

Quality Data Model Technical Specification

National Quality Forum

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Expression Language (syntax)

The information provided in the QDM so far provides a clear method to articulate each data element used within a measure, a clinical decision support rule, or a request for information for other purposes. To communicate the information requirements fully, however, a measure developer must provide additional context regarding how each data element relates to other data elements. For example, to express that a depression scale was used to evaluate every patient with a new diagnosis of depression requires two QDM elements: a description of a depression scale and a diagnosis of depression. To describe a new diagnosis of depression requires some logic to indicate the expectation of the *first* instance of the diagnosis or to describe an occurrence of the active diagnosis of depression in the absence of such an active diagnosis during the previous six months (or some other time frame determined appropriate). The *new* diagnosis is a phrase or clause using some logic to impart additional meaning. Adding the expectation that a depression scale is completed with a known result applies additional logic to create a larger clause.

The first clause:

[*Diagnosis active: depression (onset date)*] *in the absence of* [*Diagnosis active: depression (<= 6 months prior)*]

The second, larger clause:

[*Risk assessment document: depression scale*] *within 48 hours of* [*Diagnosis active: depression (onset date)*] *in the absence of* [*Diagnosis active: depression (<= 6 months prior)*]

Each clause can be incorporated into each measure as it may apply to the population, denominator, numerator, or exclusion sections.

An expression language, or *syntax*, to apply QDM elements within a clause or a measure include: 1) relative timings, 2) operators, or 3) functions. Relative timings allow a measure developer to describe timing relationships among individual QDM elements to create clauses that add meaning to the individual QDM elements. Operators allow measure developers to compare two or more QDM elements logically or mathematically (AND, OR, >=, etc.) and also allow description of acceptable ranges of results for laboratory tests, diagnostic studies, and other QDM concepts. Functions specify sequencing (ordinality) and provide the ability to specify a calculation (subtract, add, divide, multiply, etc.) with respect to QDM elements and clauses containing them.

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Relative Timings¹

Relative Timings: Relative timings allow a measure developer to describe timing relationships among individual QDM elements to create clauses that add meaning to the individual QDM elements.		
Timing	Description	Example
Starts before or during	A relationship in which the source act's effective time starts before the start of the target or starts during the target's effective time.	<p>A pacemaker is present at any time <i>starts before or during</i> the measurement period:</p> <p><i>[Diagnosis active: pacemaker in situ] starts before or during [measurement period]</i></p> <p>A condition [diagnosis] that <i>starts before or during</i> [measurement end date], that means the diagnosis occurred anytime before the measurement end date <i>including</i> the possibility that the diagnosis was established on the measurement end date itself</p>
Starts before start of	A relationship in which the source act's effective time starts before the beginning of the effective start time of the target.	<p>Patient age is ≥ 17 before the beginning of the measurement period:</p> <p><i>[Patient characteristic: birthdate] (age) \geq (17, "years") starts before the start of [measurement period]</i></p>
Starts after end of	A relationship in which the target act takes place with a defined temporal relationship with respect to the time	<p>Medication reconciliation occurs within 30 days of a hospital discharge:</p> <p><i>[Encounter: encounter medication reconciliation] starts after the</i></p>

¹ The relative timings are part of HL7's normative Reference Information Model (RIM), which is incorporated in the HL7 Draft Standard for Trial Use, eMeasure Representation of the Health Quality Measure Format (HQMF). The timings are temporal comparators, codes defined to define *act relationships* that connect two *acts*. They are part of the ActRelationshipType code system, available at: <http://www.hl7.org/v3ballot/html/infrastructure/vocabulary/ActRelationshipType.html>.

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Relative Timings: Relative timings allow a measure developer to describe timing relationships among individual QDM elements to create clauses that add meaning to the individual QDM elements.

Timing	Description	Example
	at which the source act terminates.	<i>end of [Encounter: encounter inpatient] <= (30, "days")</i>
Occurs during	A relationship in which the source act's effective time is wholly within the target act's effective time.	>= 2 outpatient encounters occur during the measurement year: <i>[Encounter: encounter outpatient] DURING [measurement year]</i>
Starts after start of	The source act starts after the start of the target Act (i.e., if we say "ActOne starts after start of ActTwo," ActOne is the source, and ActTwo is the target).	Medication reconciliation occurs within 24 hours of inpatient admission: <i>[Encounter: encounter medication reconciliation] starts after start of [Encounter: encounter inpatient] <= (24, "hours")</i>
Linked to	Typically used to connect two otherwise unrelated facts. In the 2010 retooling effort, <i>LINKED TO</i> was primarily used for <i>negation rationale</i> (reasons an action was not performed), using the term <i>not done</i> . With the new QDM applying <i>decline</i> as an action related to any given concept, <i>LINKED TO</i> may have limited use.	To indicate the patient reason for why a medication was not given: <i>[Medication not done: patient reason] LINKEDTO [beta blocker medication]</i>
Ends before start of	A relationship in which the source act terminates before the target act's effective time.	To state that all aspirin products are discontinued at least 3 before the start of a surgical hospital admission: <i>[Medication active: aspirin products] ends before start of</i>

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Relative Timings: Relative timings allow a measure developer to describe timing relationships among individual QDM elements to create clauses that add meaning to the individual QDM elements.

Timing	Description	Example
		<i>[Encounter: surgical hospital encounter] >= (3 days)</i>
Ends before or during	A relationship in which the source act terminates before the target act terminates.	To state that intravenous anticoagulant medication is stopped before inpatient hospital discharge: <i>[Medication administered: anticoagulant medication (route = IV)] ends before or during [Encounter: encounter inpatient]</i>
Ends after end of	A relationship in which the source act terminates after the target act terminates.	To state that antidepressant medication continues for at least 150 days of treatment after the end of an inpatient admission: <i>[Medication dispensed: anti-depressant medications] ends after end of [Encounter: encounter inpatient] >= 150, days</i>
Ends after start of	A relationship in which the source act terminates after the target act's effective time.	To state that intravenous anticoagulation administration ends within 3 days after the start of oral warfarin administration: <i>[Medication administered: intravenous anticoagulants (route = IV)] ends after start of [Medication administered: warfarin (route = oral)] <=(3, "days")</i>
Ends during	A relationship in which the source act terminates within the target act's effective time.	To describe all patients with inpatient admissions with discharge dates occurring during the measurement period: <i>[Encounter: inpatient] ends during [measurement period]</i>
Starts during	A relationship in which the source act's effective time begins within the target act's effective time.	To describe oral anticoagulation therapy that starts during a hospital admission: <i>[Medication administered: oral anticoagulants] starts during</i>

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Relative Timings: Relative timings allow a measure developer to describe timing relationships among individual QDM elements to create clauses that add meaning to the individual QDM elements.

Timing	Description	Example
		[<i>Encounter: encounter inpatient</i>]
Ends concurrent with	A relationship in which the source act's effective time ends with the end of the target act's effective time.	To describe oral antibiotics that are stopped on the day of hospital admission: [<i>Medication active: oral antibiotics</i>] <i>ends concurrent with</i> [<i>Encounter: acute hospital admission</i>]
Starts concurrent with	A relationship in which the source act's effective time starts with the start of the target act's effective time.	To describe coronary artery bypass graft surgery (CABG) that is performed on the first day of an inpatient encounter: [<i>Procedure performed: CABG</i>] <i>starts concurrent with</i> [<i>encounter: inpatient</i>]
Concurrent with	A relationship in which the source act's effective time is the same as the target act's effective time.	To describe systolic and diastolic blood pressure that are taken from the same blood pressure reading: [<i>Physical exam finding: systolic blood pressure</i>] CONCURRENT [<i>Physical exam finding: diastolic blood pressure</i>]

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Operators

Operators: Operators allow measure developers to compare two or more QDM elements logically or mathematically (AND, OR, >=, etc.) and also allow description of acceptable ranges of results for laboratory tests, diagnostic studies, and other QDM concepts.		
Operator Name	Description	Example
Logical Operators		
AND	Used to conjoin two or more QDM elements or phrases through the use of 'AND'. Note: The addition of any measure phrase should always be preceded by an 'AND' or an 'OR'.	("Encounter perform: Hospital Inpatient" AND "Physical Exam, perform: Weight Measurement") DURING Measurement Period The syntax provided above asserts that the following must have occurred during the measurement period: 1) A Hospital Inpatient Encounter -AND- 2) a Physical Exam Performed for Weight Measurement
OR	Used to conjoin two or more QDM elements or phrases through the use of 'OR'. Note: The addition of any measure phrase should always be preceded by an 'AND' or an 'OR'.	("Encounter perform: Hospital Inpatient" OR "Encounter perform: Hospital Outpatient") DURING Measurement Period The syntax provided above asserts that one of the following must have occurred during the measurement period: 1) A Hospital Inpatient Encounter -OR- 2) A Hospital Outpatient Encounter
Math Operators		
SUBTRACTED FROM	Subtract operator. This operator should be used in coordination with either the SUBTIME or SUBDATE function. It is used to subtract a particular period of time to a QDM element.	SUBDATE(Measurement End Date SUBTRACTED FROM 165 DAYS) The syntax provided above asserts that 165 days should be subtracted from the measurement end date.

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Operators: Operators allow measure developers to compare two or more QDM elements logically or mathematically (AND, OR, >=, etc.) and also allow description of acceptable ranges of results for laboratory tests, diagnostic studies, and other QDM concepts.

Operator Name	Description	Example
ADDED TO	Addition operator. This operator should be used in coordination with either the ADDTIME or ADDDATE function. It is used to add a particular period of time to a QDM element.	<p><i>ADDDATE(Measurement Start Date ADDED TO 165 DAYS)</i></p> <p>The syntax provided above asserts that 165 days should be added to the measurement start date.</p>
Comparison Operators		
LESS THAN	Less than operator. In a mathematical expression, this comparison operator is used to denote that the value of the left-hand side is less than the value of the right-hand side (e.g., $x < y$). In clinical terms, the left-hand side might equate to the value of a data type specific attribute of a QDM or the timing associated between one or more QDM elements or phrases, while the right-hand side would equate to a specified quantity with/without an associated unit.	<p><i>"Encounter perform: Hospital Inpatient (duration < 120 DAYS)"</i></p> <p>The syntax above asserts that the Hospital Inpatient Encounter was less than 120 days in length.</p>
EQUAL TO	Equal operator. In a mathematical expression, this comparison operator is used to denote that the value of the left-hand side is equal to the value of the right-hand side (e.g., $x = y$). In clinical terms, the left-hand side might equate to the value of a data type specific attribute of a QDM or the timing associated between one or more QDM elements or phrases, while the right-hand side would equate to a specified quantity with/without an associated unit.	<p><i>"Encounter perform: Hospital Inpatient (duration = 120 DAYS)"</i></p> <p>The syntax above asserts that the Hospital Inpatient Encounter must be equal to 120 days in length.</p>

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Operators: Operators allow measure developers to compare two or more QDM elements logically or mathematically (AND, OR, >=, etc.) and also allow description of acceptable ranges of results for laboratory tests, diagnostic studies, and other QDM concepts.

Operator Name	Description	Example
NOT EQUAL TO	Not Equal To operator. In a mathematical expression, this comparison operator is used to denote that the value of the left-hand side is not equal to the value of the right-hand side (e.g., $x \neq y$). In clinical terms, the left-hand side might equate to the value of a data type specific attribute of a QDM or the timing associated between one or more QDM elements or phrases, while the right-hand side would equate to a specified quantity with/without an associated unit.	<p><i>"Encounter perform: Hospital Inpatient (duration \neq 120 DAYS)"</i></p> <p>The syntax above asserts that the Hospital Inpatient Encounter was not 120 days in length.</p>
Comparison Operators		
GREATER THAN OR EQUAL TO	Greater Than Or Equal To operator. In a mathematical expression, this comparison operator is used to denote that the value of the left-hand side is greater than or equal to the value of the right-hand side (e.g., $x \geq y$). In clinical terms, the left-hand side might equate to the value of a data type specific attribute of a QDM or the timing associated between one or more QDM elements or phrases, while the right-hand side would equate to a specified quantity with/without an associated unit.	<p><i>"Encounter perform: Hospital Inpatient (duration \geq 120 DAYS)"</i></p> <p>The syntax above asserts that the Hospital Inpatient Encounter was greater than or equal to 120 days in length.</p>

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Operators: Operators allow measure developers to compare two or more QDM elements logically or mathematically (AND, OR, >=, etc.) and also allow description of acceptable ranges of results for laboratory tests, diagnostic studies, and other QDM concepts.

Operator Name	Description	Example
GREATER THAN	Greater Than operator. In a mathematical expression, this comparison operator is used to denote that the value of the left-hand side is greater than the value of the right-hand side (e.g., $x > y$). In clinical terms, the left-hand side might equate to the value of a data type specific attribute of a QDM or the timing associated between one or more QDM elements or phrases, while the right-hand side would equate to a specified quantity with/without an associated unit.	<p><i>"Encounter perform: Hospital Inpatient (duration > 120 DAYS)"</i></p> <p>The syntax above asserts that the Hospital Inpatient Encounter was greater than 120 days in length.</p>
LESS THAN OR EQUAL TO	Less Than Or Equal To operator. In a mathematical expression, this comparison operator is used to denote that the value of the left-hand side is less than or equal to the value of the right-hand side (e.g., $x \leq y$). In clinical terms, the left-hand side might equate to the value of a data type specific attribute of a QDM or the timing associated between one or more QDM elements or phrases, while the right-hand side would equate to a specified quantity with/without an associated unit.	<p><i>"Encounter perform: Hospital Inpatient (duration ≤ 120 DAYS)"</i></p> <p>The syntax above asserts that the Hospital Inpatient Encounter was less than or equal to 120 days in length.</p>
Miscellaneous Operators		

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Operators: Operators allow measure developers to compare two or more QDM elements logically or mathematically (AND, OR, >=, etc.) and also allow description of acceptable ranges of results for laboratory tests, diagnostic studies, and other QDM concepts.

Operator Name	Description	Example
IS NOT NULL	NOT NULL value indicates the attribute result must be have a value (i.e., <i>not null</i>); the exact value or set of values that should be expected are not specified. Example: " <i>Laboratory test document: LDL (result = NOT NULL)</i> " The syntax asserts that the LDL result is present.	1) ("Diagnostic study <i>document: chest Xray (result = NOT NULL)</i>) STARTS AFTER START OF ("Encounter <i>perform: Hospital Inpatient</i>) DURING Measurement Period) <= 24 hours
IS NULL	NULL value indicates the attribute result is not valued. Example: " <i>Laboratory test document: <u>LDL (result = NULL)</u></i> " <u>The syntax asserts that the LDL may have been performed but no result is documented.</u>	1) ("Diagnostic study <i>document: chest Xray (result = NULL)</i> ") STARTS AFTER START OF ("Encounter <i>perform: Hospital Inpatient</i>) DURING Measurement Period) <= 24 hours
XOR	Logical XOR – ‘exclusive OR’ – only one of a series is true but not all	1) A patient should be included in the measure if he or she has allergy to only one of two medications required for the measure but not allergy to both medications ("Allergy <i>document: ACEI</i> ") XOR ("Allergy <i>document: ARB</i> ")
DIVIDED BY	Division operator indicates the mathematical operation to occur between two elements in the measure (simple division)	1) Low-density lipoprotein can be described directly as a data element or can be calculated. The calculation uses a division operator: ("Laboratory test <i>document: high-density lipoprotein (HDL)(value)</i> " minus "Laboratory test <i>document: triglycerides (value)</i> ") DIVIDED BY 5) < 100 mg/dL
TIMES	Times operator indicates the mathematical operation to occur between two elements in the measure (simple multiplication)	1) Absolute neutrophil count can be described directly as a data element or can be calculated. The calculation uses a multiplication operator: ("Laboratory test <i>document: neutrophil count (percentage value)</i> " TIMES "Laboratory test <i>document: total white blood cell (absolute value)</i> ") <= 500 cells/hpf

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Functions

Functions: Functions specify sequencing (ordinality) and provide the ability to specify a calculation (subtract, add, divide, multiply, etc.) with respect to QDM elements and clauses containing them.

Function Name	Description
FIRST	<p>Return the first occurrence of the associated QDM element or phrase. This is the first item in a list. Example:</p> <p><i>FIRST("Diagnosis active: Diabetes")</i></p> <p>The syntax provided above would return the green item in the following list:</p> <ol style="list-style-type: none"><i>1. "Diagnosis active: Diabetes"</i>"Diagnosis active: Diabetes""Diagnosis active: Diabetes""Diagnosis active: Diabetes""Diagnosis active: Diabetes"
SECOND	<p>Return the second occurrence of the associated QDM element or phrase. This is the second item in a list. Example:</p> <p><i>SECOND("Diagnosis active: Diabetes")</i></p> <p>The syntax provided above would return the green item in the following list:</p> <ol style="list-style-type: none">"Diagnosis active: Diabetes"<i>2. "Diagnosis active: Diabetes"</i>"Diagnosis active: Diabetes""Diagnosis active: Diabetes""Diagnosis active: Diabetes"

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Functions: Functions specify sequencing (ordinality) and provide the ability to specify a calculation (subtract, add, divide, multiply, etc.) with respect to QDM elements and clauses containing them.

Function Name	Description
THIRD	<p>Return the third occurrence of the associated QDM element or phrase. This is the third item in a list. Example:</p> <p><i>THIRD("Diagnosis active: Diabetes")</i></p> <p>The syntax provided above would return the green item in the following list:</p> <ol style="list-style-type: none"> 1. "Diagnosis, <i>active</i>: Diabetes" 2. "Diagnosis, <i>active</i>: Diabetes" 3. "<i>Diagnosis, active: Diabetes</i>" 4. "Diagnosis <i>active</i>: Diabetes" 5. "Diagnosis <i>active</i>: Diabetes"
FOURTH	<p>Return the fourth occurrence of the associated QDM element or phrase. This is the fourth item in a list. Example: <i>FOURTH("Diagnosis active: Diabetes")</i> The syntax provided above would return the green item in the following list:</p> <ol style="list-style-type: none"> 1. "Diagnosis <i>active</i>: Diabetes" 2. "Diagnosis <i>active</i>: Diabetes" 3. "Diagnosis <i>active</i>: Diabetes" 4. "<i>Diagnosis active: Diabetes</i>" 5. "Diagnosis <i>active</i>: Diabetes"

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Function Name	Description
FIFTH	<p>Return the fifth occurrence of the associated QDM element. This is the fifth item in a list or phrase. Example:</p> <p><i>FIFTH("Diagnosis active: Diabetes")</i></p> <p>The syntax provided above would return the green item in the following list:</p> <ol style="list-style-type: none"> 1. "Diagnosis active: Diabetes" 2. "Diagnosis active: Diabetes" 3. "Diagnosis active: Diabetes" 4. "Diagnosis active: Diabetes" 5. "Diagnosis active: Diabetes" 6. "Diagnosis active: Diabetes" 7. "Diagnosis active: Diabetes"
LAST	<p>Return the last occurrence of the associated QDM element or phrase. This is the very last item in a list. For example, LAST("Diagnosis active: Diabetes") would return the green item in the following list of eight diagnoses:</p> <ol style="list-style-type: none"> 1. "Diagnosis active: Diabetes" 2. "Diagnosis active: Diabetes" 3. "Diagnosis active: Diabetes" 8. "Diagnosis active: Diabetes"
COUNT	<p>Returns a True/False based on a count of a particular QDM element, with or without an attribute, or phrase and the result specified. The result must be specified as a positive integer. Example:</p> <p><i>COUNT("Encounter perform: Hospital Inpatient" DURING Measurement Period) > 4</i></p> <p>The syntax provided above would return "True" if and only if there were more than four hospital inpatient encounters during the measurement period.</p>

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Functions: Functions specify sequencing (ordinality) and provide the ability to specify a calculation (subtract, add, divide, multiply, etc.) with respect to QDM elements and clauses containing them.

Function Name	Description
COUNTDISTINCT	<p>Returns a True/False based on the distinct count of a QDM element with an assigned data type specific attribute(s) that equates to "is present." When using this function, an attribute must be added to define how the QDM element should be counted. The query is performed based on the given attribute(s) and filtered by the particular QDM data type to which it belongs (e.g., Encounter). The result must be specified as a positive integer. Example:</p> <p><i>COUNTDISTINCT("Encounter: Hospital Inpatient (start datetime is present)" DURING Measurement Period) > 4</i></p> <p>The syntax provided above would return "True" if and only if there were more than four hospital inpatient encounters during the measurement period that had a different start date/time.</p>
MAX	<p>Returns a True/False based on the maximum result value specified for a data type specific attribute of a QDM element. The result must be specified as a number. Example:</p> <p><i>MAX("Physical Exam result: Systolic Blood Pressure (result value < 90 mm/Hg)" DURING Measurement Period)</i></p> <p>The syntax provided above would return "True" if and only if the maximum systolic blood pressure value recorded for a patient during the measurement period was less than 90 mm/Hg.</p>
MIN	<p>Returns a True/False based on the minimum result value specified for a data type specific attribute of a QDM element. The result must be specified as a number. Example:</p> <p><i>MIN("Physical Exam perform: Diastolic Blood Pressure (result value < 90 mm/Hg)" DURING Measurement Period)</i></p> <p>The syntax provided above would return "True" if and only if the minimum systolic blood pressure value recorded for a patient during the measurement period was less than 90 mm/Hg.</p>

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Functions: Functions specify sequencing (ordinality) and provide the ability to specify a calculation (subtract, add, divide, multiply, etc.) with respect to QDM elements and clauses containing them.

Function Name	Description
RELATIVEFIRST	<p>Return the relative first item in a list (i.e., Immediate Prior). This function allows timing of a given list of clinical events to be compared, where each event must be considered in order of when it occurred in conjunction with the event that was immediately after it. As a result, this function should always be used in conjunction with the RELATIVESECOND function. Example:</p> <p><i>NOT((RELATIVEFIRST("Diagnosis active: ADHD")) Starts Before Start Of (RELATIVESECOND("Diagnosis active: ADHD")) > 6 months)</i></p> <p>The syntax provided above asserts that there was never an active diagnosis of ADHD that started before the start of any other active diagnosis of ADHD by greater than six months.</p>
RELATIVESECOND	<p>Return the relative second item in a list (i.e., Current). This function allows timing of a given list of clinical events to be compared, where each event must be considered in order of when it occurred in conjunction with the event that was immediately preceding it. As a result, this function should always be used in conjunction with the RELATIVEFIRST function. Example:</p> <p><i>NOT((RELATIVEFIRST("Diagnosis active: ADHD")) Starts Before Start Of (RELATIVESECOND("Diagnosis active: ADHD")) > 6 months)</i></p> <p>The syntax provided above asserts that there was never an active diagnosis of ADHD that started before the start of any other active diagnosis of ADHD by greater than six months.</p>

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Functions: Functions specify sequencing (ordinality) and provide the ability to specify a calculation (subtract, add, divide, multiply, etc.) with respect to QDM elements and clauses containing them.

Function Name	Description
NOT	<p>Negates QDM element with associated attribute(s) or phrase. Please note that when an attribute is indicated for a QDM element at this level, what is being negated is the occurrence of a particular QDM element with that attribute. Example:</p> <p><i>NOT("Lab Test document: LDL (result is present)" SAS Measurement Period)</i></p> <p>The above syntax indicates that there was not a LDL reading performed that:</p> <ol style="list-style-type: none"> 1) started after the start of the measurement period -AND- 2) had a documented result <p>However, there could have been an LDL reading that occurred that:</p> <ol style="list-style-type: none"> 1) started after the start of the measurement period -AND- 2) did not have a documented result
ABS	<p>Returns a True/False based on the absolute result value specified for a data type specific attribute value of a QDM element. The result must be specified as a positive number. Example:</p> <p><i>ABS("Physical Exam perform: Diastolic Blood Pressure(result is present)" DURING Measurement Period) > 120 mmHg</i></p> <p>The syntax provided above would return "True" if and only if the absolute value for a diastolic blood pressure reading was greater than 120.</p>
ROUND	<p>Returns a True/False based on the result value specified for a rounded data type specific attribute value of a QDM element. The result must be specified as a positive number. Example:</p> <p><i>ROUND("Physical Exam perform: Diastolic Blood Pressure (result is present)" DURING Measurement Period) > 140 mmHg</i></p> <p>The syntax provided above would return "True" if and only if the rounded diastolic blood pressure value recorded for a patient during the measurement period was less than 90 mmHg.</p>

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Function Name	Description
SUM	<p>Returns a True/False based on the result value specified for a summed data type specific attribute value of a QDM element. The result must be specified as a positive number. Example:</p> <p><i>SUM("Intervention perform: Physical Restraint (duration is present)" DURING Measurement Period) > 5 HOURS</i></p> <p>The syntax provided above would return "True" if and only if the summed overall durations of physical restraint were greater than five hours.</p>

Example Measures Using Expression Language (Syntax)

The following are examples of measure concepts that account for longitudinal, care coordination or patient centered measures. None of the following measures has been developed, reviewed or endorsed. The purpose of providing these examples is to show how the QDM and the expression language can be used to describe new areas of measurement.

- A. **Hypertension:** These examples are provided to show how the QDM can be used to express required measure criteria. The examples do not explore all of the clinical permutations or appropriateness of measure design, which requires detailed clinical evaluation and may be managed using a composite measure approach (e.g., <a> proportion of patients with improvement, mean or median time to improvement for those who improved, <c> mean or median of actual change in diastolic BP from intake or initial diagnosis until six months post intake, etc.).
- a. Initial Diagnosis to diastolic BP less than 90 using blood pressure taken by a device in the patient's home:
 - The QDM elements for the example are (elements in parentheses are attribute):
 - "Patient characteristic *document*: birth date"
 - "Diagnosis *active*: hypertension (timing: onset time)"

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- "Physical exam finding *document*: diastolic blood pressure (value \geq 90 mmHg)
- Application of the expression language:
 - Population:
 - AND: "Patient characteristic *document*: birth date" \geq 18 years starts before start of "measurement period"
 - Denominator:
 - AND: FIRST "Diagnosis *active*: hypertension" starts before or during "measurement period"
 - AND: "Physical exam finding *document*: diastolic blood pressure (value \geq 90 mmHg; data flow source: blood pressure monitor, recorder: blood pressure monitor, subject: patient; environment: ambulatory office) starts concurrent with FIRST "Diagnosis *active*: hypertension"
 - Numerator:
 - AND: FIRST "Physical exam finding *document*: diastolic blood pressure (value $<$ 90 mmHg; timing: start time; data flow source: blood pressure monitor, recorder: blood pressure monitor, subject: patient; environment: home) minus FIRST "Diagnosis *active*: hypertension (timing: onset time)"
- The general meaning of the description—Provide the time from the initial entry of hypertension active diagnosis that is associated with an elevated diastolic blood pressure result to the first diastolic blood pressure reading of $<$ 90 mmHg that occurs after the initial entry of hypertension active diagnosis. The challenge with this measure is to determine when the diagnosis of hypertension was actually determined and whether it is recorded. That is a workflow and implementation issue. The denominator components of active hypertension diagnosis and elevated diastolic blood pressure may seem redundant; however, including both components ensures that there is an elevated value for which to expect improvement. A patient with controlled hypertension presenting to a new community with no prior electronic record information is therefore not included.
- b. Time from initial (intake) visit to achievement of diastolic BP $<$ 90 based on blood pressure taken by a device in the patient?
 - QDM elements
 - "Patient characteristic *document*: birth date"
 - "Encounter *perform*: ambulatory or inpatient encounter (timing: start time)"
 - "Physical exam finding *document*: diastolic blood pressure (value \geq 90 mmHg)

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- "Diagnosis *active*: hypertension (timing: onset time)"
- Application of expression language:
 - Population:
 - AND: "Patient characteristic *document*: birth date" \geq 18 years starts before start of "measurement period"
 - Denominator:
 - AND: FIRST "Encounter *perform*: ambulatory or inpatient encounter (timing: start time)" during the "measurement period"
 - AND: "Diagnosis *active*: hypertension (timing: onset time)" starts before or during FIRST "Encounter *perform*: ambulatory or inpatient encounter"
 - AND: "Physical exam finding *document*: diastolic blood pressure (value \geq 90 mmHg; data flow source: blood pressure monitor, recorder: blood pressure monitor, subject: patient; environment: ambulatory office) during FIRST "Encounter *perform*: ambulatory or inpatient encounter"
 - Numerator:
 - AND: FIRST "Physical exam finding *document*: diastolic blood pressure (value $<$ 90 mmHg; timing: start time) minus FIRST "Encounter *perform*: ambulatory or inpatient encounter (timing: start time; data flow source: blood pressure monitor, recorder: blood pressure monitor, subject: patient; environment: home)"
- The general meaning of the description—Provide the time from the initial patient visit (here listed as any encounter in any setting) with an entry diagnosis of hypertension and an elevated diastolic blood pressure at intake to the first diastolic blood pressure reading of $<$ 90 mmHg that occurs after that visit. This is described as an individual patient measure with a unique value for each patient.

B. Care Coordination: Stage 2 Recommended measure statement expecting composite measures assessing closing the “referral loop.” Description: These composite measures would assess the success of critical information communicated in a bidirectional manner between specialists, primary care physicians, and patients. Specifically, measures would assess information transfer between the physician requesting referral / consultation and the provider completing referral / consultation. In addition, measures within this composite would assess communication of results by both specialist and primary care physician to patient and family members.

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- a. **Example measure:** Transmission and receipt of consultation and return of consultation report shared with referring physician and the patient. Note: This is only an example. Detailed specification can vary and the example is to show only how the QDM and the expression language can be used to describe the measure criteria.
- QDM elements:
 - “Patient characteristic *document*: birth date”
 - “Health record component *transmit*: consultation referral”
 - “Health record component *transmit*: consultation report”
 - Application of the expression language:
 - Population:
 - AND: “Patient characteristic *document*: birth date” \geq 18 years starts before start of “measurement period”
 - Denominator:
 - AND: “Health record component *transmit*: consultation referral (data flow attribute: sender = *primary care physician*; actor attributes: source = *primary care physician*, recorder = *primary care physician*, subject = *patient*)” DURING “measurement period”
 - Numerator 1:
 - AND: “Health record component *receive*: consultation referral (data flow attribute: receiver = *specialist physician*; actor attributes: source = *primary care physician*, recorder = *primary care physician*, subject = *patient*)
 - Numerator 2:
 - AND: “Health record component *transmit*: consultation report (data flow attribute: sender = *specialist physician*; actor attributes: source = *specialist physician*, recorder = *specialist physician*, subject = *patient*)
 - AND: “Health record component *receive*: consultation report (data flow attribute: receiver = *primary care physician*; actor attributes: source = *specialist physician*, recorder = *specialist physician*, subject = *patient*)
 - AND: “Health record component *receive*: consultation report (data flow attribute: receiver = *patient*; actor attributes: source = *specialist physician*, recorder = *specialist physician*, subject = *patient*)

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QDM Mapping of Concepts to States

Each of the concepts described in the QDM has specific states in which it can be described. Most of the QDM concepts are generally found in only a subset of the available states. The following table provides the states generally appropriate to each QDM concept. A description of the concept and state is available in the QDM Glossary. Recommendations for additional states or for additional mappings are encouraged as part of the QDM comment process. Each of the QDM concepts and its associated state is depicted in the eMeasure computer readable version as a pattern based on HL7 Version 3.0 reference information model (RIM) concepts.

QDM Mapping of Concepts to States			
Concept	State	State of Action	State of Being
Allergy	Document	x	
	Update	x	
Characteristics	Acknowledge	x	
	Document	x	
	Order	x	
	Report	x	
Communication	Acknowledge	x	
	Decline	x	
	Record	x	
	Transmit	x	
Condition/Diagnosis/Problem	Active		x
	Inactive		x
Device	Apply	x	
	Decline	x	
	Plan	x	
Diagnostic Study	Decline	x	
	Order	x	

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QDM Mapping of Concepts to States			
Concept	State	State of Action	State of Being
	Perform	x	
	Recommend	x	
Encounter	Decline	x	
	Order	x	
	Perform	x	
	Recommend	x	
Experience	Acknowledge	x	
	Document	x	
	Order	x	
	Report	x	
Family History	Decline	x	
	Document	x	
	Update	x	
Functional Status	Decline	x	
	Order	x	
	Perform	x	
Health Record Component	Access	x	
	Acknowledge	x	
	Alert	x	
	Calculate	x	
	Create	x	
	Discontinue	x	
	Document	x	
	Implement	x	
	Notify	x	
	Order	x	
	Perform	x	

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QDM Mapping of Concepts to States			
Concept	State	State of Action	State of Being
	Receive	x	
	Recommend	x	
	Reconcile	x	
	Remind	x	
	Report	x	
	Review	x	
	Stratify	x	
	Transmit	x	
	Update	x	
Intervention	Order	x	
	Perform	x	
	Recommend	x	
Intolerance	Document	x	
	Update	x	
Laboratory Test	Decline	x	
	Perform	x	
	Order	x	
Medication	Active		x
	Administer	x	
	Decline	x	
	Dispense	x	
	Order	x	
Physical Exam	Decline	x	
	Order	x	
	Perform	x	
Preference	Acknowledge	x	
	Document	x	

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QDM Mapping of Concepts to States			
Concept	State	State of Action	State of Being
	Report	x	
	Request	x	
Procedure	Decline	x	
	Order	x	
	Perform	x	
	Recommend	x	
Risk Evaluation	Perform	x	
	Record	x	
Substance	Administer	x	
	Order	x	
Symptom	Active		x
	Assess	x	
	Inactive		x
	Resolved		x
System resources	Acknowledge	x	
	Document	x	
	Report	x	
	Order	x	
Transfer	Order	x	
	Perform	x	

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Quality Data Model (QDM) Terminology Definitions (Glossary)

This glossary, which corresponds with the **Quality Data Model (QDM) Version 3.0**, defines the major QDM components and then describes them in more detail with corresponding examples.

QUALITY DATA MODEL (QDM) COMPONENTS	
QDM Element	<i>QDM element</i> is an atomic unit of information that has precise meaning to communicate the data required within a quality measure. A <i>QDM element</i> includes a <i>concept</i> , the <i>state</i> in which the concept is expected to be found with respect to electronic clinical data, and all required <i>metadata</i> (i.e., a <i>value set</i> of terms and all required <i>attributes</i>). The QDM element provides unambiguous definition and enables consistent capture and use of data for quality measurement. A QDM element may be defined for any given measure and reused when the same information is required for another measure. Reuse encourages standardization of quality measures and reduces computer programming requirements for new measures. ²
Concept	<i>Concept</i> refers to a particular category of information that can be addressed in a quality measure. It is analogous to the HL7 Concept Domain, a named category of like concepts (semantic type) that will be bound to one or more <i>coded elements</i> . ¹ The concept is the highest level of definition for a QDM element. The QDM currently contains 23 concepts. Some examples include medication, procedure, condition/diagnosis/problem, communication, and encounter.
Instance	<i>Instance</i> is a specific use or representation of the concept. An instance of a concept is created when a specific value set is applied to it. <i>Example: Diabetes</i> is an instance of the concept <i>diagnosis</i> when a value set derived from ICD-9-CM or SNOMED-CT™ is applied. <i>Aspirin</i> is an instance of the concept <i>medication</i> when a value set derived from RxNorm is applied.
Taxonomy	<i>Taxonomy</i> is a standard vocabulary or other classification system that can be used to define a QDM

² NQF Health Information Technology Expert Panel II (HITEP II), *HIT Automation of Quality Measurement: Quality Data Set and Data Flow*. Washington DC: National Quality Forum; 2009.

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QUALITY DATA MODEL (QDM) COMPONENTS	
	<p>element's concept. For the purpose of the QDM, taxonomy is synonymous with a code system (a collection of codes with associated designations and meanings³). Specific taxonomies are used in applying the QDM to quality measures based on the results of consensus-based standards harmonization efforts, such as the HIT Standards Committee of the Office of the National Coordinator for Health Information Technology (ONC) and established certification rules for meaningful use. <i>Examples:</i> ICD-9-CM, ICD-10, SNOMED-CT™, and CPT-™ are examples of taxonomies. The concept of <i>diabetes</i> may be described in QDM with ICD-9-CM, ICD-10, and/or SNOMED-CT™.</p>
Value Set	<p><i>Value set</i>, (also referred to as <i>code list</i>), is a set of values that contain specific codes derived from a particular taxonomy. Value sets are used to define an instance of a concept used in a QDM element. A <i>parent</i> value set may also contain <i>child</i> (or nested) value sets that define the same concept. The approach is consistent with the HL7 definition for a value set as “a uniquely identifiable set of valid concept representations, where any concept representation can be tested to determine whether or not it is a member of the value set...A sub-value set is a sub-set of a ‘parent’ value set...When a Value Set Entry references another Value Set, the child value set is referred to as a <i>Nested Value Set</i>. There is no preset limit to the level of nesting allowed within value sets. Value sets cannot contain themselves, or any of their ancestors (i.e.. they cannot be defined recursively).”⁴</p> <p><i>Examples:</i></p> <p><i>Value Set A:</i> The concept diagnosis may be defined by a value set containing values using the taxonomy ICD-9-CM. [250, 250.0, 250.1, ...]</p> <p>or</p> <p><i>Value Set B:</i> The concept diagnosis may be defined by a <i>parent</i> value set that contains more than one <i>child</i> value set each using a different taxonomy. For example, the concept diagnosis with the instance <i>asthma</i> may be defined by a <i>parent</i> value set <i>asthma</i> that contains three <i>child</i> value sets using ICD-9CM, ICD-10, and SNOMED-CT™.</p> <p>or</p> <p><i>Value Set C:</i> Some value sets may contain more than one <i>child</i> value set that represent distinctly</p>

³ Value Set Consortium, Value set definition and binding document. Available at: http://valuesets.org/wiki/index.php?title=Value_Set_Definition_and_Binding_Document. Last accessed April 2011.

⁴ Value Set Consortium, Value set definition and binding document. Available at: http://valuesets.org/wiki/index.php?title=Value_Set_Definition_and_Binding_Document. Last accessed April 2011.

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QUALITY DATA MODEL (QDM) COMPONENTS	
	different instances but are grouped together for convenience. For example, the value set describing the concept medication instance <i>ACEI</i> ⁵ may be combined with the value set describing the concept medication instance <i>ARB</i> ⁶ into a parent value set <i>ACEI/ARB</i> . For consistency, applications of the QDM have used such “convenience” parent value sets only when the child value sets included in them all use the same taxonomy.
Value	<p>With respect to value sets, a <i>value</i> is a specific code defined by a given taxonomy. Values are included in value sets.</p> <p>A value also may be used to express an attribute, or metadata, about a QDM element that specifies an expected result. In the context of QDM elements, some concepts (e.g., laboratory test) have an <i>attribute</i> of “result. A result may be expressed as a value (numerical, alphanumeric, or words); see entry under <i>result</i>.</p>
State	<p>A <i>state</i> is a context or mode of existence or activity expected for any given QDM element. A state may indicate either that an instance of a concept (<i>state of being</i>) or an activity expected for the instance of a concept (<i>state of action</i>) exists. Examples of states of being include <i>active</i>, <i>inactive</i>, and <i>resolved</i> when applied to the concept <i>diagnosis/condition/problem</i>, or <i>active</i> when applied to the concept <i>medication</i>. Examples of states of action include <i>administer</i>, <i>decline</i>, <i>order</i>, and <i>dispense</i> when applied to the concept <i>medication</i>. A full list of states of action and states of being is provided in the QDM Model.</p>
Attribute	<p>An <i>attribute</i> provides specific detail about a QDM element. QDM elements have required attributes related to actor, timing, and <i>data flow</i>, or they may have optional attributes based on the concept of a QDM element. Examples of actor attributes include <i>source</i>, <i>recorder</i>, and <i>subject</i>. Timing attributes refer to the beginning and end time of a QDM element, while the time span of a QDM element may be calculated from the timing attributes. Data flow attributes may include human or system <i>sender</i> and <i>receiver</i>. A list of optional concept-specific attributes sorted by QDM concept may be found in Table XX,</p>

⁵ ACEI—Angiotensin-converting enzyme inhibitors, a unique class of medications used for treating elevated blood pressure and heart failure, among other conditions.

⁶ ARB—Angiotensin receptor blockers, a unique class of medications used for treating elevated blood pressure and heart failure, among other conditions

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QUALITY DATA MODEL (QDM) COMPONENTS	
	QDM Concepts and States of the QDM Overview.

CONCEPT —Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication</i> , <i>procedure</i> , <i>condition/diagnosis/problem</i> , <i>communication</i> , and <i>encounter</i> .	
Allergy	An allergy is an immunologically mediated reaction that is specific to exposure to a given agent and recurs on re-exposure to that agent. That agent may be a medication, a substance, or, in the case of a device, the materials used within that device. Non-allergic reactions are covered under <i>intolerance</i> .
Characteristic	<i>Characteristics</i> refer to specific factors about a patient, clinician, provider, or facility. Included are demographics, behavioral factors, social or cultural factors, available resources and preferences. <i>Behaviors</i> reference responses or actions that affect (either positively or negatively) health or healthcare. Included in this category are mental health issues, adherence issues unrelated to other factors or resources, coping ability, grief issues, and substance use/abuse. <i>Social/cultural factors</i> are characteristics of an individual related to family/caregiver support, education and literacy (including health literacy), primary language, cultural beliefs (including health beliefs), persistent life stressors, spiritual and religious beliefs, immigration status, and history of abuse or neglect. <i>Resources</i> are means available to a patient to meet health and healthcare needs, which would include caregiver support, insurance coverage, financial resources, and community resources to which the patient is already connected and receiving benefit. <i>Preferences</i> are choices made by patients and their caregivers relative to options for care or treatment (including scheduling, care experience, and meeting of personal health goals) and the sharing and disclosure of their health information.
Communication	<i>Communication</i> is the transmission, receipt, or acknowledgement of information sent from a source to a recipient. This may include the provision of any communication from one clinician to another regarding findings, assessments, plans of care, consultative advice, instructions, educational resources, etc. It also may include the receipt of response from a patient with respect to any aspect of the care provided. Furthermore, it may include the provision of any communication from provider to patient. (e.g., results, findings, plans for care, medical advice, instructions, educational resources, appointments, result). A time and date stamp is required.

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CONCEPT —Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication, procedure, condition/diagnosis/problem, communication, and encounter</i> .	
Condition/Diagnosis/Problem	A <i>problem, diagnosis, or condition</i> is a scientific interpretation of result, assessment, and treatment response data that persists over time and tends to require intervention or management, or a clinical feature that includes but is not limited to those treated, monitored, evaluated, or impacts other treatment or venues of care (e.g., encounters or lengths of stay). It is used to guide planning, implementation, treatment, and evaluation. A problem or condition includes, but is not limited to, acute, intermittent, or chronic conditions; diagnoses; symptoms; functional limitations; or visit- or stay-specific conditions.
Device	<i>Device</i> is an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component part, or accessory, intended for use in the diagnosis, cure, mitigation, treatment or prevention of disease and that is not dependent on being metabolized to achieve any of its primary intended purposes. ⁷
Diagnostic study	A <i>diagnostic study</i> is any kind of medical test performed as a specific test or series of steps to aid in diagnosing or detecting disease (e.g., to establish a diagnosis, measure the progress or recovery from disease, to confirm that a person is free from disease). ⁸ The QDM defines diagnostic studies as those that are not performed in organizations that perform testing on samples of human blood, tissue, or other substance from the body. Diagnostic studies may make use of digital images and textual reports. Such studies include but are not limited to imaging studies, cardiology studies (electrocardiogram, treadmill stress testing), pulmonary function testing, vascular laboratory testing, and others.
Encounter	An <i>encounter</i> is an identifiable grouping of healthcare-related activities characterized by the entity relationship between the subject of care and a healthcare provider; such grouping is determined by the healthcare provider. ⁹ A patient encounter represents interaction between a healthcare provider and a patient with a face-to-face patient visit to a clinician's office, or any electronically remote

⁷ Derived from the device definition of the US Food and Drug Administration (FDA), Department of Health and Human Services, Washington DC; 2010. Available at <http://www.fda.gov/>. Last accessed July 2010.

⁸ Canada Health Infoway EHR Glossary (Note: No changes in the QDS Model Version 2 and 2.1 citations took place.)

⁹ International Organization for Standardization (ISO), *Health Informatics—Requirements for an Electronic Health Record Architecture ISO/TS 18308*. Geneva, Switzerland: ISO; 2004. Available at www.iso.org/iso/home.htm. Last accessed May 2010. (Note: No changes in the QDS Model Version 2 and 2.1 citations took place.)

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<p>CONCEPT—Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication, procedure, condition/diagnosis/problem, communication, and encounter</i>.</p>	
	<p>interaction with a clinician for any form of diagnostic treatment or therapeutic event. Encounters can be billable events but are not limited to billable interactions. Each encounter has an associated location or modality within which it occurred (such as an office, home, electronic methods, phone encounter, or telemedicine methods). The encounter location is the patient's location at the time of measurement.</p>
Experience	<p>Experience is defined as information collected from a consumer, patient, or family member about their perception of the care they received or from a care giver about the care provided. Information collected includes the elements of care coordination, communication, whole-person approach to care, access to care, timeliness of care, and information sharing.</p>
Family History	<p>Problems, conditions, and diagnoses experienced by a patient's family members whether existing currently or in the past. The <i>family history</i> represents a patient's pedigree information associated with clinical and genomic data.</p>
Functional Status	<p><i>Functional status</i> assessment is specific to tools that evaluate an individual patient's actual physical or behavioral performance as an indicator of capabilities at a point in time. The functional status assessment can be used in measurement to determine change in physical or behavioral performance over time, or specific capabilities that cause a patient to be included or excluded from a measurement population.</p> <p>Examples include: Eastern Cooperative Oncology Group (ECOG) Performance Status, Edmonton Functional Assessment Tool (EFAT), Karnofsky Performance Scale, Katz Index of Independence in Activities of Daily Living, Palliative Performance Scale version 2, the Medical Outcomes Study (MOS) Short Form Survey Instrument (SF-12), and the Asthma Quality of Life Questionnaire. Alternately, <i>risk assessment</i> refers to appraisals of health and well-being, providing information as to the risk for conditions or increased severity of illness (e.g., Braden Skin Scale, Morse Fall Risk Scale, etc.), whereas <i>physical exam</i> includes psychiatric examinations.</p>
Health Record Component	<p>A <i>health record component</i> is a section of a clinical record that contains information about a patient and upon which actions can be performed (e.g., transmit, acknowledge, document, etc.). A few examples of <i>health record components</i> include allergy lists, problem lists, clinical summaries, medication lists, and others.</p>

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<p>CONCEPT—Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication, procedure, condition/diagnosis/problem, communication, and encounter.</i></p>	
<p>Intervention</p>	<p>An <i>intervention</i> is an action—treatment, procedure, or activity—designed to achieve an outcome. Interventions represent those care activities that can be performed by a clinician, a patient, or a caregiver and that require supervision, monitoring, or communication. Interventions represent a broad concept of activities distinct from diagnostic tests, procedures, laboratory tests, or encounters, each of which is a step in any individual patient's care process. Included are education, communication, patient referrals (e.g., between providers, to counselors, to church support groups), behavioral interventions (counseling), physical actions (dressing change, ambulation with or without assistance), use of inhalation devices, provision of nutrition, exercise, use of psychosocial interaction, or relaxation techniques, to name a few.</p> <p>To distinguish interventions from the concept <i>procedures</i>, procedures can be specifically identified and used in reimbursement schema (e.g., surgical operations, chiropractic manipulation, setting of bone fractures, and placement of a cast). Both procedures and interventions can generate a claim for payment, but a claim is not necessarily created. Examples: (1) instruction in walking with crutches is an intervention, yet there is a billing process for reimbursement; and (2) periodic oral evaluation and cleaning are procedures (generally performed by a dentist and oral hygienist), yet mouth care is an intervention because it is a routine process performed by a patient, caregiver, or clinician.</p>
<p>Intolerance</p>	<p><i>Intolerance</i> refers to the inability to take a specific substance or medication, or endure a device, study, test, or procedure unrelated to a true allergic reaction.</p> <p>Intolerance encompasses adverse events and adverse effects. In the instance of a quality measure, an adverse event is an unexpected or dangerous reaction to a device, diagnostic study, intervention, laboratory test, procedure, or substance. Serious adverse events are those that are fatal, life-threatening, permanently or significantly disabling, require or prolong hospitalization, lead to congenital anomaly (in the case of diagnostic studies and substances), require intervention to prevent permanent impairment or damage, or require specific treatment, care plan, or encounter. <i>Medication adverse effects</i> refer to conditions that are due to drugs and medical and biological</p>

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<p>CONCEPT—Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication</i>, <i>procedure</i>, <i>condition/diagnosis/problem</i>, <i>communication</i>, and <i>encounter</i>.</p>	
	<p>substances when the correct substance was administered as prescribed. These are generally clinician-identified effects. Medication adverse effects are distinct from medication allergy and intolerance.</p> <p>Intolerance is generally based on patient report and perception. Immunologic reactions are covered with the concept <i>allergy</i>.</p>
Laboratory Test	<p>A <i>laboratory test</i> is a medical procedure that involves testing a sample of blood, urine, or other substance from the body. Tests can help determine a diagnosis, plan treatment, check to see if treatment is working, or monitor the disease over time.¹⁰ Laboratory tests may be performed on specimens not derived from patients (electrolytes or contents of water or consumed fluids, cultures of environment, pets, other animals). The states will remain the same.</p>
Medication	<p>A <i>medication</i> refers to clinical drugs or chemical substances intended for use in the medical diagnosis, cure, treatment, or prevention of disease. A medication contains a value derived from taxonomies such as RxNorm.</p>
Physical Examination	<p>A <i>physical examination</i> is the evaluation of the patient's body to determine its state of health. The techniques of inspection include palpation (feeling with the hands or fingers), percussion (tapping with the fingers), auscultation (listening), visual inspection, and smell. Measurements may include vital signs (blood pressure, pulse, respirations) as well as other clinical measures (such as expiratory flow rate, size of lesion, etc.). Physical exam includes psychiatric examinations.</p>
Preference	<p><i>Preference</i> refers to the healthcare treatment choices influenced, but not limited to, language, religious, or cultural preferences. Preference can be driven as well by utility measurement. A health utility index (HUI) is a family of generic health profiles and preference-based systems for measuring health status, reporting health-related quality of life (HRQL), and producing utility scores. HRQL, as defined by Patrick and Erickson, "is the value assigned to duration of life as modified by the impairments, functional states, perceptions, and social opportunities that are influenced by disease, injury, treatment, or policy." HUI questionnaires, designed to elicit responses from a wide variety of</p>

¹⁰ National Cancer Institute (NCI). Bethesda, MD: NCI; 2010. Available at www.cancer.gov/. Last accessed May 2010. (Note: No changes in the QDS Model Version 2 and 2.1 citations took place.)

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CONCEPT —Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication, procedure, condition/diagnosis/problem, communication, and encounter</i> .	
	subjects, make it easy to incorporate such a patient-reported outcome (PRO) and utility instrument into a clinical study. HUI evolved in response to the need for a standardized system to measure health status and HRQL to describe: 1) the experience of patients undergoing therapy; 2) long-term outcomes associated with disease or therapy; 3) the efficacy, effectiveness, and efficiency of healthcare interventions; and 4) the health status of general populations. ¹¹ Preference may be expressed in legal documents such as consent forms, living wills, and advance directives.
Procedure	A <i>procedure</i> is a course of action intended to achieve a result in the care of persons with health problems. It is generally invasive and involves physical contact. A procedure may be a surgery or other type of physical manipulation of a person's body in whole or in part for purposes of making observations and diagnoses or providing treatment. ¹² Some of these procedures are not reimbursed. Note that procedure is distinct from intervention.
Risk Evaluation	Risk category assessments include tools and calculators that suggest vulnerabilities for any given patient. Distinct from functional status, risk categorization uses findings, observations, results, and sometimes judgments and patient-generated information for use within clinical care algorithms, clinical decision support, and severity analysis. A time and date stamp is required. <i>Examples:</i> Braden Score for Predicting Pressure Score Risk, Morse Fall Risk Scale, Pneumonia Severity Index. ¹³
Substance	A chemical element and its compounds in the natural state or obtained by any manufacturing process (other than pharmaceutical drugs), including any additive necessary to preserve its stability

¹¹ Patrick DL, Erickson P, *Health Status and Health Policy: Quality of Life in Health Care Evaluation and Resource Allocation*. New York: Oxford University Press; 1993; and Horsman J, Furlong W, Feeny D, et al., The health utilities index (HUI): concepts, measurement properties and applications, *Health and Quality of Life Outcomes*, 2003;1-54. Abstract available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC293474/>.

¹² Modified from Canada Health Infoway.

¹³ AHRQ, *Pneumonia Severity Index Calculator (PSI)*, Bethesda, MD: AHRQ. Available at: <http://pda.ahrq.gov/clinic/psi/psicalc.asp>. Last accessed May 2010.

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CONCEPT —Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include <i>medication, procedure, condition/diagnosis/problem, communication, and encounter</i> .	
	and any impurity deriving from the process used, but excluding any solvent that may be separated without affecting the stability of the substance or changing its composition. ¹⁴ Substance may or may not have a code or be classified by a code system such RxNorm. Examples of a substance may include but are not limited to: environmental agents (e.g., pollen, dust) and food (e.g., vitamins).
Symptom	A <i>symptom</i> is an indication that a person has a condition or disease. Some examples are headache, fever, fatigue, nausea, vomiting, and pain. ¹⁵ Also, subjective of disease perceived by the patient. ¹⁶ As an example to differentiate symptom from finding, the patient's subjective symptom of fever is distinguished from the temperature (a finding). For a finding, there is a source of either a temperature-measuring device, and there is a recorder of the device (electronically) or an individual (healthcare provider, patient, etc.).
System Resources	The configuration of an organization (e.g., nursing staff ratios; availability of durable medical equipment; health information technology infrastructure and capabilities, such as e-prescribing; access to care systems; or invasive procedure capabilities.
Transfer	<i>Transfer</i> refers to the different locations or settings a patient is released to, or received from, to ensure the coordination and continuity of healthcare. Such transfers involve a handoff process, whereby patient information and permanent or temporary medical devices or equipment are exchanged, and accountability and responsibility for patient care are transferred. ¹⁷ This may

¹⁴ European Chemicals Agency, *REACH-Registration, Evaluation, and Authorisation of Chemicals*, France; 2005. Available at www.prc.cnrs-gif.fr/reach/en/home.html. Last accessed May 2010.

¹⁵ UMLS Dictionary, 2010. <http://www.nlm.nih.gov/research/umls/> Last accessed December. 2010.

¹⁶ National Cancer Institute (NCI), Bethesda, MD; NCI, 2010. Available at www.cancer.gov/. Last accessed May 2010.

¹⁷ (i) Coleman E, Falling through the cracks: challenges and opportunities for improving transitional care for persons with continuous complex care needs, *J Am Geriatr Soc*, 2003;51(4):549-555. (ii) Alem L Joseph M, Kethers S et al. ,Information environments for supporting consistent registrar medical Handover, *Health Inform Manage J* , 2008;37(1): 9-23; Anderson C D, Mangino RR, Nurse shift report: who says you can't talk in front of the patient?, *Nurs Ad Q*, 2006;30(2):112-122; (iii) Benson E.Rippin-Sisler C, Jabusch K, et al., Improving nursing shift-to-shift report, *J Nurs Care Qual*, 2006; 22(1):80-84; (iv) Caruso EM, The evolution of nurse-to-nurse bedside report on a medical-surgical cardiology unit, *Medsurg Nurs*, 2007;16(1):17-22.; (v) Kerr MP, A qualitative study of shift handover practice and function from a socio-technical perspective, *J Adv Nurs*, 2002; 37(2):125-134; (vi) Lardner R, *Effective Shift Handover— A Literature Review*, Health and Safety Executive Report, Edinburgh,

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CONCEPT—Refers to a particular category of information in a quality measure. There are 23 concepts in the current version of the QDM. Examples of concepts include *medication, procedure, condition/diagnosis/problem, communication, and encounter*.

include the setting from which a patient is received or released (e.g., home, acute care hospital, skilled nursing) to the current location. A time and date stamp is required.

STATES OF ACTION

STATES—A *state* is a mode of existence or activity of a *QDM element*. A *state* may be either a form of existence (*state of being*) including *active, inactive, and resolved*, or it may be an action (*state of action*), including but not limited to *administer, decline, and dispense*. *Examples*: The concept *diagnosis* may have a state of being of *active*, and the concept *medication* may have a state of action of *administer*.

STATES OF ACTION

Access	The act of retrieving data or a computer file.
Acknowledge	To officially recognize, admit, or accept receipt of an object or information.
Administer	To give or directly oversee by injection, inhalation, ingestion (or other means) the use of medicines, drugs, remedies, or other substances.
Alert	To make someone aware of a possible danger or difficulty.
Apply	To utilize or put into operation equipment designed to treat, monitor, or diagnose a patient's status that is in use, or impacts or alters treatment, care plan, or encounter (e.g., an antithrombotic device is placed on the patient's legs to prevent thromboembolism, or a cardiac pacemaker).

UK: Keil Centre; 1996, p. 17. Available at: <http://www.npsf.org/download/Focus2004Vol7No2.pdf>. Last accessed May 2010;
 (vii) Manning ML, Improving clinical communication through structured conversation, *Nurs Econ*, 2006; 24(5): 268-271; (viii) Riesenber LA, Leitzsch J, Little BW, Systematic review of handoff mnemonics literature, *Am J Med Qual*, 2006; 24(3):196-204; (ix) Strople, B, Ottani, P, Can technology improve intershift report? What the research reveals, *J Prof Nurs*, 2006;22(3):197-204.

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STATES OF ACTION

Assess	To evaluate a situation or process.
Calculate	To compute mathematically.
Create	To produce something, as in a printed report or electronic copy.
Decline	To indicate that something is not done, generally associated with a <i>reason</i> when used in quality measures.
Discontinue	To stop or end an activity that is planned or is happening regularly; also to remove an element from existing patient information, such as an allergy from an allergy list.
Dispense	To give medications to a patient or patient proxy based on a prescription. Typically, in the ambulatory setting, medications are primarily taken directly by patients and not directly observed. Hence, medications dispensed are the closest health provider documentation of medication compliance. ¹⁸
Document	To create a record of facts, events, symptoms, or findings.
Implement	To put into effect or action.
Notify	To inform or warn officially to make something known. Typically, an indication from a patient, clinician, or system application to another patient, clinician, or system application that some fact or process must be addressed.
Order	An instruction to bring, supply, perform, or activate something. Typically, this refers to provider-generated instructions or requests for processes to be performed (e.g., <i>order</i> a medication, <i>order</i> a laboratory test, <i>order</i> a diagnostic test).

¹⁸ Adapted from HITSP C154 Quality Data Dictionary. V1.01. 2010.

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STATES OF ACTION

Perform	To carry out an action or accomplish a task, especially one requiring care or skill.
Plan	To arrange or design a method or scheme for any prospective or intended orders, interventions, encounters, services, procedures, or any other proceedings. ¹⁹
Recommend	To suggest something as worthy of being accepted, used or performed.
Reconcile	To make two or more potentially conflicting things consistent or compatible such that inconsistencies are resolved or explained. Often used in the context of <i>reconciliation</i> of medication lists, problem lists, or allergy lists.
<u>Record</u>	To register or preserve data in some form of log or documentation.
Remind	To cause an actor (individual, organization, or application) to remember or think of something, such as to take a specific action to maintain or improve health.
Report	To give detailed information about results of aggregate research, analysis, or investigations.
Request	To ask a person or system or application to do something.
Review	To examine something critically to make sure it is adequate, accurate, and correct and to determine if new actions should be undertaken.
Stratify	To divide or arrange into classes, castes, or social strata into a series of graded statuses.
Transmit	To communicate a message, information, or news.

¹⁹ Adapted from HITSP C154 Quality Data Dictionary. V1.01. 2010.

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STATES OF ACTION

Update	To provide someone or something with the most recent information or with more recent information than was previously available.

STATES OF BEING

STATES—A *state* is a mode of existence or activity of a *QDM element*. A *state* may be either a form of existence (*state of being*) including *active*, *inactive*, and *resolved*, or it may be an action (*state of action*), including, but not limited to, *administer*, *decline*, and *dispense*. *Examples*: The concept *diagnosis* may have a state of being of *active*, and the concept *medication* may have a state of action of *administer*.

STATES OF BEING

Active	An <i>active</i> diagnosis is a problem, diagnosis, or condition that is currently monitored, tracked, or a factor that must be considered as part of the treatment plan in progress. An active medication is a medication a patient currently is taking. An active symptom is a patient's reported perception of departure from normal functioning that is present at the time indicated. A time and date stamp is required.
Inactive	A problem, diagnosis, condition, or symptom that has been present in the past and currently is not under active treatment or causing clinical manifestations but may require treatment or monitoring in the future. A time and date stamp is required.
Resolve	A resolved diagnosis is a problem, diagnosis, condition, or symptom that has been present in the past, no longer requires treatment, and is currently unlikely or unexpected to recur. A date and time stamp is required.

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ATTRIBUTE—An *attribute* provides specific detail about a QDM element. QDM elements *may* have attributes related to actor, timing, and data flow, or optional attributes based on the concept of a QDM element.

TIME

Time

Time refers to the occurrence required for a specific QDM element. Each element has an initiation time and an ending time. In some cases, the initiation and the end are the same, and there is no intervening interval. Examples of paired beginning and end times (*beginning—end*) encountered during the 2010 measure retooling process include: *admission—discharge, arrival—departure, insertion—removal, incision—closure, start—stop*.

Timing also applies a sequencing of QDM elements in a series, or *process context*. The occurrence of any given QDM element (beginning or end) may be one step in a sequence of process steps. Timing provides a mechanism to apply such sequencing in the logic of a measure. As one example of sequencing, duration is calculated from the difference between the beginning time and end time attributes. Cumulative duration may be expressed further by combining the durations of individual processes (e.g., cumulative medication duration over a defined period of time).

DATA FLOW

Data Flow

Data flow refers to the movement of information from one place or person to another. Data flow requires both a *sender* and a *receiver*.

Sender: the human or system entity (or application) that output the information content expressed by the QDM element to another system, individual, or location.

Receiver: the human or system entity (or application) that was given the information content expressed by the QDM element from another system, individual, or location.

Example: To express transmission of a clinical summary of an outpatient visit, the data flow sender may be the physician (or the EHR application), and the data flow receiver may be the patient (or a care giver.) To express acknowledgement of receipt of the clinical summary, the data flow sender may be the patient (or a care giver), and the data flow receiver may be the physician (or the EHR application).

ATTRIBUTE—An *attribute* provides specific detail about a QDM element. QDM elements *may* have required attributes related to actor, timing, and data flow, or optional attributes based on the *concept* of a *QDM element*.

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ACTOR	
Actor	<p>The <i>actor</i> is used to define the expected origin of the QDM element that, therefore, implies specific intended meaning. There are three actors of import to a QDM element that are involved in the origination, capture, and display of the data. These actors are the <i>source</i>, <i>recorder</i>, and <i>subject</i>.</p> <p>The <i>source</i> is the originator of the QDM element. The source may be a human individual or an electronic application or system.</p> <p>The <i>recorder</i> is the human individual or the electronic application or system that enters the data element into a health record field.</p> <p>The <i>subject</i>, or focus of the information in the data element, is the human individual or the electronic application or system for which the data element is relevant.</p> <p>The same application or individual may be a source, recorder, and subject of the QDM element, but not necessarily.</p> <p><i>Examples:</i></p> <ol style="list-style-type: none">1. A measure for depression could define a QDM element, PHQ-9 (Public Health Questionnaire 9: Depression screener), with the patient as a source (the person providing the information for the responses), a clinician as a recorder (the person who enters the responses into a computer interface screen), and the patient as the subject (the individual about whom the information is relevant). Alternatively, a different version of this measure for depression could define a QDM element, PHQ-9 (Public Health Questionnaire 9: Depression screener), with the patient as a source (the person providing the information for the responses), the patient as a recorder (the person who enters the responses into a computer interface screen), and the patient as the subject (the individual about whom the information is relevant). The very specific definition of the source, recorder, and subject allows a measure developer to incorporate clear direction to how information should be interpreted.2. A measure for blood pressure control could define a QDM element, Physical examination finding: systolic blood pressure, with the electronic blood pressure monitor as a source (the application or device providing the information for the blood pressure value), a clinician as a recorder (the person who enters the blood pressure values into a computer interface screen), and the patient as the subject (the individual about whom the information is relevant). Alternatively, a different version of the measure for blood pressure control could define a QDM element, Physical examination finding: systolic blood pressure, with the electronic blood pressure monitor as a source (the application or device providing the information for the blood pressure value), the electronic blood pressure monitor as the recorder (the clinical application or device that enters the blood pressure values directly into the computer via electronic transmission), and the patient as the subject (the individual about whom the information is relevant). Each measure evaluates blood pressure, but the potential value of the data captured is different for each. Note, using the attribute of <i>environmental location</i> (see <i>concept-specific attributes</i>), the measure developer could further specify whether the blood pressure was obtained in a home or office setting, thereby incorporating additional meaning to the information.

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ATTRIBUTE—An <i>attribute</i> provides specific detail about a QDM element.	
CONCEPT-SPECIFIC ATTRIBUTES	
Anatomical Structure	The particular structure, location, or body part of a subject.
Discharge Status	The disposition of the patient at the time of discharge (generally used in the 2010 retooling project to express exclusions, e.g., left against medical advice, expired).
Dosage	The amount of therapeutic agent that was indicated to be given during a procedure, diagnostic test, or medication or substance administration.
Environmental Location	The setting in which an action or event takes place (e.g., home, school, work, etc.).
Facility Location	The particular location of a facility in which an encounter occurs. Examples include, but are not limited, to intensive care unit (ICU) locations, non-ICU locations, burn critical care unit, neonatal ICU, and respiratory care unit.
Health Record Field	The location where the data element is expected to be found. In the context of the 2010 retooling project, this attribute is used to describe the <i>health record</i> location of <i>discharge medication list</i> . This new version of the QDM provides a QDM concept <i>health record component</i> , which can be used to describe <i>discharge medication list</i> . Thus, the attribute <i>health record field</i> may no longer be required and may be retired as an attribute.
Laterality	The left or right side of the body or body part or object of interest to the measure developer describing the QDM element. <i>Example:</i> A process measure to determine that a diabetic patient has had an examination of the skin integrity of the feet can use “Physical exam performed: dermatological exam” to apply two attributes—one for anatomical location (foot) and the other for laterality (right), and also indicate the same examination for the left foot.

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ATTRIBUTE—An <i>attribute</i> provides specific detail about a QDM element.	
CONCEPT-SPECIFIC ATTRIBUTES	
Ordinality	The scale in which objects are ordered in terms of their qualitative value, as opposed to a ranking performed strictly numerically or quantitatively. For example, a clinical quality measure may only be interested in including patients with a principal diagnosis of congestive heart failure to evaluate care during a hospitalization. The measure developer can specify <i>Diagnosis active: congestive heart failure</i> with the attribute <i>ordinality: principal</i> .
Reason	The thought process or justification for an action or for not performing an action. In some measures, specific treatments are acceptable inclusion criteria only if a justified reason is present. Each of these measures uses a value set (often, but not exclusively, using SNOMED-CT™) to express acceptable justification reasons. Other measures specify reasons as justification for exclusions. Examples include patient, system, or medical-related reasons for declining to perform specific actions. Each of these measures also uses a value set to express acceptable justification reasons for declining to perform expected actions.
Result	The final consequences or data collected from a sequence of actions or events, or observable entities, including, but not limited to procedures, laboratory tests, physical examinations, or diagnostic tests. There are three sub-attributes that can be expressed for a result: (1) is valued, meaning that a result is present in the electronic record but any entry is acceptable; (2) is numerical, combined with a mathematical operator (e.g., LDL \geq 100 mg/dL, or systolic blood pressure is $<$ 140 mmHg), or (3) is one of a specific set of elements in a value set (e.g., chest Xray result = <findings consistent with pneumonia>).
Route	<i>Route</i> refers to the path by which a therapeutic agent or substance is taken into the body systems, such as intradermally, intrathecally, intramuscularly, intranasally, intravenously, orally, rectally, subcutaneously, sublingually, topically, or vaginally.
Severity	A clinical qualifier that describes the intensity of illness required to be criteria for the QDM element; the severity attribute is always accompanied by a specific <i>value set</i> that defines allowable values (e.g., persistent, moderate, or severe).
Status	The particular stage of the subject within a defined process (e.g., whether a patient is <i>discharged</i> , a test is <i>completed</i> , a medication is <i>discontinued</i> or is <i>on hold</i> , or a report is <i>finalized</i>).

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For more information on the QDM, visit www.qualityforum.org/Projects/h/QDS_Model/Quality_Data_Model.aspx.

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