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HL7 Domain Analysis Model: Health Quality Improvement, Release 1

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HL7 Informative Ballot

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Clinical Quality Information

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Architecture Review Board

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The QIDAM learns from and builds upon work done in several other projects and specifications, including HL7 FHIR, vMR, QDM, QRDA, and CCDA. Many of the model elements and their documentation are drawn from these and other specifications.

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|  |  |  |  |
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| 2 | 12/11/13 | Aziz Boxwala | Complete draft for review by WGs |
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# Introduction

Electronic clinical quality measures (eCQMs) and clinical decision support (CDS) artifacts are currently expressed using two different data models: eCQMs are expressed using the Quality Data Model (QDM) [1], while CDS artifacts are expressed using the Virtual Medical Record (vMR) [2]. This is unfortunate since clinical quality measurement and clinical quality improvement via clinical decision support are intimately related. While eCQMs measure the quality of care provided, CDS provides the interventions to improve the quality of care. They share common requirements in identifying patients to which a particular eCQM or CDS artifact applies.

<def name=*"Pregnancy"*>

<expression xsi:type=*"ClinicalRequest"* cardinality=*"Multiple"*

dataType=*"vmr:Problem"* codeProperty=*"problemCode"*

dateProperty=*"problemEffectiveTime.low"*

useValueSets=*"true"* subjectProperty=*"evaluatedPersonId"*>

<codes xsi:type=*"ValueSet"* id=*"2.16.840.1.113883.3.600.1622"*

authority=*"Quality Insights of Pennsylvania"*

version=*"20130614"* />

</expression>

</def>

Figure 1. CDS Artifact Mapping the Term “Pregnancy” to an Element in the HL7 Virtual Medical Record Schema

Figure 1 shows an excerpt from a CDS artifact in the HL7 Knowledge Artifact Schema. The excerpt illustrates the mapping of the term “Pregnancy” to problems having the codes from controlled terminologies specified in the value set. This example uses the Problem class from the vMR to define the data specification.

Figure 2. eCQM Artifact Mapping the term “Pregnancy” to an Element in the Quality Data Model

Figure 2 shows an excerpt from an eCQM that maps the term “Diagnosis, Active: Pregnancy” to a QDM class of Diagnosis with the specified value set.

## Purpose

This specification, the Health Quality Improvement Domain Analysis Model (QIDAM), is a conceptual data model that can be used as the basis for a logical data model for the health quality improvement domain. The QIDAM identifies the requirements for the logical model and, in particular, the types of elements needed in the model. More broadly, the primary purpose of the logical model derived from the QIDAM is to serve as a model of clinical data within data mapping expressions (such as those illustrated in the previous section), logical criteria, population criteria, formulae, and other expressions in health quality improvement artifacts. The QIDAM thus provides the foundation for consistency in format across eCQMs and CDS artifacts.

The QIDAM harmonizes the elements from the existing eCQM and CDS data models into a single, unified conceptual model. This model can be mapped onto existing logical models while defining the structure and domain concepts required by eCQMs and CDS artifacts.

## Audience

The audience for this document is knowledge workers in the health quality domains of measurement, management, and reporting and include artifact authors and implementers, standards analysts and developers, tooling developers, and systems integrators. Readers must be familiar with object-oriented design principles and understand class diagrams in the Unified Modeling Language (UML). References to materials providing an introduction to UML class diagrams are provided in the section containing the class diagrams.

## Background

Certification of electronic health record (EHR) systems to Meaningful Use Stage 2 (MU2) standards requires implementation of CDS artifacts that support improvement of approved eCQMs. The use of different data models for eCQM and CDS artifacts:

* Prevents sharing of patient data requirement specifications between eCQMs and CDS artifacts
* Requires EHR vendors to implement two different mappings from their source data
* Prevents development of shared modules that can be used for eCQM calculation and CDS artifact evaluation

Many current CDS standards in HL7 use the Virtual Medical Record (vMR) as the clinical data model, while eCQM standards currently use QDM as their clinical data model.

The vMR is an HL7 logical model; release 2 was published in early 2014. The logical model is defined in terms of UML class diagrams. The model draws concepts from the HL7 Clinical Statements model and uses a simplification of the HL7 version 3 datatypes, release 2. Similar to the latter model, at the core of the vMR is a class known as ClinicalStatement. Concrete classes such as ProcedureEvent are derived from this abstract class. vMR also includes classes that model proposals for actions. These “proposal” classes support the output from CDS systems such as recommendations from a rule or items in an order set.

QDM defines the model in terms of components and specifies how the components can be assembled into a data mapping expression. The components include:

* Category (e.g., Procedure, Medication, Communication)
* State (e.g., Active, Administered)
* Attribute (e.g., Dosage, Frequency, Admission Date Time)

Timing Operators (e.g., Starts Before or During)

Thus, while the two models have significant overlap in the concepts they aim to represent, they take very different approaches. The QIDAM unifies the modeling approach and the concepts represented in these models, as described later.

## Approach

The QIDAM is a conceptual model that identifies data needs of the health quality improvement applications. A conceptual model for this domain does not exist, hence the need for a new one. This new model harmonizes the functional capabilities of vMR and QDM (and the QDM-based Health Quality Measures Framework (HQMF) Implementation Guide [3]).

As sources of input to the model, document templates used for healthcare quality applications were also reviewed. Specifically, templates contained in the following specifications were used to inform the QIDAM on the concepts to be modeled and their structure:

* Quality Reporting Document Architecture (QRDA) Category 1 Templates [4]
* vMR Templates [5]

Consolidated Clinical Document Architecture (CCDA) Templates [6]

Furthermore, the model was informed by and reuses elements from the other specifications when appropriate, including:

* HL7 Fast Healthcare Interoperability Resources (FHIR) Specification [7]

Federal Health Information Model (FHIM) Specification [8]

The supplemental worksheet (QDM-vMR-cross-map.xlsx) maps the QIDAM, QDM [1], and vMR [2] classes. The worksheet shows the mappings of the QDM data types (with QRDA-I templates [3]) and QIDAM and vMR classes with each top-level QDM category (e.g., Medication) followed by a specific state (e.g., Medication, Administered, which is mapped to the SubstanceAdministrationEvent vMR class). The other tabs in the worksheet are associated with the appropriate QDM category (e.g., Diagnosis, Encounter, Intervention, etc.), and each category lists the QDM attributes, which are mapped to the equivalent vMR classes and attributes. The Additional Notes column describes exceptions or limitations.

The purpose of these mappings in the supplemental worksheet is to assess the coverage of concepts from QDM and vMR in the QIDAM. The mappings are not intended to be specifications for computational transformations across these models. Data represented in other models will not need to be transformed to the QIDAM since the QIDAM is conceptual. However, mapping to the QIDAM may be used to determine whether a given logical or physical model can represent the data and concepts required for health quality improvement, as we have done with QDM and VMR mappings.

## Scope

The primary scope of this model is limited to the clinical data elements that need to be represented in US Realm eCQMs and CDS artifacts. The working definition of the scope is the union of the existing clinical concepts represented in QDM [1] (and, by derivation, the QDM-based HQMF Implementation Guide) and vMR [2] that are further informed by the templates specifications previously listed.

The model currently addresses concepts related to:

* Communication
* Care goals
* Diet and nutrition
* Participation in care plans and protocols
* Use of devices
* Encounters
* Immunization
* Medication treatments
* Procedures
* Allergies, intolerances, and adverse reactions
* Conditions including findings, diagnoses, symptoms
* Contraindications
* Care experience
* Family history
* Observation results
* Predictions such as risks and prognoses

# Use Cases

This section describes three use cases for the QIDAM:

1. Development of artifacts
2. Implementation of artifacts
3. Evaluation of artifacts

This list of use cases is not exhaustive; it describes the most common expected uses of the QIDAM. Additional uses are possible, including variations of the existing use cases—e.g., implementation of artifacts in a decision-support service. Please note that the use cases refer to using the QIDAM as the data model within artifacts; in practice, the logical model created from the QIDAM will be used for this purpose.

## eCQM and CDS Artifact Development

|  |  |
| --- | --- |
| **Description** | eCQM or CDS artifact author creates data specifications or action specifications. |
| **Scenario identifier** | M1 |
| **Actors** | eCQM author or CDS artifact author (called “author” henceforth) |
| **Pre-conditions** | 1. A data specification exists in a descriptive (free text) form in a measure or guideline (e.g., discharge medication: aspirin with dose). 2. For CDS artifacts, a care recommendation or other an action specification exists in a descriptive (free text) form in a guideline (e.g., prescribe metformin, perform serum LDL test). |
| **Actions** | 1. Author identifies the appropriate clinical concept type from the QIDAM to represent the data specification (e.g., medication) or the action. 2. Author identifies the context of the data specification (e.g., discharge) or the action and uses that to select the appropriate clinical concept class from the QIDAM. 3. Author identifies attributes of interest (e.g., medication dose) and uses the QIDAM attributes to complete the data or action specification. |
| **Post-conditions** | The QIDAM allows for an accurate and complete definition of the data specification (e.g., discharge medication dose) or the action. The specifications incorporate appropriate attributes such as dosage, timestamps, and attributes whose values are codes from controlled terminologies that indicate the data elements of interest (e.g., for diagnosis, medication, procedure). |
| **Comments** | While the QIDAM provides attributes whose values may be codes from controlled terminologies, constraints on the codes to be used (e.g., value sets, subsets, terminologies) are outside the scope of a conceptual model. |

## eCQM and CDS Artifact Implementation

|  |  |
| --- | --- |
| **Description** | eCQM or CDS artifact implementer at a clinical site maps data specifications and action specifications defined using the QIDAM to entries in an electronic health record system, order entry system, or a clinical data repository.  This scenario applies equally to an implementer at a vendor of a complete EHR system or EHR module. |
| **Scenario identifier** | M2 |
| **Actors** | eCQM implementer or CDS artifact implementer (called “implementer” henceforth) |
| **Pre-conditions** | 1. A data specification exists in an eCQM or CDS artifact. The data specification maps a symbol or name (e.g., Last LDL result) used in the artifact to its definition in the QIDAM (e.g., an observation result with the specified LOINC codes and date selection criteria). 2. A CDS artifact contains a specification of an action (e.g., prescription of statins). |
| **Actions** | 1. Implementer identifies the appropriate element (a table, a class) in the target system that is equivalent to the data specification or action specification in the QIDAM. 2. Implementer uses the definition (including attribute values) to construct the equivalent data or action definition in the target environment. 3. Implementer consults the model specifications document if the meaning or purpose of a QIDAM element or attribute is unclear. 4. Implementer repeats this task for all data specifications and action specifications. |
| **Post-conditions** | Implementer correctly maps all data specifications and action specifications from the eCQM or CDS artifact to the equivalent in the target environment. |
| **Comments** | Some data specifications and action specifications may not have equivalent elements in the target environment; those will not be mapped according to the above use case. |

## eCQM and CDS Artifact Evaluation

|  |  |
| --- | --- |
| **Description** | A measure calculation system or a CDS system evaluates an eCQM or CDS artifact. The data specifications and action specifications are specified using QIDAM. |
| **Scenario identifier** | M3 |
| **Actors** | A measure calculation system or a CDS system (referred to as “system” in this use case) |
| **Pre-conditions** | 1. A data specification exists in an eCQM or CDS artifact. The data specification maps a symbol used in the artifact to its definition in the QIDAM. 2. A CDS artifact contains a specification of an action. 3. All the specifications in the artifacts have been mapped previously to the data schema in the system or to actions that can be executed by the system or the user of the system. See the previous use case (Section 2.2), for example. |
| **Actions** | 1. The system evaluates the CDS artifact or the eCQM. 2. When the system encounters a data specification, it is able to translate the specification unambiguously into a request or query to retrieve the data. 3. The system uses the retrieved data to calculate a performance or evaluate CDS logic. 4. The CDS system may determine an action specification must be applied as a result of evaluating the logic. The system translates that specification to an executable action unambiguously. 5. The action is presented as a proposal to a user or is executed autonomously by the system. 6. The system translates all needed data specifications and action specifications. |
| **Post-conditions** | The eCQM evaluation results in a computed performance of the quality metric.  The CDS artifact evaluation results in the determination of whether a set of actions must be applied and the execution of those actions. |
| **Comments** |  |

# Requirements

This chapter describes the requirements of a domain analysis model for quality improvement. The first subsection describes the extent of the domain—i.e., the concepts to be described by the model. Subsequent subsections describe requirements related to the use of the model and the need to extend the data model beyond what is included in the standard specification. The last subsection lists items explicitly identified as being out of scope of this specification.

## Coverage

The following requirements define the domain, focus, and content of the QIDAM:

* Represents data typically found in an electronic health record of a patient and that are pertinent to health quality.
* Only includes data elements used in eCQMs and CDS artifacts; omits data elements that are not used in these domains. For example:
  + Omit details of an order transmittal data flow between an EHR and ancillary systems or within an EHR itself but captures that an order was placed, when, and its status.
* Includes clinical data concepts in vMR and QDM. The model also will include relevant concepts from templates defined in the vMR, QRDA, and CCDA specifications.
* Represents the canonical basis of clinical concepts.
  + Concepts within the model should, if at all, minimally overlap with each other.
  + The QIDAM will be suitable for extension/refinement to create specialized concepts (e.g., SurgicalProcedure extends Procedure with data about anesthesia).

## Format

The QIDAM will be a UML class diagram that is thoroughly and clearly documented. The purpose, scope, and constraints of each element in the model are described within the specification.

## Usability

The QIDAM will provide a bridge between clinical and technical users by using intuitive or clinical names for classes and attributes. Technical jargon for names will be avoided. Classes should be unambiguous, well defined, and non-overlapping so that users can distinguish when to use different model elements.

Data elements in the QIDAM need to relate in a way that is intuitive to authors of eCQMs and CDS artifacts, and to users of them. Categories or classes and the states associated with them will be clearly defined.

Specifically, these are the established principles of usability to be met by the QIDAM:

* **Effectiveness** – Ensure that the model allows all users to achieve their goals accurately by building the QIDAM based on how it will be used.
* **Efficiency** – Ensure that all users will be able to use the model to achieve their goals for their context of use in an efficient manner. Having unambiguous, non-overlapping concepts aids in this efficiency. Extensibility will also aid in efficiency.
* **Familiarity** – Name QIDAM concepts in a manner familiar to users. Avoid unfamiliar technical terms.

## Computability

The QIDAM will balance the needs for understandability by humans and computability. For instance, the use of more specific attribute names will be favored over abstract but general representations, except in cases where computability requirements favor more general attribute names to support consistent and correct inferencing. The following are key areas that the QIDAM needs to address:

* **Semantic clarity** – The QIDAM must represent clinical concepts and attributes in an unambiguous manner. In cases where semantic clarity and understandability by humans compete (e.g., terms familiar to clinicians but with multiple meanings), semantic clarity will trump.
* **“Just enough” concept granularity** – The model will define concepts at a level of granularity that meet the needs of the clinical community and our use cases. Granularity must also be consistent across concepts (e.g., frequency or criticality should not be specified differently from one concept to another) unless there is a reason for such differences (e.g., frequency for chemotherapy regimen is much more complex than frequency for daily aspirin).
* **Inferencing**– The QIDAM will define concept relationships (e.g., IS-A and PART-OF relationships) that support the inferencing needs of CDS systems. This includes the definition of general (broader) concepts at higher or more abstract levels (e.g., an act) in a concept hierarchy that may then be composed together to represent lower-level and more concrete concepts (e.g., an order for a diagnostic test) more familiar to clinicians. CDS systems may operate on these broader concepts, while eCQM or CDS artifact authors may operate on the concrete concepts.

## Interoperability

Each concept and attribute of vMR and QDM must have an unambiguous mapping to a QIDAM equivalent unless there is a justification for not doing so. Such justifications may include ambiguity in the source model, inconsistency across models, and interoperability with other models (e.g., FHIR).

## Extensibility

The QIDAM, initially, will only address existing concepts from vMR and QDM, and will therefore not include a representation for all types of clinical data. For example, the QIDAM may include a class for DiagnosticTestResult but not for GeneticTestResult that would require specific attributes for representing genes and their variations. The QIDAM (and logical or physical models derived from it) should have a flexible design. The design should allow incorporation of new classes and attributes in the future with little to no impact on existing classes.

It is expected that gaps in the models will be addressed through the standardization process—i.e., by proposing requirements and highlighting limitations of the model in appropriate working groups in HL7, collaboratively creating solutions by modifying the standard, and getting those solutions approved through ballots and other change management procedures at HL7. However, there often is a need to incorporate additional classes and attributes into a model even before the standardization is completed. Furthermore, such additions may be needed for local or regional business requirements, even though such requirements may not warrant modifications to the national or international standard. These needs for extension may arise during use of the logical models and physical models derived from the QIDAM. Those models must be extensible by the users and implementers of the specification. For example, the vMR provides relatedClinicalStatement, relatedEntity, and an attribute named “attribute” in the base ClinicalStatement and Entity classes for purposes of extension—i.e., for implementers to specify attributes that do not exist in the standard vMR model. Similar approaches are used in the FHIR and Clinical Statement specifications.

It is expected that the logical and physical model specifications will elucidate the mechanisms for users to extend the respective models. It is advisable for those extension mechanisms to be designed for graceful degradation—i.e., classes will degrade gracefully to the core model class that they extend. For example, a GeneticTestResult extension of a DiagnosticTestResult will still be processable by a system as a DiagnosticTestResult.

## Out of Scope

The following items are considered out of scope for the QIDAM specification:

* The language used to specify data mapping expressions or other expressions
* The approach to extending the derivative models of the QIDAM (i.e., the logical and physical models) is not part of the conceptual model. Therefore, this document does not specify an extension mechanism.

# Model Overview

## Design

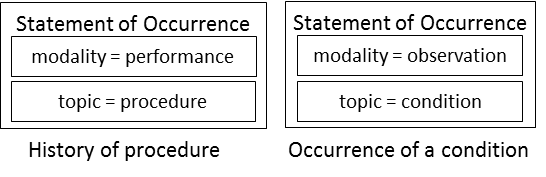
### Approach

The core concept for representing patient data in the QIDAM is a class called ClinicalStatement. The model divides clinical statements into three broad types:

* **StatementOfOccurrence**: This statement indicates the occurrence of an event (e.g., pneumonia) or an action (e.g., administration of digoxin) related to the patient’s health.
* **StatementOfNonOccurrence**: This statement indicates that a specified type of event or an action did not occur.
* **StatementOfUnknownOccurrence**: This statement indicates that it is unknown if a specified type of an event or action occurred.

Each of these types of clinical statements, besides containing metadata about the statement, includes a topic and a modality (Figure 3). The topic is the subject matter of the statement such as a symptom, a test result, a procedure, or an immunization. The modality describes the way the topic exists, happens, or is experienced—e.g., an observation, an order, a plan. Thus, a patient’s diagnosis would be constructed as a statement of occurrence having a condition as topic and an observation as modality. Similarly, a history of a procedure would be a statement of occurrence having a procedure as the topic and performance as the modality, as shown in Figure 3. The modalities and topics are defined as classes which can then have attributes specific to the type of modality or topic (e.g., the immunization topic has a vaccine attribute).

Figure 3. High-level Clinical Statement Structure

 In Figure 3, the boxes in the left and right illustrate examples respectively of a statement about a procedure that was performed and a statement about a condition that was observed.

The QIDAM currently defines two types of topics (Figure 4):

* **Acts**: Things done to a patient to assess or alter their health—for example, treatment with a medication, measuring the blood pressure, performing a chest x-ray.
* **Observables**: Elements that comprise the patient’s state of health. They typically are the result of medical examinations, investigations, or diagnostics—for example, past and present conditions (diagnoses, symptoms, findings), test results, vital sign results, allergies, prognoses.

Corresponding to the two types of topics, the QIDAM also defines two types of modalities:

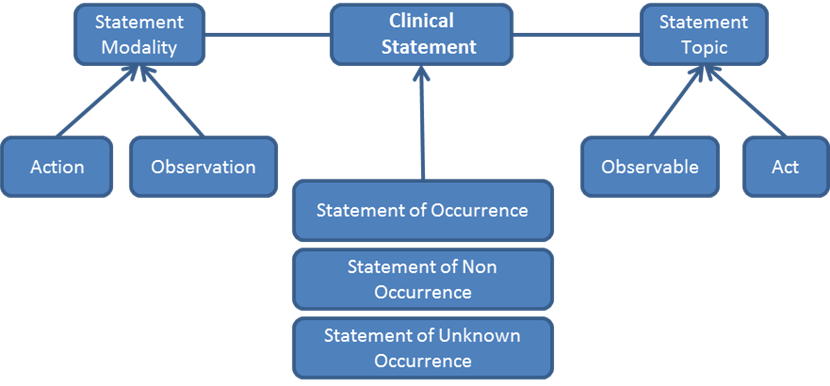
* **Action**: Describes the mode in which the act exists within a clinical statement. It further defines subtypes, including order and performance. Thus, a statement of occurrence with a procedure act and a mode of order indicates this statement is an order for a procedure (to be performed). A statement of occurrence with a procedure act and a mode of peformance indicates the procedure has been or is being performed.
* **Observation**: Describes the mode in which an observable exists within a clinical statement. No subtypes of observation are defined—i.e., observables only exist as observations.

Figure 4. Relationship among Clinical Statement, Topic, and Modality

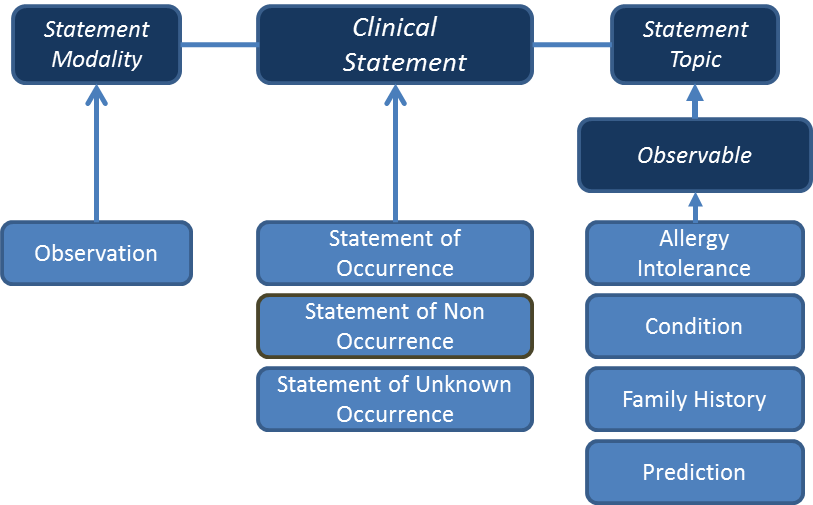
A clinical statement necessarily must match the topic to the corresponding type of modality. Thus, a statement with an observable must have an observation as a modality (Figure 5), and a statement with an act must have a subtype of an action as the modality (Figure 6). In Figure 5 and Figure 6, only elements shown in the lighter boxes with non-italic fonts can be used in actual clinical statements. The elements in boxes with italic fonts are abstract and define the hierarchical structure of the model. The diagrams shows a partial list of the topic classes.

Figure 5. Components that Comprise a Clinical Statement about an Observable

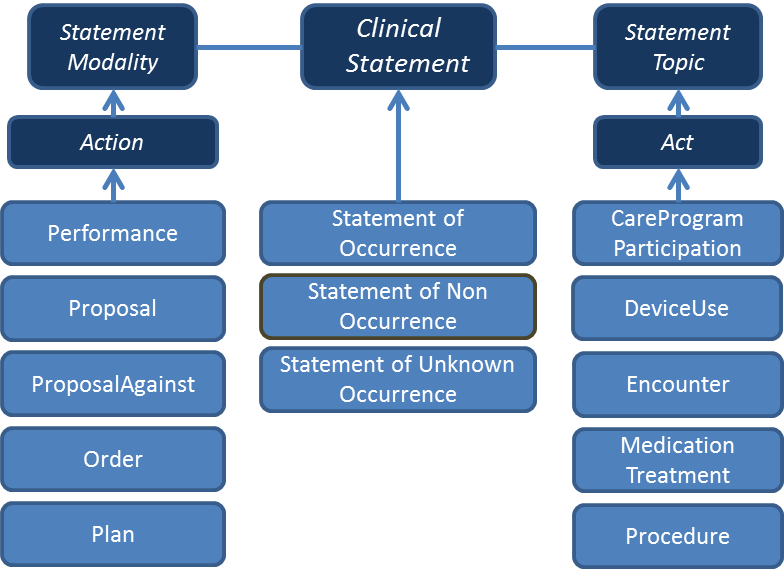
As previously mentioned, the QIDAM uses a compositional design approach. That is, a clinical statement is composed or built by assembling a clinical statement with a topic and a modality (i.e., picking one item from each column in Figure 5 and Figure 6. The next two sections provide more details on the components of the statements about actions and observations and how they are assembled together.

Figure 6. Components that Comprise a Clinical Statement about an Act

A short-hand notation for a clinical statement such as a Statement of occurrence, with action modality of Performance and topic of Procedure, can be represented as *StatementOfOccurrence[ Procedure, Performance ]*. Likewise, a Statement of occurrence with topic of Condition can be represented notionally as *StatementOfOccurrence[ Condition ].*

### Statements about Actions

Clinical statements about actions are composed using a topic that is of type Act and a modality of type Action. These are the types of Acts within the QIDAM:

* **CareProgramParticipation**: Participation of a patient in a recognized program of care such as a care plan, a chemotherapy protocol, or a clinical trial.
* **Communication**: A message transmitted from a sender to a recipient. The sender and recipients can be any entity, including persons and devices. Examples are an alert from a CDS system to a provider about a critical lab result, a notification to a public health authority about a patient presenting with a communicable disease, or an automated reminder to a patient to fill their prescription.
* **DeviceUse**: Use of equipment or device for or by the patient. Examples are use of a wheelchair, a Holter monitor, a pacemaker, or an intra-uterine contraceptive device. The act of implanting the device itself is modeled as a Procedure, described below.
* **Diet**: Constraints to and components of the nutrition to be administered to a patient. Examples are low-carbohydrate diet and enteral feeding.
* **Encounter**: An interaction between a patient and healthcare provider(s) or other healthcare professionals to provide healthcare service(s) or assess the health status of a patient. Examples are inpatient admission or visit to an anti-coagulation clinic.
* **Goal**: A defined target or measure to be achieved in the process of patient care; an expected outcome. A typical goal is expressed as a change in status expected at a defined future time. Examples are an LDL cholesterol goal of less than 100 mg/dL or a blood pressure of less than 140/90 mm Hg.
* **Immunization**: Administration of a vaccine to a patient. Examples are administration of influenza vaccine and polio vaccine. This does not include the administration of non-vaccine agents, even those that may have or claim immunological effects.
* **MedicationTreatment**: Administration of medication to a patient. Examples are prescribing lovastatin 10 mg oral and administering Interferon beta-1a intramuscularly. The model defines two additional specialized types of MedicationTreatment:
  + **CompositeIntravenousMedicationAdministration**: Parameters for intravenous fluid administration that may consist of one or more additives mixed into a diluent. Example is administration of a dopamine drip.
  + **PatientControlledAnalgesia**: Analgesics administered to the patient using a delivery system with which patients self-administer predetermined doses. Examples are order for or administration of morphine.
* **Procedure**: An activity performed with or on a patient as part of the provision of care. A procedure can be physical like an operation, or less invasive like counseling or hypnotherapy. Examples include surgical procedures, diagnostic procedures, endoscopic procedures, biopsies. Procedures exclude activities for which there are specific types of acts defined, such as those for immunizations, medication administrations, diet, and use of devices. The model includes additional specialized types of Procedures listed below. These subtypes are intended to illustrate how topics can be specialized. We expect that the logical model will incorporate additional subtypes (such as for respiratory therapy).
  + **Imaging**: An examination of a person using an imaging procedure. Examples are Chest Radiograph – PA and Lateral and Head MRI.
  + **LaboratoryTest**: A procedure to test a tissue or fluid specimen from a patient. Examples are complete blood count and blood culture.

The QIDAM defines the following types of modalities of actions:

* **Order**: An instruction by a healthcare provider to another healthcare provider to perform some action. Examples are an order for a laboratory test procedure or for a medication treatment.
* **Performance**: The actual performance or execution of a healthcare-related action. Examples are 3rd dose of Hepatitis B vaccine administered on Dec 4th 2012 or appendectomy performed today.
* **Plan**: An action that is planned to be performed. Typically, this would include a time at which the action is scheduled to be performed. Examples are an appointment (which is a planned encounter) or a scheduled surgery.
* **Proposal**: An offer or a suggestion to perform a healthcare act. A recommendation to a provider is an example of a proposal made by a CDS system. A proposal must be accepted by an entity in order for it to be performed.
* **ProposalAgainst**: A suggestion to not perform a healthcare act. An example may be a recommendation against prescribing a medication because the patient has a contraindication. Note that ProposalAgainst and Contraindication (a type of Observable) are very different concepts. The latter is one reason for proposing against an act. Other reasons can be cost-effectiveness and patient’s preferences.

The modalities have a (non-strict) lifecycle. For example, a CDS system offers a proposal for an MRI exam; the acceptance of the proposal leads to an order for the exam; an appointment is scheduled; and finally the exam is performed at the scheduled time. However, this sequence does not necessarily have to get followed. In fact, providers write orders without a prompt by a CDS system, many orders are fulfilled without an explicit plan being created, and many acts do not require orders if it is within the scope of the responsibility of the person carrying out the action (e.g., a physician counseling the patient on smoking cessation will not write an order, even though a CDS system may propose doing so and a quality measurement system expects a statement reflecting that such counseling was performed).

Clinical statements about actions are composed, as mentioned previously, by selecting the act topic and the action modality with a subtype of clinical statement. Table 1 illustrates the combination of modality and topic. The top row shows the modalities, the left column shows the different topics, and the other cells show their possible combinations. A third dimension of this table, not shown here, is the three subtypes of ClinicalStatement. Not all combinations of clinical statement subtypes, modality, and topic will be realized for practical reasons, as explained in the text. Due to layout constraints, the table does not show ProposalAgainst modality or the subtopics of MedicationTreatment and Procedure. Some combinations of statements, action modalities, and act topics either do not make sense clinically, are encountered rarely, or are usually not found in a structured format in an electronic health record. Thus, not all combinations may be realized in the logical model. Determining the allowable combinations and how those will be formally specified will be part of the scope of a subsequent project for a logical model for quality improvement.

Table 1. Possible Combinations of Topic and Modality for Clinical Statements about Actions

| **Modality →**  **Topic ↓** | **Performance** | **Order** | **Proposal** | **Plan** |
| --- | --- | --- | --- | --- |
| **CareProgram Participation** | CareProgram Participation Performance | CareProgram Participation Order | CareProgram Participation Proposal | CareProgram Participation Planned |
| **Communication** | Communication Performance | Communication Order | Communication Proposal | Communication Planned |
| **Diet** | Diet Performance | Diet Order | Diet Proposal | Diet Planned |
| **DeviceUse** | DeviceUse Performance | DeviceUse Order | DeviceUse Proposal | DeviceUse Planned |
| **Encounter** | Encounter Performance | Encounter Order | Encounter Proposal | Encounter Planned |
| **Goal** | Goal Performance | Goal Order | Goal Proposal | Goal Planned |
| **Immunization** | Immunization Performance | Immunization Order | Immunization Proposal | Immunization Planned |
| **Medication Treatment** | Medication  Treatment Performance | Medication  Treatment Order | Medication  Treatment Proposal | Medication  Treatment Planned |
| **Procedure** | Procedure Performance | Procedure Order | Procedure Proposal | Procedure Planned |

### Statements about Observations

Clinical statements about observations are composed using a topic of type Observable and modality of type Observation. The QIDAM contains these Observables:

* **AdverseReaction**: An unexpected reaction suspected to be related to the exposure of the patient to a substance. The substance may be a medication, immunization, food, or environmental agent. An adverse reaction can range from a mild reaction, such as a harmless rash, to a severe and life-threatening condition. Reactions can occur immediately or develop over time. For example, a patient may develop a rash after taking a sulpha medication. AdverseReaction models an actual instance of a reaction (i.e., an event), whereas AllergyIntolerance models a known susceptibility.
* **AllergyIntolerance**: Indicates that the patient has a susceptibility to an undesirable physiologic or other reaction upon exposure to a specified stimulus. This stimulus may be a substance or an activity. The reaction is not seen in most individuals who are exposed to the type and magnitude of the stimulus (e.g., the quantity of substance). Examples of AllergyIntolerance are a known allergy to penicillin or intolerance to MRI.
* **CareExperience**: Information collected from a consumer, patient, or family member about their perception of the care they received or from a caregiver 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. Experience also encompasses the patient’s outcomes from care provided in the past. For example, a patient receiving chemotherapy who has not responded to first-line medication treatment or who no longer responds to such therapy may require second-tier treatment. Such a patient’s experience of care is an important factor in defining subsequent treatment, which can be driven by patient preference.
* **Condition**: Health conditions, problems, or diagnoses recognized by a clinician as relevant for tracking and reporting purposes. The Condition class specifically excludes AdverseReactions and AllergyIntolerances as those are modeled in their own classes. The Condition class has many uses, including recording a concern or a diagnosis during an encounter or populating a problem list or a summary statement, such as a discharge summary.
* **Contraindication**: A concern about the performance of an action (proposed, ongoing, or past)— e.g., medication intake, due to a health reason. A contraindication is a specific situation in which a drug, procedure, or surgery should not be used because it may be harmful to the patient. Contraindications do not represent concerns that are administrative—e.g., lack of consent, insurance coverage. Contraindications are different from the action modality ProposalAgainst (though a contraindication may be the basis for proposing against an action). Contraindications also are different than conditions, such as pregnancy or a bleeding ulcer, which may be the basis for contraindications. An example of a contraindication is for a category X medication (medications deemed unsafe in pregnancy). The rationale is that the patient is pregnant (a condition). The contraindication might lead to a proposal against prescribing a statin, a category X medication.
* **FamilyHistory**: Significant health event or condition in people related to the patient and relevant in the context of care for the patient. This information can be known to different levels of accuracy. Sometimes the person can be identified (“my aunt Agatha”) and sometimes all that is known is that the person was an uncle. Examples of family history are “father has heart disease”, “maternal aunt had breast cancer with onset at the age of 38 years”.
* **ObservationResult**: Assertions and measurements made about a patient. ObservationResults are a central element in healthcare, used to support diagnosis, monitor progress, determine baselines and patterns, and even capture demographic characteristics. Fundamentally, observations are name/value pair assertions. ObservationResult is an abstract class. In clinical statements, one of the following subtypes must be used:
  + **SimpleObservationResult**: Measurements and simple assertions having a single value. Examples of simple observation results are:
    - Vital signs: temperature, blood pressure, respiration rate
    - Measurements emitted by devices
    - Personal characteristics: height, weight, eye color
    - Social history: tobacco use, family supports, cognitive status
    - Core characteristics: blood type
    - Computed scores: Glasgow coma scale
  + **ResultGroup**: A group of related observation values bound together due to the observations being performed on the same specimen in the same time period, or in the same test. Examples are a laboratory result panel (e.g., complete blood count) and blood pressure with its systolic and diastolic values.
  + **MicrobiologySensitivityResult**: Findings of the microbiology sensitivity test. This class is used to specify traditional, culture-isolate-run susceptibilities. It is not used to specify genetic methods for organism sensitivity.
* **Prediction**: The likely course of an existing disease or condition or the likelihood for that disease or condition to occur within a specified time frame. Examples are 5-year survival for a patient having small-cell lung cancer, 10-year risk of heart disease (Framingham score), and probability of motor function recovery one year after spinal cord injury. Such estimates may be arrived at by using different algorithms.

Each of these Observables must be used with the Observation modality. The latter has no subtypes. As with statements about actions, the determination of the allowable combinations of ClinicalStatements and Observables (the modality is fixed to Observation since it has no subtypes) and how those will be formally specified will be part of the scope of the logical model.

### Rationale for Design

The QIDAM uses a combination of inheritance and composition to construct the model elements. This approach is well-suited to creating a structure that is easy to use in writing and evaluating expressions, enables extensibility of the model, and results in an internally consistent model.

Data about a patient are modeled as concrete subclasses of ClinicalStatement. While the ClinicalStatement directly provides the attributes about a statement (e.g., the author, the subject, the time of the statement), the modality and topic address the concern about the “clinical content” (e.g., the procedure to be performed, the body site). Thus, a concrete statement is composed by “plugging in” the appropriate modality and topic. By reusing the modalities and topics, we achieve consistency in the model. For example, all statements about orders have the same attributes for an order because they use the same Order modality class. This approach also allows programs to reason about Orders (for any type of act) in a uniform manner.

Different subtypes of Action or Observable classes are specified as subclasses of the respective parent. For example, different types of procedures, such as diagnostic imaging and laboratory tests, each have their own sets of attributes. Thus, the Procedure act has the respective specializations Imaging and LaboratoryTest. This object-oriented design enables one to reason about these types of actions collectively as a Procedure (e.g., procedures with sedation might include general procedures and certain diagnostic imaging procedures) and as the specialized type when needed (e.g., imaging tests using contrast).

The QIDAM separates into distinct classes statements about actions and observations that occurred, those that did not occur, or those whose occurrence is unknown. An alternative approach used in other models is to use an attribute to make these distinctions—e.g., a negation indicator attribute is used in the HL7 Reference Information Model. For decision support and quality measurement applications, such a modeling approach is predisposed to errors in logic. For example, consider a data criterion like “Diagnosis with a code value from the Stroke value set”. Since the value of the negation indicator is not specified in the criterion, the result set would include diagnoses where the diagnosis of stroke was refuted. This could lead to erroneous decision support recommendations and create a safety hazard for the patient. By separating out into distinct classes events that occurred from those that did not occur, the QIDAM design approach circumvents such errors in the logic specification. Furthermore, the design approach is interoperable with other models so that data could be stored and transported in a different model, then transformed and reasoned about using the QIDAM.

## Datatypes, Entities, and Extended Types

Since the QIDAM is a conceptual data model, it provides very high-level datatypes. These datatypes will be further subtyped and have detailed attributes specified in a logical model realized from QIDAM. Table 2 lists the datatypes currently used within QIDAM classes and interfaces.

Table 2. Datatypes in QIDAM

|  |  |
| --- | --- |
| QIDAM Datatype | Description |
| Address | A geographic location |
| Code | A concept taken from a controlled terminology, such as a code from LOINC |
| Range | A range expressed over a quantity (i.e., has low and high values) |
| Ratio | A relationship between two quantity values expressed as a numerator and a denominator |
| Quantity | A numeric value expressing an amount, with or without units |
| TelecomAddress | Telecommunication end-point addresses such as telephone numbers, email addresses, or web addresses |
| Text | A string of characters, formatted or unformatted for presentation |
| TimePoint | A particular time point that may be expressed at different levels of granularity such as date or date+time (e.g., Nov 15 2013, or Nov 15 2013 11:42:07 a.m. EST) |
| TimePeriod | An interval of time bounded by TimePoint values indicating the beginning and the ending of the period |
| Value | Any of the above types |

The QIDAM also specifies certain entities and complex datatypes. These entities and types are described in Chapter 5.

## Cardinality and Optionality

The QIDAM specifies the cardinality of attributes and connections but not the optionality. The convention used in the class diagram is as follows:

* When the cardinality is intended to be single, cardinality is not indicated in the class diagram.
* When the cardinality is intended to be multiple, the cardinality is indicated as “0..\*”   
  (i.e., zero to many). The zero should not be interpreted as an indication of the optionality of the attribute or connection. This constraint is more appropriately specified in a logical model.

## Logical Model for Quality Improvement

The key objective of the QIDAM is to provide the requirements for developing a logical clinical information model for quality improvement. That logical model will be used within criteria and other expressions in quality improvement artifacts (such as measures, rules, and order sets) to reference clinical data. The logical model will use the conceptual structures specified here and will enhance them in the following ways:

1. Specify in greater detail how particular clinical statements (see Table 1 for example) will be composed and how the statements and their attributes might be accessed from within expressions.
2. Add attributes and refactor existing attributes to make the classes computable. For example, attributes for identifiers may be added.
3. Specify the datatypes, entities, and other extended types in more detail to allow computation operations to then be specified.
4. Specify cardinality and optionality of attributes.
5. Specify mechanisms for extension of the logical model.
6. Reorganize classes and attributes as needed to map to other models in order to support interoperability. In particular, it is expected that the logical model will interoperate with HL7’s FHIR model [7].

# Model Specification

This chapter provides a complete specification of the model. It lists all classes and interfaces and their attributes and connections. While the previous chapter provide an overview of the QIDAM and an explanation of the design, the objective of the material in this section is to provide a comprehensive reference to the elements in the domain analysis model. The content is organized in alphabetical order of package names and then class names, with names as the section headings. The heading hierarchy also is the package hierarchy.

The model is specified in the form of a UML class diagram. The website <http://www.sparxsystems.com/resources/uml2_tutorial/uml2_classdiagram.html> provides an introduction to class diagrams in UML and also describes the notation used in diagrams in this chapter. In addition to the reference format in this chapter, the supplementary material of this specification includes (1) the UML diagrams in the standard XMI format, and (2) reference documentation in HTML format that might be more convenient to browse.

## action



### action.act











#### Act

The object of an action, the specific thing that is being done or proposed, e.g., a medication is being administered.

#### CareProgramParticipation

Participation of a patient in a recognized program of care such as a care plan, a chemotherapy protocol, or a clinical trial.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| goals | StatementOfOccurrence | The goals that have been established for the patient as part of the care plan and the performance against those goals. |
| participationStatus | Code | A patient's state of participation within the care plan, e.g., enrolled, ongoing, completed, suspended. |
| program | Text | The particular program in which the patient is enrolled, was enrolled, or is being enrolled. |
| programType | Code | The type of the care program such as Care Plan, Clinical Trial, Chemotherapy Protocol |

#### Communication

A communication is a message sent between a sender and a recipient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| medium | Code | The communication medium, e.g., email, fax. |
| message | Text | Text and other information to be communicated to the recipient. |
| recipient | Entity | The entity (e.g., person, organization, clinical information system, or device) which is the intended target of the communication. |
| relatedStatement | ClinicalStatement | Any statement that is pertinent to the message. |
| sender | Entity | The entity (e.g., person, organization, clinical information system, or device) which is the source of the communication. |

#### CompositeIntravenousMedicationAdministration

Parameters for IV fluid administration that may consist of one or more additives mixed into a diluent. Additives and diluents are represented as constituents with the appropriate constituentType.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| constituent | Constituent | The constituents of this composite IV medication. |
| totalVolume | Quantity | The total volume of the overall mixture such as the volume of the bag. |

#### DeviceUse

Application or use of equipment or device for the patient, e.g., wheelchair, Holter monitor, pacemaker, intra-uterine contraceptive device.

Note that DeviceUse does not model the act of implanting a device on or in the patient. That is modeled as a Procedure.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| applicationSchedule | Schedule | If the application or use of the supply or equipment is repeated, the frequency pattern for repetitions. |
| device | Device | The details of the device used or to be used. |
| targetBodySite | BodySite | Body site where the device is to be used. |

#### Diet

Diet/nutrition to be administered to a patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| foodModifier | Text | Order-specific modifiers about the type of food that should be given. These can be derived from patient allergies, intolerances, or preferences. They can also be specific to the order and not have any relationship to the allergies, intolerances, or preferences. |
| nutritionItem | NutritionItem | Different items that combine to make a complete description of the nutrition to be administered. |

#### Encounter

An interaction between a patient and healthcare provider(s) to provide healthcare service(s) or assess the health status of a patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| class | Code | Classification of the encounter, e.g., inpatient, outpatient, virtual. |
| encounterSchedule | Schedule | If the encounter is repeated, the frequency pattern for repetitions. |
| hospitalization | Hospitalization | Details about an admission to a clinic. |
| length | Quantity | Quantity of time the encounter lasted. |
| location | Location | The location the encounter takes place, e.g., clinic location, hospital bed. |
| partOf | StatementOfOccurrence | Another encounter of which this encounter is a part (administratively or in time). |
| relatedCondition | EncounterCondition | The conditions considered and cared for within this encounter. |
| serviceProvider | Organization | Department or team providing care, e.g., infectious diseases service. |
| serviceType | Code | The type of service provided during the encounter, e.g., surgery, rehabilitation, annual physical exam. |

#### Goal

A defined target or measure to be achieved in the process of patient care; an expected outcome. A typical goal is expressed as a change in status expected at a defined future time.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| goalAchievementTargetTime | TimePeriod | The time that is targeted for the goal to be attained. For example, there may be a goal to reach a weight of 150 pounds by June 30, 2015. |
| goalFocus | Code | The metric that is the clinical subject of the goal. Typically, this is a measurable clinical attribute of the patient. E.g., body weight, blood pressure, hemoglobin A1c level. |
| goalPursuitEffectiveTime | TimePeriod | The time in which the subject pursues the goal. This includes pursuing maintenance of a goal that has already been achieved.  The end time of the interval may be "open" or not stated, if the goal is being indefinitely pursued. This time is optional, as, for example, one may simply wish to propose weight loss without specifying a pursuit effective time. |
| goalValue | Value | The metric whose achievement would signify fulfillment of the goal. E.g., 150 pounds, 7.0%. |

#### Imaging

An Imaging examination, e.g., Chest Radiograph - PA and Lateral.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| contrast | MedicationTreatment | Contrast substance if any to be administered for this procedure. |
| isolationCode | Code | Specification for type of precautions that should be taken when in proximity to the patient. For instance, Airborne Precautions, Contact Precautions, Droplet Precautions, Standard Precautions. |
| portableExam | YesNo | Designation of whether or not the imaging procedure should be performed at the patient's bedside (Yes) or if the procedure can be conducted in the location of the performing department (No). |
| radiationDose | Range | The amount of radiation intended to be administered to a patient. |
| sedation | YesNo | Indication of whether sedation is required or was administered for this procedure. |
| stressor | Code | Type of physiologic or pharmacologic stress that will be subjected to the patient during the imaging procedure. For example, Adenosine, Dipyrdomole, Persantine, Thallium, Cardiolite, Dobutamine, Treadmill. |
| transportMode | Code | How a patient will be moved from their hospital room to the performing department. |

#### Immunization

Administration of vaccines to patients across all healthcare disciplines in all care settings and all regions. This does not include the administration of non-vaccine agents, even those that may have or claim immunological effects.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| dosage | Dosage | The dose of the vaccine administered or to be administered. |
| protocol | VaccinationProtocol | The role of the dose in an immunization protocol. |
| reported | Code | True if this statement describes the reported prior administration of a dose of vaccine rather than directly administered. |
| vaccine | Vaccine | The vaccine product that is administered. |

#### LaboratoryTest

A procedure to test a tissue or fluid specimen from a patient, e.g., complete blood count, blood culture.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| collectionMethod | Code | Specification of how the specimen for testing should be obtained. |
| specialHandling | Code | Special instructions on how to handle a laboratory specimen, e.g., 'Keep on ice'. |
| specimenSource | Specimen | The source of the laboratory specimen to be collected. |
| suspectedPathogen | Code | The pathogen or pathogens thought to be the most likely cause of the patient's condition that led to the laboratory procedure proposal. For instance, Staphylococcus, Streptococcus, Pseudomonas, Neisseria. |

#### MedicationTreatment

Prevention or treatment of a condition using medications.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| dispense | Dispense | Dispensation details to be used only when needed, e.g., as part of a statement about a prescription or a dispensation event. |
| dosage | Dosage | Details for the dose or doses of medication administered or to be administered to the patient. |
| medication | Medication | The medication being dispensed or administered, e.g., simvastatin. |

#### PatientControlledAnalgesia

Parameters for Patient Controlled Analgesia (PCA) administration, e.g., morphine PCA, 5 mg loading dose, followed by 10 mg/hr basal rate, 1 mg demand dose, lockout interval 10 min.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| lockoutInterval | Range | The amount of time that must elapse after a PCA demand dose is administered before the next PCA demand dose can be delivered. For example, 10 minutes. |

#### Procedure

An activity performed with or on a patient as part of the provision of care. This can be a physical "thing" like an operation, or less invasive like counseling or hypnotherapy. Examples include surgical procedures, diagnostic procedures, endoscopic procedures,and biopsies, and exclude things for which there are specific types of actions defined, such as those for immunizations, medication administrations, and nutrition administration.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| approachBodySite | BodySite | The body site used for gaining access to the target body site, e.g., femoral artery for a coronary angiography. |
| procedureCode | Code | Code that identifies the procedure with as much specificity as available, or as required, e.g., appendectomy, coronary artery bypass graft surgery. |
| procedureMethod | Code | The method used for the procedure. For example, a surgical procedure method might be laparoscopic surgery or robotic surgery; an imaging procedure such as a chest radiograph might have methods that represent the views such as PA and lateral; a laboratory procedure like urinalysis might have a method of clean catch; a respiratory care procedure such as supplemental oxygen might have a method of nasal cannula, hood, face mask, or non-rebreather mask. |
| procedureSchedule | Schedule | If the procedure is repeated, the frequency pattern for repetitions. |
| targetBodySite | BodySite | The body site where the procedure takes place, e.g., left lower arm for fracture reduction. |

### action.common





#### EncounterCondition

A condition that is considered within the encounter and the role that the condition played within the encounter, e.g., diagnosis at discharge.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| condition | StatementOfOccurrence | The reference to the condition such as a problem. |
| conditionRole | Code | The role of the condition within an encounter, e.g., chief complaint, admission diagnosis, discharge diagnosis, comorbidity |

#### Hospitalization

Details about an admission to a hospital.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| admissionSourceType | Code | The location type from where the patient arrived for admission, e.g., ED, another hospital, an ambulatory care facility. |
| dischargeDisposition | Code | The final place or setting to which the patient was discharged on the day of discharge. e.g., home, hospice, expired. |

#### Indication

An asserted clinical reason justifying an action such as to prescribe a medication, or to perform a procedure or a test.

The reason can be specified as a code or as another statement, e.g., code for diabetes (ICD-9-CM 250.0) or Condition (with diabetes code) documented elsewhere in a patient's record.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| narrative | Text | A human-readable description of the indicated reason. |
| reason | Code | A code representing the reason. |
| supportingStatement | ClinicalStatement | Other patient data that lends support for this indication. |

#### Constituent

A component of a multi-component substance administration. May be an additive in a composite IV.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| constituent | MedicationIngredient | Generally the ingredient of the constituent (e.g., dopamine) and the quantity such as an additive in a composite IV. |
| constituentType | Code | Indicates the category of the constituent. For instance, for a composite IV, the constituent may be either a 'diluent' or an 'additive'. For a TPN order, the constituent category may be a nutrient grouping such as 'electrolyte' or 'lipid', etc. |
| dose | Dosage | The dose of the constituent that makes up the whole. E.g., 500 mL 50% Dextrose solution. |

#### AdministeredDose

How the substance was administered to the patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| attestationType | Code | How the dose administration was claimed or verified. E.g., patient-reported, observed by care provider, performed by care provider. Can be used as a gauge of reliability, or when verified substance administration (e.g., for tuberculosis treatment) is required. |

#### Dispense

Details of the dispensation of a supply (e.g., medication, device) such as the number of days of supply, and the quantity (to be) dispensed.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| amount | Quantity | The number of units of the supply to be or that are actually dispensed. e.g., 30 tablets. |
| expectedSupplyDuration | TimePeriod | The number of times the supply may be dispensed. For example, the number of times the prescribed quantity is to be supplied, including the initial standard fill. |
| numberOfRepeatsAllowed | Quantity | The number of times the supply may be dispensed. For example, the number of times the prescribed quantity is to be supplied, including the initial standard fill. |
| substitutionReason | Code | The reason for the substitution of (or lack of substitution) from what was prescribed. |
| substitutionType | Code | A code signifying whether a different item was dispensed from what was prescribed. |
| validityPeriod | TimePeriod | The validity period of a prescription (stale dating the Prescription). It reflects the prescriber perspective for the validity of the prescription. Supply must not be dispensed against the prescription outside of this period. The lower-bound of the Dispensing Window signifies the earliest date that the prescription can be filled for the first time. If an upper-bound is not specified then the Prescription is open-ended or will default to a stale-date based on regulations. |

#### Dosage

Details, such as quantity, rate, route, schedule of administering a substance, e.g., medication, immunization, or enteral nutrition.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| administrationFrequency | Schedule | The frequency pattern for administration of doses. e.g., three times per day after meals. |
| approachBodySite | BodySite | The body site used for gaining access to the target body site for the purpose of the substance administration. This is the anatomic site where the substance first enters the body, e.g., left subclavian vein. |
| doseQuantity | Quantity | The amount of the substance given at one administration event. e.g., 500 mg, 1 tablet, 1 teaspoon. |
| doseType | Code | The type of dose, e.g., initial, maintenance, loading. |
| infuseOver | Quantity | Represents the actual time the medication is infused, for each infusion. |
| method | Code | A coded value indicating the method by which the substance is introduced into or onto the body. Most commonly used for injections, e.g., Slow Push; Deep IV. |
| rate | Quantity | The speed with which the substance is introduced into the subject, typically the rate for an infusion, e.g., 200 mL in 2 hours. |
| rateIncrement | Range | Change in the dosing rate; usually an increase for a patient who is initiating tube feeding. E.g., 20 mL/hour. |
| rateIncrementInterval | Range | Period of time after which the rateIncrement should be attempted, e.g., 4 hours. |
| route | Code | The physical route through which the substance is administered, e.g., IV, PO. |
| targetBodySite | BodySite | The body site where the substance is delivered. |

#### DosageInstruction

Indicates how the substance is to be administered to or used by the patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| additionalInstructions | Code | Additional instructions such as "Swallow with plenty of water", which may or may not be coded. |
| dosageInstructionsText | Text | Free text dosage instructions for cases where the instructions are too complex to code. |
| maximumDeliveryRate | Quantity | The maximum rate of substance administration. This value may be used as a stopping condition when a rateIncrement is specified without a count. |
| maximumDosePerPeriod | Ratio | The maximum total quantity of a therapeutic substance that may be administered to a subject over the period of time, e.g. 1000 mg in 24 hours. |
| maximumVolumeToDeliver | Quantity | The maximum volume of fluid to administer to a patient |
| minimumDosePerPeriod | Ratio | The minimum total quantity of a therapeutic substance that may be administered to a subject over the period of time. E.g. 10 mg in 24 hours. |
| rateGoal | Range | The target rate to reach for this infusion. Note that rateGoal is typically less than the maximum delivery rate, which is the rate not to exceed. For enteral feeding orders, a target tube feeding rate of 75ml/hour may be specified. |
| validAdministrationInterval | TimePeriod | Acceptable time for administering the substance, includes acceptable but suboptimal administration times. This is an important aspect of immunizations, which have recommended and acceptable/valid timeframes for administration that can differ. |

#### EnteralFormula

Food to be administered through a tube placed in the nose, mouth, stomach, or small intestine.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| administration | DosageInstruction | Dosage and administration instructions for the enteral nutrition. |
| caloricDensity | Quantity | An amount of calories per volume, which identifies the type of formula. |
| product | NutritionProduct | The nutritional product to be administered. |

#### NutrientModification

Constraints on the quantity of diet components.

NutrientModification consists of the nutrient (e.g., Sodium) and the amount in the diet (e.g., 20-30g).

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| nutrientType | Code | The type of nutrient that this diet contains. Nutrient types include carbohydrates, lipids and fats, salts such as Sodium or Potassium, fibers, and fluids. |
| quantity | Range | Indicates how much of the nutrient is to be or was administered. |

#### NutritionItem

The details of the nutrition item, with specific attributes depending on the mode by which the nutrition is administered.

#### NutritionalSupplement

A preparation intended to supplement the diet and provide calories or nutrients, such as vitamins, minerals, fiber, fatty acids, carbohydrates, or amino acids, that may be missing or may not be consumed in sufficient quantity in a person's diet. Such products may be ordered in addition to the diet (either general or therapeutic) to enhance a person’s intake. Supplemental food products provide some but not all of a patient’s nutritional needs.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| additiveProduct | NutritionProduct | Any additives to be provided or administered, e.g., protein supplement, fiber supplement. |
| baseProduct | NutritionProduct | The base supplement to be provided or administered, e.g., standard formula. |
| frequency | Schedule | The frequency with which this supplement is administered. |
| quantity | Range | How much of the nutritional supplement to administer. |

#### OralDiet

Food and/or a nutritional supplement prepared from food ingredients that is self-administered by a patient and consumed orally.

A patient can have only one effective oral diet at a time.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| dietType | Code | The kind of diet to be administered such as  "Consistent carbohydrate diet". |
| foodType | Code | Indicates what type of food the diet should contain. |
| frequency | Schedule | The frequency with which this diet item is administered. |
| nutrient | NutrientModification | Particular nutrients and the quantities explicitly called out to be included in the diet. |
| texture | TextureModification | Specifies or modifies the texture for one or more types of food in a diet. |

#### TextureModification

Modifies the texture for one or more types of food in a diet, e.g., ground, chopped, or puree. Texture modification is part of the diet specification and may have different textures ordered for different food groups, e.g., ground meat.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| foodType | Code | Indicates the type of food to which the texture modification applies. |
| textureModifier | Code | A further modification to the texture, e.g. Pudding Thick. |
| textureType | Code | A code that identifies any texture modifications that should be made, e.g., Pureed, Easy to Chew. |

#### VaccinationProtocol

Information about the protocol(s) under which the vaccine was administered.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| authority | Organization | Indicates the authority who published the protocol. e.g. Advisory Committee on Immunization Practices. |
| description | Text | Description about the protocol under which the vaccine was administered. |
| doseSequence | Quantity | Nominal position of dose in a series. |
| doseStatus | Code | Indicates if the immunization event should "count" against the protocol. |
| doseStatusReason | Code | Provides an explanation of why an immunization event should or should not count against the protocol. |
| doseTarget | Code | The disease targeted by this vaccine administered. |
| series | Text | One possible path to achieve presumed immunity against a disease. |
| seriesDoses | Quantity | The recommended number of doses to achieve immunity. |

### action.modality



#### Action

Describes the mode in which the act topic exists within a clinical statement. The action modality itself is abstract (i.e., it cannot be used within a clinical statement). It defines subtypes such as order and performance.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| currentStatus | ActionStatus | The status of an action. It is expected that the range of values for statusCode (i.e., the value set) will vary by the subtypes of ActionPhase. For example, Proposal might have one of its status values as Declined. |
| indication | Indication | Reason or justification for the action. |
| patientPreference | Code | Choices made by patients about options for care or treatment (including scheduling, care experience, and meeting of personal health goals) and the sharing and disclosure of their health information. |
| providerPreference | Code | Choices made by care providers about options for care or treatment (including scheduling, care experience, and meeting of personal health goals). |
| statusHistory | ActionStatus | Past statuses of this action. For example, an order may evolve from draft to placed to in progress to completed or canceled. |

#### ActionStatus

Class describing the status of an action.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| reason | Code | A coded reason for the status. This is used typically when the status indicates the action was changed, canceled, rejected, or not performed. E.g., patient declined. |
| status | Code | A coded value for the status, e.g., Completed, Rejected, Pending. |
| statusUpdateTime | TimePoint | The date and time when the status was updated. |

#### Order

An instruction by a healthcare provider to another healthcare provider to perform some action.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| expectedPerformanceTime | TimePeriod | The time when the action is expected to be performed. |
| fromProposal | StatementOfOccurrence | Identifies a proposal that led to this order. |
| orderedAtTime | TimePoint | Time at which the order was created. |
| orderedBy | Practitioner | The responsible person who places this order (e.g., physician). This may be different than the author of the order (e.g., clerk) who may be the statement's author. |
| originationMode | Code | Mode by which the order was received (such as by telephone, electronic, verbal, written). |
| prnReason | Indication | The ordered act must be performed if the indicated conditions occur, e.g.., shortness of breath, SpO2 less than x%, insomnia, nausea. |
| urgency | Code | Characterizes how quickly the ordered action must be initiated. Includes concepts such as stat, urgent, routine. |

#### Performance

The actual performance or execution of a healthcare-related action, e.g., 3rd dose of Hepatitis B vaccine administered on Dec 4th 2012, or appendectomy performed today.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| actionPerformed | Code | The component of a composite action that was performed. For instance, the fulfillment of a prescription may result in both a substance administration event and a dispense event, thus resulting in two action being performed. |
| enactsPlan | StatementOfOccurrence | Identifies a plan that is partly or wholly enacted by the performance of this act. |
| fromProposal | StatementOfOccurrence | Identifies a proposal that recommended the performance of this act. |
| fulfillsOrder | StatementOfOccurrence | Identifies an order that is partly or wholly filled by the performance of this act. |
| performanceTime | TimePeriod | The overall time period in which the action is performed. This may be different than the scheduled time or the expected performance time. |
| performedBy | Participant | Persons who perform this action, e.g., the person who administered the medication, performed the surgery.  A performance may have many participants. In comparison, an order or a plan typically has one participant. Hence, in performance many participants can be described along with their specific roles. |

#### Plan

Description of action that is planned to be performed. Typically, this would include a time at which the action is scheduled to be performed.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| expectedPerformanceTime | TimePoint | The time when the planned action is expected to be performed. |
| fromProposal | StatementOfOccurrence | Identifies a proposal that led to this plan. |
| fulfillsOrder | StatementOfOccurrence | Identifies an order that will be partly or wholly filled by the performance of the planned act. |
| plannedAtTime | TimePoint | The time at which the plan was created. |
| plannedBy | Person | The person who is the primary planner of this action, e.g., the person who scheduled the appointment. |

#### Proposal

An offer or a suggestion to perform a healthcare act. A recommendation to a provider is an example of proposal made by a CDS system. A proposal must be accepted by an entity in order for it to be performed.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| expectedPerformanceTime | TimePeriod | The time when the action is expected to be performed. |
| originationMode | Code | The mode by which the proposal was received (e.g., by telephone, electronic, verbal, written). |
| prnReason | Indication | The proposed act must be performed if the indicated conditions occur, e.g.., shortness of breath, SpO2 less than x%, insomnia, nausea. |
| proposedAtTime | TimePoint | The time when the proposal was made. |
| urgency | Code | Characterizes how quickly the proposed action must be initiated. Includes concepts such as stat, urgent, routine. |

#### ProposalAgainst

A recommendation from a clinical decision support system or advice from a consultation to not perform an act.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| originationMode | Code | The mode by which the proposal was received (e.g., by telephone, electronic, verbal, written). |
| proposedAtTime | TimePoint | The time when the proposal was made. |

## common



### BodySite

A location on a person's body. e.g., left breast, heart.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| anatomicalLocation | Code | A location on a patient's body. May or may not encompass laterality. e.g., lung, left lung. |
| directionality | Code | Further specification of the body part by adding directionality, e.g., "upper", "lower", "frontal", "medial". |
| laterality | Code | The side of the body, from the patient's perspective. e.g., left, right, bilateral. |

### Participant

Person playing a specified role in an action.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| individual | Person | The healthcare professional or related person participating in the action. |
| participantRole | Code | Role of participant in the action., e.g., admitter, attending, primary care physician. |

### Schedule

The recurrening pattern of events, e.g., three times a day after meals.

A schedule that specifies an event that may occur multiple times. Schedules should not be used to record when events did happen but rather when actions or events are expected or requested to occur.

A schedule can be either a list of "calendar time" events (periods on which the event ought to occur), or a single event with repeating criteria, or just repeating criteria with no actual event (as represented by the 'cycle' concept and attribute).

Given these variations in how Schedule can be specified, it is not modeled in this conceptual specification. A detailed model should be included in the logical model specification.

### common.entity







#### ComputerSystem

A service or information system excluding medical devices. Such services may include a communication service that generates an alert, a system that supports the persistence and retrieval of clinical information, or a clinical decision support system that may be the source of a proposal for a procedure.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| name | Text | A name or label assigned to this system. |
| telecom | TelecomAddress | A telecommunication address such as URL or email address associated with this system. |
| type | Code | A code that represents the type of computer system. |

#### Device

An instance of a manufactured product used in the provision of healthcare without being substantially changed through that activity. The device may be a machine, an insert, a computer, an application, etc. This includes durable (reusable) medical equipment as well as disposable equipment used for diagnostics, treatment, and research for healthcare and public health.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| location | Location | The place where the resource may be found. |
| model | Text | Model identifier assigned by the manufacturer. |
| owner | Organization | An organization responsible for the provision and ongoing maintenance of the device. |
| patient | Patient | Patient information, if the resource is affixed to a person. |
| type | Code | A code that identifies the type of device supplied with as much specificity as available, e.g., wheelchair. |
| udi | Text | FDA mandated Unique Device Identifier. Use the human-readable information (the content that the user sees, which is sometimes different than the exact syntax represented in the barcode). See http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/UniqueDeviceIdentification/default.htm. |
| url | TelecomAddress | A network address on which the device may be contacted directly. |
| version | Text | The version of the device, if the device has multiple releases under the same model, or if the device is software or carries firmware. |

#### Entity

A physical thing, group of physical things, or an organization. It is a concrete class that can be used as is or specialized as needed.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| characteristic | EntityCharacteristic | The characteristics of this entity. |

#### EntityCharacteristic

Specific factors about any entity such as the patient, practitioner, organization, or product. Included are behavioral factors, social or cultural factors, available resources, and preferences. Behaviors 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. Social/cultural factors 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. Resources 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.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| code | Code | A code specifying the characteristic or feature. |
| presence | YesNo | Whether the characteristic is present or absent. |

#### Location

Details about a physical place where services are provided and resources and participants may be stored, found, contained or accommodated.

A location includes both incidental locations (a place used for healthcare without prior designation or authorization) and dedicated, formally appointed locations. Locations may be private, public, mobile or fixed and scale from small freezers to full hospital buildings or parking garages.

Examples of locations are:

* Building, ward, corridor or room
* Freezer, incubator
* Vehicle or lift
* Home, shed, or garage
* Road, parking place, or park

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| address | Address | Geographic address for the location. |
| function | Code | Type of function performed at the location. |
| name | Text | Name for the location. Does not need to be unique. |
| partOf | Location | Another location of which this location is physically a part. |
| telecom | TelecomAddress | Contact details of communication devices available at the location. This can include phone numbers, fax numbers, mobile numbers, email addresses, and web sites. |

#### ManufacturedProduct

A product used in the care of a patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| expiry | TimePoint | Expiration date of this product (if applicable). |
| lotNumber | Text | Lot number assigned by the manufacturer. |
| manufacturerName | Text | Name of the product's manufacturer. |

#### Medication

Description of the medication administered in a treatment.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| code | Code | A code (or set of codes) that identify this medication. |
| form | Code | Form of the item, e.g., powder, tablet, carton. |
| ingredient | MedicationIngredient | A constituent of interest in the medication product (e.g., sulfamethoxazole 800 mg). |
| isBrand | YesNo | Set to true if the item is attributable to a specific manufacturer. |

#### MedicationIngredient

The composition of the medication.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| item | Code | The actual ingredient item that makes up this medication. |
| strength | Quantity | How many (or how much) of the items there are in this medication, e.g. 250 mg of the item per tablet. |

#### NutritionProduct

A manufactured item administered for a patient's nutrition.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| type | Code | A code that indicates the general classification of the product. This can be a class of products (e.g., vegetables), or a specific product (e.g., broccoli). |

#### Organization

A formally or informally recognized grouping of people or organizations formed for achieving some type of collective action - includes companies, institutions, corporations, departments, community groups, healthcare practice groups, etc.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| address | Address | Place or the name of the place where an organization is located or may be reached. |
| name | Text | Name by which the organization is known. |
| telecom | TelecomAddress | A locatable resource of the organization such as a web page, telephone number (voice, fax or some other resource mediated by telecommunication equipment), e-mail address, or any other locatable resource. |
| type | Code | The kind of organization that this is., e.g., hospital, long-term care facility, hospital department, government agency, educational institution. |

#### Patient

Demographics and other administrative information about a person receiving care or other health-related services.

The data in the element covers the "who" information about the patient; its attributes focus on the demographic information necessary to support the administrative, financial, and logistic procedures.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| isDeceased | YesNo | Whether the patient is deceased. |
| maritalStatus | Code | The patient's most recent marital (civil) status. |
| timeOfDeath | TimePoint | The time when the patient died. |

#### Person

Demographic and identification information for an individual.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| address | Address | Place or the name of the place where a person is located or may be reached. |
| birthTime | TimePoint | Date and time of birth for the individual. |
| ethnicity | Code | Person's ethnicity. An ethnicity or ethnic group is a group of people whose members identify with each other through a common heritage, e.g., Hispanic. |
| gender | Code | Gender that the patient is considered to have for administration and record keeping purposes. |
| languages | Code | Languages which may be used to communicate with this person. |
| name | Text | Name by which the patient is known. |
| preferredLanguage | Code | Person's language of preference. E.g., English. |
| race | Code | Person's race. Race is a classification of humans into large groups by various factors, such as heritable phenotypic characteristics or geographic ancestry, e.g., White, Asian. |
| telecom | TelecomAddress | Locatable resource to communicate with a person such as a web page, telephone number (voice, fax or some other resource mediated by telecommunication equipment), e-mail address, or any other locatable resource. |

#### Practitioner

Demographics and qualification information for an individual directly or indirectly involved in the provisioning of healthcare.

Practitioner covers all individuals who are engaged in the healthcare process and healthcare-related services as part of their professional responsibilities. Practitioners include (but are not limited to):

* Physicians, dentists, pharmacists
* Physician assistants, nurses, scribes
* Midwives, dietitians, therapists, optometrists, paramedics
* Medical technicians, laboratory scientists, prosthetic technicians, radiographers
* Social workers, professional home carers, official volunteers
* Receptionists handling patient registration
* IT personnel merging or unmerging patient records

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| organization | Organization | Organization that the practitioner represents. |
| qualification | Qualification | Qualifications obtained by training and certification. |
| role | Code | Roles which this practitioner is authorized perform for the organization. |
| speciality | Code | Professional specialty of the practitioner, e..g, cardiologist, midwife. |

#### Qualification

Qualifications obtained by training and certification.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| code | Code | Coded representation of the qualification. |
| issuer | Organization | Organization that regulates and issues the qualification. |
| validityPeriod | TimePeriod | Period during which the qualification is valid. |

#### RelatedPerson

Information about a person involved in a patient's care, but who is neither the target of healthcare nor has a professional responsibility in the care process.

RelatedPersons typically have a personal or non-healthcare-specific professional relationship to the patient. A RelatedPerson element is primarily used for attribution of information since RelatedPersons are often a source of information about the patient. Example RelatedPersons are:

* Patient's wife or husband
* Patient's relatives or friends
* Neighbor bringing a patient to the hospital
* Patient's attorney or guardian

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| ageAtDeath | Quantity | Age of the related person at the time of their death. |
| isDeceased | YesNo | Whether the related person is deceased. |
| relationship | Code | Nature of the relationship between a patient and the related person. |

#### Specimen

A sample of tissue, blood, urine, etc., taken for diagnostic examination or evaluation.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| collectionMethod | Code | Technique used to collect the specimen, e.g., aspiration, scraping. |
| collectionSite | BodySite | Site from which the specimen was collected. |
| subject | Patient | Patient from whom the specimen was obtained. |
| type | Code | The kind of material, e.g., blood, urine, tissue. |

#### Vaccine

Details about the vaccine product administered to the patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| vaccineType | Code | The kind of vaccine that is or was or was not administered, e.g., DTaP, pertussis, influenze whole. |

## core



### ClinicalStatement

A record of something of clinical relevance that is observed, is being done, has been done, can be done, or is intended or requested to be done. This class serves as the basis for other more specific clinical statements, such as a statement that an observation has occurred or that a procedure has not been proposed.

Note that there are currently three types of clinical statements:

1. A StatementOfOccurrence which indicates that the topic of the statement has or will occur.
2. A StatementOfNonOccurrence which indicates that the topic of the statement has not occurred. The statement author is explicitly declaring that the statement's topic did not occur. This supports open-world reasoning in which the lack of a StatementOfOccurrence within a particular database does not imply that the topic did not occur. Therefore, an explicit statement about non-occurrence must be made.
3. A StatementOfUnknownOccurrence which represents an explicit statement that it is not known whether something has occurred.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| additionalText | Text | Details about the clinical statement that were not represented at all or sufficiently in one of the attributes provided in a class. For example, these may include a comment, instruction, or note associated with the statement. |
| encounter | Encounter | Encounter within which the clinical statement was generated. |
| modality | StatementModality | The modality of a Clinical Statement describes the way the topic exists, happens, or is experienced. |
| statementAuthor | Person | Person who created the statement. |
| statementDateTime | TimePoint | Time at which the statement was made/recorded. This may not be the same time as the occurrence of the action or the observation event. |
| statementSource | Entity | The person, device, or other system that was the source of this statement. |
| subject | Patient | The patient described by this statement. |
| template | Text | Identifies a template for a statement. Templates specify constraints and often extensions to a related set of clinical statements. For example, a template for a HospitalAdmission will require the hospitalization attribute of the Encounter act to always be present. |
| topic | StatementTopic | The subject matter of this clinical statement. |

### StatementModality

The modality of a Clinical Statement describes the way the topic exists, happens, or is experienced.

### StatementOfNonOccurrence

A record of something of clinical relevance generally made by a patient, practitioner, or system stating that the statement's topic + modality did not occur.

For example, a patient may assert that they have NOT HAD FEVER in the past seven days. This is an explicit assertion about a non-occurrence. This is not the same as there being NO STATEMENTS about the patient having fever in the past seven days (which could be due to missing or incomplete records).

### StatementOfOccurrence

A record of something of clinical relevance generally made by a patient, practitioner, or system stating the occurrence of the statement's topic.

### StatementOfUnknownOccurrence

A record of something of clinical relevance generally made by a patient, practitioner, or system stating that it is not known that the statement's topic + modality has occurred.

For example, a patient may assert that they do not know if they had rheumatic fever in their childhood. This is an explicit assertion about an unknown occurrence. This is not the same as there being NO STATEMENTS about the patient having had rheumatic fever in their childhood (which could be due to missing or incomplete records).

### StatementTopic

The topic of a clinical statement. Generally statement topics fall into two broad categories: (1) statements about things that are observed (e.g., a clinical observation such as a blood pressure measurement or a condition such as diabetes) and (2) statements about clinical actions that ought to be, may have been, have been, or will be done (e.g., a proposal for an imaging procedure or the performance of an angioplasty).

## observable



### AdverseReaction

An adverse event caused by exposure to some agent (e.g., a medication, immunization, food, or environmental agent).

An adverse reaction can range from a mild reaction, such as a harmless rash to a severe and life-threatening condition. It can occur immediately or develop over time. For example, a patient may develop a rash after taking a particular medication.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| exposure | Exposure | Exposure to an action that is presumed to have caused the action. |
| symptom | ManifestedSymptom | Signs and symptoms that were observed as part of the reaction. |

### AllergyIntolerance

A description of an undesirable physiologic or other reaction to an external stimulus.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| criticality | Code | The potential seriousness of a future reaction. This represents a clinical judgment about the worst case scenario for a future reaction. It would be based on the severity of past reactions, the strength of the stimulus (e.g., the dose and route of exposure) that produced past reactions, and the life-threatening or organ system-threatening potential of the reaction type. |
| effectiveTime | TimePeriod | Time period during which the allergy or intolerance is effective. |
| reaction | Code | Possible reactions to the stimulus, e.g., respiratory distress. |
| sensitivityType | Code | A code that indicates whether this sensitivity is of an allergic nature or an intolerance to a stimulus. |
| stimulus | Code | The stimulus that causes the undesirable effect, or when a non-allergy is being specified, the stimulus that does not lead to an undesirable effect.  The stimulus may be a substance (amount of a substance that would not produce a reaction in most individuals) or other agents, e.g., a signal, confined space.  A substance is a physical entity and for purposes of this aspect of the model can mean a drug or biologic, food, chemical agent, plant, animal, plastic, etc. |

### CareExperience

Information collected from a consumer, patient, or family member about their perception of the care they received or from a caregiver 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. Experience also encompasses the patient’s outcomes from care provided in the past. For example, a patient receiving chemotherapy who has not responded to first-line medication treatment or who no longer responds to such therapy may require second-tier treatment. Such a patient’s experience of care is an important factor in defining subsequent treatment which can be driven by patient preference.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| about | ClinicalStatement | Statement (e.g., encounter, procedure) that is the basis for the experience. |
| experience | Code | The actual experience, e.g., poor communication. |

### Condition

Used to record detailed information about conditions, problems or diagnoses recognized by a clinician. There are many uses including recording a Diagnosis during an Encounter, or populating a problem List or a Summary Statement, such as a Discharge Summary.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| ageAtOnset | Quantity | Patient's age when the problem began. |
| bodySite | BodySite | Indicates the location of the symptom on the patient's body. |
| category | Code | A category assigned to the condition, e.g. finding, diagnosis, concern, symptom. |
| certainty | Code | Degree of confidence that this condition is correct. |
| conditionQualifier | Qualifier | Qualifier that allows specifying more details or restrictions. e.g., severity, triggering factors, stage. |
| conditionStatus | Code | State of the condition at the time of the observation, e.g., active, inactive. |
| contributionToDeath | Code | Whether the problem was the cause or contributor to the patient's death. |
| effectiveTime | TimePeriod | Time period during which the condition is effective. |
| name | Code | Identification of the condition, problem or diagnosis. e.g., diabetes mellitus type II, headache. |

### Contraindication

A concern about the performance of an action (proposed, ongoing, or past), e.g., medication intake, due to a health reason. A contraindication is a specific situation in which a drug, procedure, or surgery should not be used because it may be harmful to the patient. e.g., Contraindication to gentamycin due to poor kidney function.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| contraindicatedAct | Act | The action that is to be withheld in the context of the contraindication. Note that a contraindication may apply to the administration of a substance or to the performance of a procedure, for instance. |
| degree | Code | May be absolute or relative.  An absolute contraindication means that the course of action MUST be avoided.  A relative contraindication means that the course of action SHOULD be avoided but that the risk of proceeding with the course of action may be outweighed by other factors or mitigated in some way. |
| effectiveTime | TimePeriod | Time period during which the contraindication holds. This may be an open interval if no end time is currently known. |
| inference | Inference | Justification or reason for withholding treatment. |

### Exposure

Exposure to an agent or a healthcare action that is believed to have consequences.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| action | StatementOfOccurrence | Reference to an action believed to have caused the adverse event. |
| causalityExpectation | Code | Degree of certainty in whether the exposure caused the event. |
| exposureTime | TimePeriod | When the exposure occurred. |
| stimulus | Code | Stimulus, agent or type of action that may have caused the event. |

### FamilyHistory

Significant health event or condition for people related to the subject, relevant in the context of care for the subject.

This information can be known to different levels of accuracy. Sometimes the person can be identified ("my aunt Agatha"), and sometimes all that is known is that the person was an uncle.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| condition | Code | Condition that the related person had. |
| deceasedAge | Quantity | If dead, age at which family member died. |
| onsetAge | Quantity | When condition first manifested in this family member. |
| outcome | Code | What happened as a result of the condition, e.g., deceased, permanent disability. |
| relationship | Code | Relationship of the family member to the patient, e.g., brother. |

### Inference

An inference made, about the patient's health, based on other statements.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| inferenceMethod | Code | Algorithm, tool, or instrument used to make the inference, e.g., Framingham Risk Score, Immunization Rule Set. |
| inferredFrom | ClinicalStatement | Statements that form the basis for the inference. e.g., diagnosis of diabetes mellitus, blood pressure observations to calculate risk of heart disease. |

### ManifestedSymptom

Signs and symptoms that were observed as part of the event.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| bodySite | BodySite | Body site of the symptom or sign. |
| criticality | Code | Characterizes impact on life or durable impact on physiological function or quality of life. Includes concepts such as life-threatening or potential loss of function or capacity, e.g., life threatening, potentially requires hospitalization, self-resolving. Different from severity in that a moderate subarachnoid hemorrhage is likely to be highly important, whereas a moderate headache is not. |
| severity | Code | Characterizes the intensity of the manifestation of the sign or symptom. Includes concepts such as mild, moderate, severe. If the symptom is rash and severity is moderate, it means that the symptom was a moderate rash. |
| symptomCode | Code | Specific sign or symptom that was observed. |

### MicrobiologySensitivityResult

Findings of the microbiology sensitivity test. This element is used to specify traditional, culture-isolate- run susceptibilities. It is not used to specify genetic methods for organism sensitivity.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| organismSensitivity | OrganismSensitivity | Components of the microbiology sensitivity result. Each OrganismSensitivity item represents the sensitivity of an organism to one agent. |

### Observable

The result of interviews, examinations, medical investigations or diagnostics. e.g., the symptoms and signs noted during the history and physical.

### ObservationResult

Assertions and measurements made about a patient.

ObservationResults are a central element in healthcare used to support diagnosis, monitor progress, determine baselines and patterns and even capture demographic characteristics. Fundamentally, observations are name/value pair assertions.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| bodySite | BodySite | Indicates where on the patient's body the observation was made. |
| interpretation | Code | Assessment made based on the result of the observation. |
| method | Code | Technique or mechanism used to perform the observation. |
| name | Code | Identifies what type of observation was performed, e.g., body temperature. |
| order | StatementOfOccurrence | An order placed by a provider that led to this observation result. |
| relatedObservation | RelatedObservation | Observations related to this observation in some way, e.g., used to derive this observation, previous versions of this observation.  Related observations do not include components. Those are modeled in ResultGroup. |
| reliability | Code | Estimate of the degree to which quality issues have impacted the value reported. e.g., result is ok, measurement still ongoing, results are questionable. Usually, unreliable results are not recorded, but that is not always possible. In such cases, this attribute makes the receiver aware of the quality of the result. |
| specimen | Specimen | Specimen that was used when this observation was made.  Observations are not made on specimens themselves; they are made on a patients, but usually by the means of a specimen. Note that although specimens are often involved, they are not always tracked and reported explicitly. |
| status | Code | Status of the result value. e.g., preliminary, final. |
| validationMethod | Code | Method by which the observation result was validated, e.g., human review, sliding average. |

### OrganismSensitivity

Sensitivity of an organism to a specified antimicrobial agent.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| antiMicrobialAgent | Code | Antimicrobial agent that was tested for sensitivity, e.g., vancomycin. |
| organism | Code | Microorganism whose sensitivity is being tested. |
| sensitivity | Code | Response of the microorgranism to the agent, e.g., resistant, susceptible. |

### Prediction

Concept representing the likely course of a disease or condition.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| condition | Code | For assessments or prognosis specific to a particular condition, indicates the condition being assessed, e,g., in the condition spinal cord injury, the likelihood of the outcome "permanent loss of motor function" is being assessed. |
| inference | Inference | How the prognosis was estimated or inferred. |
| likelihood | Value | Likelihood of acquiring the condition specified as a numeric probability (less than or equal to 1) or a coded ordinal value. |
| outcome | Code | The outcomes being predicted for the patient, e.g., remission, death, breast cancer. |
| riskAssessment | StatementOfOccurrence | Risk assessment procedure that led to this prognosis. |
| timePeriod | TimePeriod | Time span within which the outcome will be reached, e.g., 10 years. |

### Qualifier

Further qualifies the concept it modifies. For instance, when associated with a condition, a qualifier may describe the intensity of pain or the criticality of the condition.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| property | Code | Detail about the condition that is being specified, e.g.., intensity of the pain condition. |
| value | Value | The value of this qualifier, e.g., severe for the value of pain intensity property. |

### RelatedObservation

A relationship of a specified type between two statements about ObservationResults.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| relationshipType | Code | The kind of relationship that exists with the target observation. |
| target | ClinicalStatement | Statement about the observation result that is related to this statement about an observation result. |

### ResultGroup

A group of related result values such as a laboratory result panel, e.g., complete blood count, blood pressure.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| component | ObservationResult | An observation result that is one of the components of the group, e.g.,white blood cell count, systolic blood pressure. |

### SimpleObservationResult

Measurements and simple assertions made about a patient, device or other subject.

Simple observation results may include:

* Vital signs: temperature, blood pressure, respiration rate
* Measurements emitted by Devices
* Personal characteristics: height, weight, eye-color
* Social history: tobacco use, family supports, cognitive status
* Core characteristics: pregnancy status, blood type

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| value | Value | Information determined as a result of making the observation, e.g., 120 mm Hg, small, 2013-11-30. |

### observable.modality

#### Observation

Indicates that the statement is concerned about observations made about a patient.

*Attributes*

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| observedAtTime | TimePeriod | When the observation was made. (This is different than when the statement about this observation was recorded, and when the observed phenomenon actually occurred.)  For example, a patient presents today at noon for a visit and indicates she had a migraine headache three days ago, which lasted for 90 minutes.  The effective time of the condition is three days ago. The "observed at" time is today at noon. The statement time is when the provider documents the encounter.  The observedAtTime attribute is applicable even in "unknown occurrence" statements; observedAtTime is the time when the provider made the observation. This observation may have been made today during a patient interview. |

# Examples

The examples in Table 3 illustrate the use of the QIDAM in creating data mapping expressions. The left column shows the identifier of the document from which the source expression was obtained. The prefix NQF indicates that the document was an eCQM from the National Quality Forum, and the prefix CMS indicates a Centers for Medicare & Medicaid Services eCQM. The subsequent digits provide the identifier assigned by NQF or CMS to that measure. The second column contains the expression from the source document. In the third column, the expressions are written in pseudocode. The abbreviation VS indicates a value set.

Table 3. Sample Expressions Written with QIDAM

| **Source  Document ID** | **Source Expression** | **QIDAM-based Expression** |
| --- | --- | --- |
| NQF 0068 | Diagnosis, Active: Acute Myocardial Infarction" <= 12 month(s) starts before start of "Measurement Period" using "Acute Myocardial Infarction Grouping Value Set (2.16.840.1.113883.3.464.1003.104.12.1001)" | **StatementOfOccurrence** with  topic **Condition** - name in AMI Grouping VS - conditionStatus = Active - effectiveTime starts <= 12 months before start of "Measurement period"  modality **Observation** |
| NQF 0068 | Procedure, Performed: Percutaneous Coronary Interventions <= 12 month(s) ends before start of "Measurement Period" using "Percutaneous Coronary Interventions Grouping Value Set (2.16.840.1.113883.3.464.1003.104.12.1010) | **StatementOfOccurrence** with topic **Procedure**  - procedureCode in PCI Grouping VS  modality **Performance** - performanceTime ends <= 12 months before start of "Measurement period" |
| NQF 0068 | Medication, Active: Aspirin and Other Anti-thrombotics" ends before start of "Measurement Period | **StatementOfOccurrence** with topic **MedicationTreatment** - medication in ASA+AT Grouping VS modality **Performance**  - performanceTime ends <= start of "Measurement period"  -actionPerformed = MedicationRegimen |
| NQF 0440 | Encounter, Performed: Non-Elective Inpatient Encounter (admission datetime)" <= 1 hour(s) starts after end of "Occurrence A of Encounter, Performed: Emergency Department Visit (facility location departure datetime)" | **StatementOfOccurrence** with topic **Encounter** -serviceType in Non-Elective Inpatient Encounter VS modality **Performance**  -performanceTime begins <=1 hour after end of "Encounter, Performed: Emergency Department Visit" |
| NQF 0002 | "Laboratory Test, Result: Group A Streptococcus Test (result)" <= 3 day(s) starts before or during "Occurrence A of Encounter, Performed: Ambulatory/ED Visit" | **StatementOfOccurrence** with topic **MicrobiologySensitivityResult** -name in Group A Streptococcus Test VS modality **Observation**  -observedAtTime <=3 days before "Encounter, Performed: Ambulatory/ED visit" |
| NQF 0565 | "Physical Exam, Finding: Best Corrected Visual Acuity (result: 'Visual acuity 20/40 or Better')" <= 90 day(s) starts after end of "Occurrence A of Procedure, Performed: Cataract Surgery" | **StatementOfOccurrence** with topic **SimpleObservationResult** -name in Best Corrected Visual Acuity VS -value > code for Visual acuity 20/40 modality **Observation**  -observedAtTime <=90 days after" Procedure, performed: Cataract surgery" |
| NQF 0018 | "Physical Exam, Finding: Systolic Blood Pressure (result < 140 mmHg)" during MOST RECENT: "Encounter, Performed: Office Visit" | **StatementOfOccurrence** with topic **SimpleObservationResult** - name in Systolic BP VS - value < 140 mm Hg modality **Observation**  - observedAtTime within (mostRecentOfficeVisitEnc.performanceTime) |
| NQF 0059 | Laboratory Test, Result: HbA1c Laboratory Test" during "Measurement Period" AND: "Occurrence A of Laboratory Test, Result: HbA1c Laboratory Test (result > 9 %)" | **StatementOfOccurrence** with topic **SimpleObservationResult** -name in HbA1c Laboratory Test in  -value > 9% modality **Observation**  -observedAtTime within measurement period |
| NQF 1659 | "Procedure, Performed not done: Drug not available" during "Occurrence A of Encounter, Performed: Encounter Inpatient" | **StatementOfNonOccurrence** with topic **Procedure**  -currentStatus = {  -reason=“Drug not available”  }  modality **Performance**  -occurredDuring = "Encounter, Performed: Encounter Inpatient |
| NQF 528 | "Medication, Administered: Hospital measures-IV Vancomycin (route: "Hospital measures-Route IV")" <=1440 minutes(s) starts before start of "Occurrence A of Procedure, Performed: Hospital measures-Joint Commission evidence of a surgical procedure requiring general or neuraxial anesthesia (incision datetime)" | **StatementOfOccurrence** with topic **MedicationTreatment** -medication in IV Vancomycin VS -dosage {deliveryRoute in Hospital measures-Route IV VS} modality **Performance**  -performanceTime.begin<=1440 minute(s) before (Procedure, Performed: Hospital measures-Joint commission evidence of a surgical procedure requiring general or neuraxial anesthesia" - performanceTime.begin)  -actionPerformed: DoseAdministration |
| https://www.icsi.org/\_asset/dwy1nl/ACSOS1112.doc | Glucose by finger stick screening 4 times daily (before meals and at bedtime) for 24 hours | **StatementOfOccurrence** with  topic **Procedure** -procedureCode in Glucose Measurement by Finger stick screening VS -procedureSchedule=4 times daily (before meals and at bedtime) for 24 hrs  modality **Proposal** |
| https://www.icsi.org/\_asset/dwy1nl/ACSOS1112.doc | Ticagrelor 180 mg loading dose by mouth once 90 mg by mouth twice daily | **StatementOfOccurrence** with topic **MedicationTreatment** -medication in Ticagrelor VS -dosage {  {  - doseType=loadingDose  - route=oral  - doseQuantity=180 mg  - schedule=Once on day 1  }  {   - deliveryRoute=oral  - doseQuantity=90 mg  - administrationSchedule=twice daily starting day 2  }  modality **Proposal** |
| NQF 0070 | Medication Adverse Event to Beta Blocker Therapy. | **StatementOfOccurrence** with  topic **AdverseReaction**  -exposure.stimulus in Beta Blocker VS  modality Observation |
| NQF 0055 | Medication dispensed:  Medications indicative  of diabetes <= 2 years  before or simultaneously to  “Measurement end date”. | **StatementOfOccurrence** with  topic **MedicationTreatment**  - medication in medications indicative of diabetes VS  modality **Performance**  -actionPerformed = Dispense  -performanceTime <=2years before or simultaneously to “measurement end date” |
| Corticosteroid inhaler reminder | Allergy To inhaled corticosteroids | **StatementOfOccurrence** with  topic **AllergyIntolerance**  -stimulus in corticosteroids VS  -sensitivityType=Allergy  modality **Observation** |
| Heart Failure Admission To  MedSurgOrderSets | Not allergic to an ACE inhibitor. | **StatementOfNonOccurrence** with  topic **AllergyIntolerance**  -stimulus in ACE inhibitor VS  -sensitivityType=Allergy  modality **Observation** |
| CMS 147v2 | Communication from patient to provider: Previous receipt of influenza vaccine | **StatementOfOccurrence** with  topic **Communication**  -recipient=provider  -sender=patient  -relatedStatement: {StatementOfOccurrence reference for influenza vaccine admin}  }  modality **Performance** |
| http://www.uspreventiveservicestaskforce.org/breastcancer.htm | Family History Of breast cancer in mother. | **StatementOfOccurrence** with  topic **FamilyHistory**  -relationship=mother  -condition= Breast Cancer  modality **Observation** |
| NQF0038 | "[Medication administered: rubella vaccine](http://ushik.org/ViewItemDetails?&system=mu&itemKey=122568000&enableAsynchronousLoading=true#qde_123518000)", occurring <2 years after "[Patient characteristic: birth date](http://ushik.org/ViewItemDetails?&system=mu&itemKey=122568000&enableAsynchronousLoading=true#qde_123397000) | **StatementOfOccurrence** with  topic **Immunization**  -vaccine.vaccineType in Rubella Vaccine VS  modality **Performance**  -performanceTime= <2years after birth date |
| CMS135v1 | "[Medication, Allergy: ACE inhibitor or ARB Allergen](http://ushik.org/ViewItemDetails?&system=mu&itemKey=161732000&enableAsynchronousLoading=true#qde_161734000)" | **StatementOfOccurrence** with  topic **AllergyIntolerance**  -sensitivityType=Allergy  -stimulus in ACE inhibitor or ARB Allergen VS  modality **Observation** |
| CMS142v1 | [Communication: From Provider to Provider: Level of Severity of Retinopathy Findings](http://ushik.org/ViewItemDetails?&system=mu&itemKey=162036000&enableAsynchronousLoading=true#qde_162048000) | **StatementOfOccurrence** with  topic **Communication**  -recipient=provider  -sender=provider  -message=“ObservationResult statement containing level of severity of retinopathy findings”  modality **Performance** |
| CMS73v1 | [Medication, Administered: Parenteral Anticoagulant](http://ushik.org/ViewItemDetails?&system=mu&itemKey=161140000&enableAsynchronousLoading=true#qde_161150000) | **StatementOfOccurrence** with  topic **MedicationTreatment**  -medication in Parenteral Anticoagulant VS  modality **Performance**  -actionPerformed = MedicationRegimen |
| CMS73v1 | [Laboratory Test, Result: INR](http://ushik.org/ViewItemDetails?&system=mu&itemKey=161140000&enableAsynchronousLoading=true#qde_161145000) (result<2) | **StatementOfOccurrence** with  topic **SimpleObservationResult**  -value <2  -name in INR VS  modality **Observation** |
| USPSTF Screening for Syphilis Infection In Pregnancy | Screen for syphilis infections | **StatementOfOccurrence** with  topic **Procedure**  -procedureCode in Screening Test for Syphilis Infection VS  modality **Proposal** |
| CMS135v2 | [Encounter, Performed: Care Services in Long-Term Residential Facility](http://ushik.org/ViewItemDetails?&system=mu&itemKey=161732000&enableAsynchronousLoading=true#qde_161741000) during Measurement Period | **StatementOfOccurrence** with  topic **Encounter**  -location.function=Long-Term Residential Facility  modality **Performance**  -performedanceTime=during Measurement Period |
| CMS190v1 | [Device, Applied not done: Patient Refusal](https://ushik.ahrq.gov/details?itemKey=160837000&System=mu&enableAsynchronousLoading=true#qde_160876000) for Graduated compression stockings (GCS) | **StatementOfNonOccurrence with**  **topic DeviceUse**  -device.type in Graduated compression stockings VS  modality Performance  -currentStatus.reason=patient refusal |
| CMS178v2 | [Device, Applied: Hospital Measures-Indwelling urinary catheter](https://ushik.ahrq.gov/details?itemKey=160677000&System=mu&enableAsynchronousLoading=true#qde_160682000) | **StatementOfOccurrence** with  topic **DeviceUse**  -device.type in Indwelling urinary catheter VS  modality **Performance** |
| CMS157v1 | Occurrence A of [Diagnosis, Active: Cancer](https://ushik.ahrq.gov/details?itemKey=162435000&System=mu&enableAsynchronousLoading=true#qde_162440000) | **StatementOfOccurrence** with  topic **Condition**  -name in Active Cancer VS  modality **Observation** |
| Acute Coronary Syndrome, Admission to CCU for - <https://www.icsi.org/_asset/dwy1nl/ACSOS1112.doc> | Consistent carbohydrate (CHO)  Diet | **StatementOfOccurrence** with  topic **Diet**  -nutritionItem[OralDiet].dietType= carbohydrates  modality **Proposal** |
| USPSTF Routine Screening for Iron Deficiency Anemia in Asymptomatic Pregnant Women | recommends routine screening for iron deficiency anemia | **StatementOfOccurrence** with  topic **Procedure**  -procedureCode in screening test for iron deficiency anemia VS  modality **Proposal** |
| CMS114v1 | [Medication, Administered not done: Medical Contraindication](https://ushik.ahrq.gov/details?itemKey=160451000&System=mu&enableAsynchronousLoading=true#qde_160472000)" for "Injectable Factor Xa Inhibitor | **StatementOfNonOccurrence** with  topic **MedicationTreatment**  -medication.code in Injectable Factor Xa VS  modality **Performance**  -currentStatus.reason=MedicalContraindication |
| CMS157v1 | [Procedure, Performed: Chemotherapy Administration](https://ushik.ahrq.gov/details?itemKey=162435000&System=mu&enableAsynchronousLoading=true#qde_162438000) | **StatementOfOccurrence** with  topic **Procedure**  -procedureCode in Chemotherapy Administration VS  modality **Performance** |
| CMS53v1 | [Diagnostic Study, Result: Hospital Measures-ECG Impression](https://ushik.ahrq.gov/details?itemKey=160997000&System=mu&enableAsynchronousLoading=true#qde_161014000) | **StatementOfOccurrence** with  topic **ObservationResult**  -name in ECG-Impression  modality **Observation** |
| CMS136v2 | [Encounter, Performed: Discharge Services- Observation Care](https://ushik.ahrq.gov/details?itemKey=161771000&System=mu&enableAsynchronousLoading=true#qde_161782000) | **StatementOfOccurrence** with  topic **Encounter**  -serviceType in Discharge services Observation care VS  modality **Performance** |
| HL7 V3 DAM, Diet and Nutrition Orders, DSTU Release 2 | a standard, polymeric enteral formula was selected from the hospital’s established formulary, and a total energy target of 20–25 kcal per kg actual body weight | **StatementOfOccurrence** with  topic **Diet**  -nutritionItem=  {EnteralFormula with  -caloricDensity=20–25 kcal per kg  -product=standard, polymeric enteral formula  }  modality **Order** |
| Stroke for Patient not Receiving tPA, Ischemic; Admission for - https://www.icsi.org/\_asset/gd1yy3/StrokeOSnontPA0712.doc | keep patient with nothing by mouth | **StatementOfOccurrence** with  topic **Diet**  -nutrititionItem[OralDiet].dietType=NPO code |
| CMS113v1 | [Diagnosis, Active: Spontaneous Rupture of Membranes](https://ushik.ahrq.gov/ViewItemDetails?&system=mu&itemKey=160421000&enableAsynchronousLoading=true#qde_160433000) | **StatementOfOccurrence** with  topic **Condition**  -name in spontaneous rupture of membranes VS  -conditionstatus=Active  modality **Observation** |
| QIDAM developers | Patient is not pregnant. | **StatementOfNonOccurrence** with  topic **Condition**  -name in Pregnancy VS  modality **Observation** |
| QIDAM developers | Unknown if patient has history of rheumatic fever | **StatementOfUknownOccurrence** with  - topic **Condition**  -name in Rheumatic fever VS  modality **Observation** |
| QIDAM developers | Patient is advised to wear holter monitor | **StatementOfOccurrence** with  topic **DeviceUse**  -device.type in Holter monitor VS  modality **Proposal** |
| QIDAM developers | Begin NTP (Non-Invasive Transcutaneous Pacing) immediately by trained nurse | **StatementOfOccurrence** with  topic **DeviceUse**  -device.type=NTP  modality **Order**  -urgency=urgent |
| QIDAM developers | Cholecystectomy was not performed | **StatementOfNonOccurrence** with  topic **Procedure**  -procedureCode in cholecystectomy VS  modality **Performance** |
| QIDAM developers | Hep B dose 1 due now. Total of 3 doses required to obtain protection from Hepatitis B infection. | **StatementOfOccurrence** with  topic **Immunization**  -vaccine.vaccineType=hepatitis B vaccine  -protocol={  -doseTarget=hepatitis B  -doseSequence=1  -seriesDoses=3  }  modality **Proposal** |
| QIDAM developers | Aspirin 81 mg ,one tablet per day orally | **StatementOfOccurrence** with  topic **MedicationTreatment**  -medication.code in Aspirin VS  -dosage={  -doseQuantity=81mg  -administrationSchedule=one per day  -route=oral  }  modality **Order** |
| QIDAM developers | Lumpectomy is contraindicated in pregnancy | **StatementOfOccurrence** with  topic **Contraindication**  -contraindicatedAct = {Procedure with procedureCode in lumpectomy VS}  -inference.inferredFrom = {Condition with name = PregnancyVS  modality **Observation** |
| QIDAM developers | No family history of lung cancer in patient | **StatementOfNonOccurrence** with  topic **FamilyHistory**  -condition in lung cancer VS  modality **Observation** |
| San Diego County Pertussis Notification Criteria | Phone epidemiology program at SDDHS | **StatementOfOccurrence** with  topic **Communication**  -medium=telephone  -sender=provider  -recipient=organization (SDDHS)  -message= notification of pertussis case  modality **Proposal** |
| QIDAM developers | notify MD if temperature goes above 104 F | **StatementOfOccurrence** with  topic **Communication**  -message=temperature above 104 F  -recipient=attending  -sender=nurse  modality **Order** |
| QIDAM developers | Unknown whether patient has Penicillin allergy | **StatementOfOccurrence** with  topic **AllergyIntolerance**  -sensitivityType=Allergy  -stimulus=Penicillin  modality **Proposal** |
| QIDAM developers | Patient receiving chemotherapy did not respond to first line medications | **StatementOfOccurrence** with  topic **CareExperience**  -experience=poor response  -about={StatementOfOccurrence about first-line chemotherapy medications}  modality **Observation** |
| QIDAM developers | Participation in a government guarantee program for immunizations (e.g., Vaccines for Children) impacts which vaccine stock is used to treat the patient | **StatementOfOccurrence** with  topic **CareProgramParticipation**  -participationStatus=ongoing  -programType=Government Guarantee Program for Immunization  modality **Performance** |
| QIDAM developers | Recommend HbA1c of less than 6.5% within next 3 months. | **StatementOfOccurrence** with  topic **Goal**  -goalFocus in HbA1c VS  -goalValue=6.5%  -goalPursuitEffectiveTime=3 months  modality **Proposal** |
| QIDAM developers | Goal of LDL level of 100 mg/dL has been established | **StatementOfOccurrence** with  topic **Goal**  -goalFocus in LDL VS  -goalValue=100 mg/dL  modality **Performance** |
| QIDAM developers | There are ventilators present in this long-term care facility. | **Organization** with  -type=long-term care facility  -characteristic={  -code=ventilator  -presence=yes  } |
| VMR | Increased fiber diet | **StatementOfOccurrence** with  topic **Diet**  -nutritionItem[OralDiet].dietType=increased fiber diet  modality **Proposal** |
| VMR | High-calorie protein shake | **StatementOfOccurrence** with  topic **Diet**  -nutritionItem[NutritionalSupplement].product= protein shake  modality **Proposal** |
| VMR | Easy to chew diet (regime/therapy) | **StatementOfOccurrence** with  topic **Diet**  -nutritionItem[OralDiet].texture.textureType=easy to chew  modality **Proposal** |
| CMS100v1 | [Transfer To: Hospital Measures - Inpatient Hospice Care](https://ushik.ahrq.gov/ViewItemDetails?&system=mu&itemKey=160114000&enableAsynchronousLoading=true#qde_160121000) | **StatementOfOccurrence** with  topic **Encounter**  -hospitalization.dischargeDisposition in Inpatient hospice care VS  -class=in-patient  modality **Performance** |
| USPSTF Screening for Hepatitis B Virus Infection in Pregnancy | High risk patients and patients who test positive for HBV should be referred to an appropriate case-management program. | **StatementOfOccurrence** with  topic **CareProgramParticipation**  -programType=code for case-management program for HBV  modality **Proposal** |
| CMS188v2 | [Diagnosis, Inactive: Cystic Fibrosis](http://ushik.org/ViewItemDetails?&system=mu&itemKey=160754000&enableAsynchronousLoading=true#qde_160805000) | **StatementOfOccurrence** with  topic **Condition**  -name in Cystic Fibrosis VS  -conditionStatus=Inactive  modality **Observation** |
| CMS 160v1 | "[Patient Characteristic Expired: Deceased](https://ushik.ahrq.gov/details?itemKey=162499000&System=mu&enableAsynchronousLoading=true#qde_162504000)" | **Patient** with  -isDeceased=yes |
| CMS 171v2 | [Device, Applied: Hospital measures-Pacemaker or implantable defibrillator device](http://ushik.org/ViewItemDetails?&system=mu&itemKey=160501000&enableAsynchronousLoading=true#qde_160525000)" | **StatementOfOccurrence** with  topic **DeviceUse**  -type in Pacemaker or Implantable defibrillator VS  modality **Performance** |
| CMS22v1 | [Intervention, Order: Referral to Alternative Provider / Primary Care Provider](http://ushik.org/ViewItemDetails?&system=mu&itemKey=162796000&enableAsynchronousLoading=true#qde_162806000) (reason: 'Finding of Hypertension') | **StatementOfOccurrence** with  topic **Encounter**  -class=out-patient  modality **Order**  -indication.reason = Finding of hypertension |
| CMS155v1 | [Intervention, Performed: Counseling for Physical Activity](https://ushik.ahrq.gov/details?itemKey=162381000&System=mu&enableAsynchronousLoading=true#qde_162395000) | **StatementOfOccurrence** with  topic **Procedure**  -procedureCode in counseling for physical activity VS  modality **Performance** |
| QIDAM Developers | Migraine triggered by bright light | **StatementOfOccurrence** with  topic **Condition**  -name in Migraine VS  -conditionDetails={  -name=triggering factor  -value=Bright Light  }  modality **Observation** |
| CMS64v3 | Risk Category Assessment: Framingham coronary heart disease 10 year risk (result > 20 %)" during "Measurement Period” | **StatementOfOccurrence** with  topic **Prediction**  -outcome=coronary heart disease  -likelihood > 20%  -within 10 years  -inference.inferenceMethod=Framingham Risk Score code  modality **Observation**  -observedAtTime during “Measurement Period” |

# Glossary

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| Term | Description |
| Action Specification | A structured and encoded description of a healthcare action. This specification is often part of the consequence of a rule, where the recommendation is described as an action specification. |
| CCDA | Consolidated Clinical Document Architecture. A specification from HL7 for templates for clinical documents. See [6] |
| CDS | Clinical decision support (CDS) provides clinicians, staff, patients, or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and healthcare. CDS encompasses a variety of tools to enhance decision-making in the clinical workflow. [9] |
| CDS Knowledge Artifact | A specification of knowledge encoded so that it can be used for computer-based CDS—e.g., a rule, an order set. |
| Clinical Concepts | Mental representations of physical or non-physical things of interest in the clinical/healthcare domain—e.g., disease, drugs. |
| Clinical Statement | An expression of a discrete item of clinical, clinically related, or public health information that is recorded because of its relevance to the care of a patient or other entities. |
| Conceptual Data Model | An abstract, simplified view of things of interest in a particular domain. |
| Data Specification | A structured and encoded description of data that can be used to retrieve or select instances of data from some source of data (e.g., database). Data specifications are used in CDS knowledge artifacts and eCQMs to express the data elements needed in logical criteria and expressions. |
| Domain Analysis Model | An abstract representation of a subject area of interest, complete enough to allow instantiation of all necessary concrete classes needed to develop child design artifacts. |
| eCQM | A clinical quality measure (CQM) is specification of criteria for measuring the quality of a healthcare process, outcome, structure, or patient experience. An electronic CQM (eCQM) encodes the criteria to enable their use by computer software. |
| EHR | Electronic health record |
| Interface | In object-oriented programming, an interface is a set of grouped behaviors for objects to communicate with each other. In the QIDAM, interfaces are used with clinical statements to enable statements to specify the data that must be be provided by the statements implemented by the behaviors. For example, the ProcedureOrder statement must provide a procedureCode attribute. |
| Logical Criteria | These computational expressions are elements of CDS knowledge artifacts and eCQMs that perform operations over data (see Data Specifications). Typically, the logical criteria result in true or false values and determine if an action should be carried out (in CDS) or whether data items should be included in a calculation (eCQM). |
| Logical Model/ Logical Data Model | A type of data model showing a detailed representation of data in a domain of interest. The representation is independent of any particular data management technology and described in business language. It is typically represented as a diagram, organized in terms of entities or classes and relationships, with underlying definitions. (Adapted from <http://en.wikipedia.org/wiki/Logical_data_model>). |
| QIDAM | Health Quality Improvement Domain Analysis Model. The term refers to the model described in this specification. |
| QRDA | Quality Reporting Document Architecture |
| UML | The Unified Modeling Language (UML) is a general-purpose modeling language in the field of software engineering. This specification uses the class diagram notation of UML to specify the model. |
| Value Set | Specifies a set of codes drawn from one or more code systems (e.g., SNOMED-CT, LOINC) that represent a particular concept of interest (e.g., blood culture tests). |
| vMR | Virtual Medical Record – An HL7 specification of a logical data model developed for use in clinical decision support applications. See [2] |

# References

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