation of these constraints, the outer critierion element (e.g., <observationCriteria>) is usually considered to be the source or constrained criterion, and the inner element is the target, or constraining criterion. These relationships can be reversed by setting the inversionInd attribute to true on the <temporallyRelatedInformation> element.

The typeCode attribute of that element indicates what the temporal constraint is and must come from the following list of terms:

|  |  |  |
| --- | --- | --- |
| Term | Outer act temporal relationship to Inner act | Description |
| EAE | Ends After End |  |
| EAS | Ends After Start |  |
| EDU | Ends During |  |
| EBS | Ends Before Start |  |
| ECW | Ends Concurrent With |  |
| SAE | Starts after End |  |
| SDU | Starts During |  |
| SBS | Starts Before Start |  |
| SCW | Starts Current With |  |
| CONCURRENT | Concurrent With |  |
| DURING | Occurs During |  |
| OVERLAP | Overlaps With |  |

The example below shows use of the <temporallyRelatedInformation> element to constrain evaluation to measurements of HbA1C taken during the measurement period.

Example TBD

The next example shows the use of the <temporallyRelatedInformation> element to constrain evaluation of the observation criterion to those occurring during a specific encounter.

Example TBD

An alternate representation of the previously demonstrated criterion shows the encounter being constrained first in the XML, and then the observation. Note the use of the inversionInd attribute to show that the temporal constraint is coming from the outer criterion element, rather than the inner one.

Example TBD

### Time offsets

To adjust the time being compared by a constant value, use the <pauseQuantity> element. The value attribute of this element indicates the magnitude of the change. A positive change adds time to the target element, and negative change subtracts time from the target element. The units of time change come from the following list of terms, and must be supplied in the unit attribute on the <pauseQuantity> element.

|  |  |
| --- | --- |
| **Term** | **Description** |
| a | Year |
| mo | Month |
| wk | Week |
| d | Day |
| h | Hour |
| min | Minute |
| s | Second |

The vocabulary defining these terms is rather precise in its definition of a year. A year is defined as 365.25 days (the mean Julian year), and a month is defined as 1/12th of a year.

*From a query implementation perspective, it is unclear whether we should require strict interpretation using these values, or if we allow systems to perform “date arithmetic” more loosely, so that adding a month to 2/15 produces 3/15, rather than 3/16 (in leap years) or 3/17 (non-leap years), or allow that to be an implementation dependency. In most cases (e.g., research), it would seem that allowing for this to be implementation dependent would be sufficient, but for regulatory reporting, it may need to be stricter.*

The following example shows how to represent the administration of aspirin within 1 hour within 1 hour of admission.

Example TBD

The next example shows how to represent a diagnosis of Steroid induced diabetes within 1 year prior to the start of the measurement period.

<entry>

<localVariableName>HasSteroidInducedDiabetes</localVariableName>

<observationCriteria>

<id root="0" extension="HasSteroidInducedDiabetes"/>

<value xsi:type="CD" valueSet="2.16.840.1.113883.3.464.1.113"/>

<definition>

<observationReference moodCode="DEF">

<id root="0" extension="Problem"/>

</observationReference>

</definition>

<temporallyRelatedInformation typeCode="SAS">

<pauseQuantity value="-1" unit="a"/>

<observationReference>

<id root="0" extension="MeasurePeriod"/>

</observationReference>

</temporallyRelatedInformation>

</observationCriteria>

</entry>

## Ordering Constraints in a Subset

Sometimes you want to deal with only the smallest or largest value of an observation. Other times you want the newest or oldest event that has occurred. The <excerpt> element can appear in allows you to specify which of the events you want , ordered either by time of the event or its value (in the case of an observation). The subset of information desired is recorded in the <subsetCode> element of the <excerpt> element.

|  |  |  |
| --- | --- | --- |
| **Term** | **Description** | **Comments** |
| PAST | Previous | Selects all events that occurred or were expected to occur in the past. |
| FIRST | First Known | Selects the first known events that occurred or was expected to occur in the past. |
| RECENT | Most Recent | Selects the most recent event that occurred or was expected to occur in the past. |
| FUTURE | Expected Future | Selects all events are expected to occur in the future. |
| LAST | Expected Last | Selects the very last event that is expected or scheduled to occur in the future. |
| NEXT | Expected Next | Selects the next event that is expected or scheduled to occur in the future. |
| SUMMARY | Summary | Composes a summary of all events that ever have, or were scheduled to occur at any time. |
| FUTSUM | Future Summary | Composes a summary of all events that are expected or scheduled to occur at any time in the future. |
| PREVSUM | Previous Summary | Composes a summary of all events that ever have, or were scheduled to occur in the past. |
| MIN | Maximum | The observation with the largest value. |
| MAX | Minimum | The observation with the smallest value. |

### Selecting the Nth in Order

The <sequenceNumber> element may be constrained to select the Nth item in order by value or date. If for example, you are interested in the second highest value of an observation, you would set the value attribute of <sequenceNumber> to 2 inside the <entry> or act relationship.

### Summary Events

## Combining Temporal and Ordering Constraints

# Appendix A – Information Items Definitions

This appendix lists the definitions that must be used for the leave criteria elements appearing within the <dataCriteriaSection> within a query.

<entry>

<definition>

<actDefinition>

<id root='…' extension=''/>

</actDefinition>

</definition>

</entry>

<entry>

<definition>

<encounterDefinition>

<id root='…' extension=''/>

</encounterDefinition>

</definition>

</entry>

<entry>

<definition>

<observationDefinition>

<id root='…' extension=''/>

</observationDefinition>

</definition>

</entry>

<entry>

<definition>

<procedureDefinition>

<id root='…' extension=''/>

</procedureDefinition>

</definition>

</entry>

<entry>

<definition>

<substanceAdministrationDefinition>

<id root='…' extension=''/>

</substanceAdministrationDefinition>

</definition>

</entry>

<entry>

<definition>

<supplyDefinition>

<id root='…' extension=''/>

</supplyDefinition>

</definition>

</entry>

These definition can included verbatim as specified above within a query, or it can be included by referencing the URI urn:org-queryhealth:model:1.0 in an xi:include element, as in the following example:

<dataCriteriaSection>

…

<xi:include href='urn:org-queryhealth:model:1.0'/>

…

</dataCriteriaSection>

The